EXPLORING THE KNOWLEDGE, ATTITUDE AND PRACTICE OF PREVENTION THROUGH DESIGN AMONG DESIGNERS IN MALAYSIA CONSTRUCTION INDUSTRY

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DEDICATION

This report is dedicated to my father, Hj. Hamdan Bin M Nor and my mother, Siti Rupiah Binti Sukaimi, my mentors and inspirations. Next to my beloved wife Nur Ateerah Binti Abdul Razak and all my children, Aeesyaa Humaira, Afreena Huriyah, and Ahmad Zeeyad Iman, for their support, love, and unquestioning belief in me, as they were the ones that keep me from succumbing to frequent feelings of inadequacy and ineptitude to complete my Master's Degree.

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ABSTRACT

The construction industry is essential in the Malaysian economy due to its involvement in the national economic chain. However, its occupational safety and health (OSH) performance are not particularly impressive. This industry is one of the most significant contributors to Malaysia's fatality accident statistics compared to other industries. In the efforts of the government to resolve this, an initiative was launched. The Guidelines of Occupational Safety and Health Construction Industry (Management) (OSHCIM), in line with the concept of Prevention through Design (PtD), have been launched and will be legislative in force soon. Therefore, this study aims to assess designers (architects, M&E engineers, and C&S engineers) in the Malaysia construction industry to the PtD principle and explore their current knowledge, attitude, and practice (KAP).This study used a questionnaire survey collected from 114 respondents for obtaining relevant inputs and was analyzed using descriptive and quantitative methods, which were then presented in the form of charts, graphs, and tables for easy understanding. The result revealed that the knowledge and practices of PtD among the designer community are relatively low despite their positive attitude toward the implementation of PtD in the construction industry.These findings also suggest that there are certain obstacles in PtD implementation, such as "lack of early education in tertiary curriculum level" and "continuous professional training", which will be undermining the enforcement of OSHCIM in the near future. Thus, it is recommended that a swift, comprehensive and holistic action plan be implemented soon for the PtD principle's success in the Malaysian construction industry.

ABSTRAK

Industri pembinaan sangat penting dalam ekonomi Malaysia kerana penglibatannya dalam rantaian ekonomi negara. Walau bagaimanapun, prestasi keselamatan dan kesihatan pekerjaannya (KKP) tidak begitu memberangsangkan. Industri ini adalah salah satu penyumbang yang paling signifikan dalam statistik kemalangan maut di Malaysia berbanding industri lain. Dalam usaha Kerajaan menyelesaikannya, satu inisiatif telah dilancarkan. Garis Panduan Industri Pembinaan Keselamatan dan Kesihatan Pekerjaan (Pengurusan) (OSHCIM), sejajar dengan konsep Pencegahan Melalui Reka Bentuk (PtD), telah dilancarkan dan akan dikuatkuasakan dalam waktu terdekat. Oleh itu, kajian ini bertujuan untuk menilai para perekabentuk (arkitek, jurutera M&E, dan jurutera C&S) dalam indsutri pembinaan di Malaysia terhadap prinsip PtD dan meneroka pengetahuan, sikap, dan amalan (KAP) mereka terhadap prinsip tersebut. Kajian ini menggunakan tinjauan soal selidik yang dikumpulkan dari 114 responden untuk mendapatkan input yang relevan dan telah dianalisa menggunakan kaedah deskriptif dan kuantitatif, yang kemudian dibentangkan dalam bentuk carta, grafik, dan jadual agar mudah difahami. Hasil kajian menunjukkan bahawa pengetahuan dan amalan PtD di kalangan komuniti perekabentuk agak rendah walaupun mereka mempunyai sikap positif terhadap pelaksanaan PtD dalam industri pembinaan. Penemuan ini juga menunjukkan bahawa ada halangan tertentu dalam pelaksanaan PtD, seperti "kurangnya pendidikan awal di tingkat kurikulum tertier" dan "latihan profesional berterusan", yang akan menjejaskan penguatkuasaan OSHCIM dalam waktu terdekat. Oleh itu, disarankan agar tindakan pantas, komprehensif dan holistik perlulah dirancang dan dilaksanakan segera untuk memastikan kejayaan prinsip PtD ini dalam industri pembinaan Malaysia.

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INTRODUCTION

1.1 Background Study

The construction industry in Malaysia is one of the driving forces of Malaysian economic due to the number of industries linked to it, such as primary metal products and electrical machinery and because it impacts on every industry (Alias, 2016). The industry also provides jobs for 9.2% of the national workforce, or approximately 1.3 million workers (CIDB, 2019; DOSM, 2019, 2020). However, while the industry has a significant impact on economic, social and well-being of the population, its current occupational safety and health (OSH) performance is poor relative among all industries in Malaysia and at international level (CIDB, 2018b).

The industry contributes 15% of the total number of fatality for the past ten years since 1999 (DOSH, 2019). The OSH performance of the industry has been declining since 2012, and the most notable was in 2015 with 140 fatality cases, 2016 (160 cases) and 2017 (183 cases), the highest since 1999. By average, from 2015-2018, a total of 4% of an accident in construction site resulting in death, to be 163 fatality cases per year (DOSH, 2019).

This alarming figure is not only happened in Malaysia, and it is globally. Construction accidents in the United States (U.S.) contributed to 19 per cent of all industrial fatalities in 2016, and ranked the highest across all (Hallowell & Hansen, 2016) while in China, it is estimated that 3,000 construction workers are killed annually due to work-related accidents (Fang et al., 2004). The high number of construction fatalities is indeed troubling stakeholders in the construction sector as it may ultimately affect the whole society as it is associated with profound and severe consequences to the worker, project and at the organization level.

From the economy point of view, the cost arising from construction occupational injuries and illnesses can be colossal. According to research by Pillay & Haupt (2008), the direct cost of a construction accident accounts for 4% of South African Gross Domestic Product (GDP) which about $4.2 billion U.S. dollar. This cost, however, is only the result of a direct cost. Typically, construction organizations do not monitor accurately and comprehensively or may not consider the costs of schedule delays, added administrative time, reduced morale, increased absenteeism, and poor customer relationships. Such indirect costs vary significantly between the direct and indirect costs of construction accidents in the 20:80 ratio of direct to indirect costs (Pillay & Haupt, 2008).

Hence, a zero-accident goal in construction industry seems a great way off as it often considered unsafe, despite numerous effort to improve its construction safety management. (Zhou et al., 2015).

1.2 Problem Statement

Although the cause of construction accidents is multi- and complicated, designs have been proven to be one of the significant contributors to accidents and injuries. This statement has reached consensus through previous research that construction site accidents have inseparable relationships with upstream phases, such as the design and planning phases (Abdelhamid & Everett, 2000; Haslam et al., 2005; Rasmussen, 1997; Rickard, 2014).

Therefore, the best solutions to minimize accidents and illnesses for site safety management are by design-out the hazards before construction starts, during the early stages of the project life cycle, which dictate the construction methods and permanent characteristics of the projects (Gambatese, 1998; Gambatese et al., 2008; Gambatese & Hinze, 1999; Haslam et al., 2005). Integrating safety-specific input early in the project planning phase is a high-order safety control and is generally considered as the most successful method for improving safety in the workplace (Szymberski, 1997).

For this intention, researchers have been working to establish new theories and methods of safety management that help practitioners identify hazards, assess and control the risk. One such theory, Prevention through Design (PtD), requires specific consideration of worker safety and health during a project's planning and design process. It is considered a theory, as it encapsulates the principles and ideals that relate to the subject matter. Recognized hazard is eliminated or controlled during project design to implement the PtD effectively principle and process (Gambatese et al., 2008; Lingard et al., 2014), and usually, the final design are adjusted to protect worker well-being (Wanberg et al., 2013).

The PtD concept for promoting safety management in the construction industry has been gradually recognized. PtD, also known as Design For Safety (DFS), Design for Construction Protection (DfCS), and Construction Danger Prevention by Design (CHPtD) (Toole & Gambatese, 2008), includes an early implementation of safety management into the design phase or redesign process, as part of engineering applications improvements or during the construction phase to fit construction methods and practices (Gambatese, 1998). Realizing the effectiveness of PtD, many developed countries have required the principle as a requirement in their construction projects, including the United Kingdom (U.K.), Australia, Singapore (Larsen & Whyte, 2013; Toh et al., 2017) and soon, Malaysia (Che Ibrahim et al., 2019; DOSH, 2019).

In Malaysia, the responsibility for safety in Malaysia has been primarily placed on the employer as one of the general duties prescribed under the Occupational Safety and Health Act 1994 (Act 514), to provide their workers and other relevant persons with a safe place of work. Thus, as the enforcement agency for OSH in Malaysia, on 28 January 2017, DOSH has launched Guidelines of Occupational Safety and Health in Construction Industry (Management) (OSHCIM) as a minimum role of every stakeholder (owner, designer and contractor) and the way they will execute their responsibilities. This guidance as a mechanism for improving the industry's safety and health performance, and as a prerequisite for every industry stakeholder to work together towards shared goals in reducing the rate of construction accidents in Malaysia.

OSHCIM was developed on the basis of the PtD principle and the Construction (Design and Management) Regulations of the United Kingdom and also reverberated on the spirit of the Occupational Safety and Health Act (OSHA), which places the responsibility of risk management to those who create it. This guidance provides the client as the owner / end-user, the designer and the contractor with a useful and a practical guide on managing the worker's and occupant 's safety, health and well-being when carrying out construction projects.

Standing at the top of the supply chain for the construction industry, the principal duty rests with the client, the project proponent or the project owner. The owner 's role is of paramount importance to a project's outstanding safety performance, particularly in ensuring that competent peoples are appointed at the right time. Both the designer and the contractor, respectively, have immense roles in monitoring and managing during preconstruction and construction stages. There should be good cooperative governance, effective communication and adequate information, instruction, training and supervision between these three key stakeholders (the owner, the designer and the contractor). Harnessing of workers' involvement to promote and develop effective measures completes the critical elements of recommendations in the PtD concept in Malaysia construction industry.

Given its connection to design as the most effective way to eliminate hazards, designer roles and involvement in PtD is paramount, provides an opportunity for designers to participate, within their scope of work, in safety as it relates to construction workers. Designer, as the clients' agent during the construction phases (Jimmie Hinze, 2001), have huge responsibilities in performing PtD in their design.

Traditionally, safety priority for designers has been limited to the end-user personnel of the facility being planned, with disregard for the workforce building it. The reasons cited for this lack of interest include a lack of skills and knowledge to address worker concerns about safety, and also the incapability to control construction site operations (Gambatese, 2000a). Resultantly, the safety of construction personnel has often been left to the contractors. However, the significance of the correlation between design and the occurrence of accidents and

injuries shown by many research (Behm, 2005; Cooke & Lingard, 2011; Gibb et al., 2014; Haslam et al., 2005) is increasingly giving motivation towards the need to embed OSH into the designing phase of delivering construction projects. Hence, it is highly likely that most designers will not conduct PtD unless ordered by the client (owners and developers of projects or facilities) or by legislation to do so.

As the importance of PtD has been highlight earlier in improving OSH in construction industries, several obstacles to the implementation of PtD were identified. There was, for example, a lack of regard for safety during design in the U.S. and the underlying causes include designer perceptions about safety, a lack of safety knowledge among designers, concerns about liability (Gambatese et al., 2005), and designers usually do not see safety and health as part of their job (Brace et al., 2009). Even in the U.K. itself, as OSHCIM was developed based on U.K. Construction (Design and Management) Regulation, there were also issues to get buy-in from designers, and "safety is widely perceived as a design afterthought" (Larsen & Whyte, 2013).

However, according to research by Goh & Chua (2016) and Che Ibrahim et al. (2019) to C&S engineer, it is found that the respondents are supportive of PtD, These findings were in line with a research by Toh et al. (2017) that also found that majority of Singapore PtD stakeholder (architects, civil and structural (C&S) engineers, mechanical and electrical (M&E) engineers, developers/clients, project managers, and safety professionals) demonstrated a positive attitude towards PtD, but the average level of PtD practice was low, significantly between developers/clients, C.S. engineers, and project managers.

Despite previous researches that have been conducted with the various parties to the PtD principle in construction industries, little is known about how knowledgeable, level of willingness and participation of the Malaysia designer (especially from architect & M&E engineer) as one of the stakeholder, to the PtD principle through OSHCIM initiatives.

Thus, as OSHCIM has been launched and will be enacted soon by DOSH into Malaysia legislation framework by the end of 2020 (DOSH, 2017, 2019), there are a need to assess the point of view of designers to PtD principle and to explore their current knowledge, attitude and practices (KAP) that will have a significant impact on the successful implementation of PtD. These findings will then can be utilized for understanding all the other stakeholders need and behaviour and thus designing more targeted interventions (Launiala, 2009).

Hence, the necessity to explore the present PtD knowledge, attitude and practice of the Malaysia designers team is significant. Efforts to understand designers' PtD capabilities are important, as they would contribute to the growth and transition of OSHCIM in the construction industry.

1.3 Aim and Objectives of Study

The aim of this study is to explore the point of view of Malaysian designers (architect, M&E engineer and C&S engineer) on Prevention Through Design (PtD) principle in term of their current knowledge, attitude and practice (KAP). This aim will be achieved through the following objectives:

i. To investigate the extent of exposure and knowledge of Malaysian designers in PtD,
ii. To assess the current level of PtD attitude of designers,
iii. To examine the extent of current PtD practices of designers,
iv. To identify the key obstacles and enablers in the implementation of PtD by designers in Malaysia.

1.4 Scope of Study

The scope of the study will be limited to Klang Valley area (Kuala Lumpur, Selangor and Putrajaya) as the main operation and location majority of the designers. The selection of respondents chosen on their involvement in the early stages of the projects design phase and their roles and responsibilities. The propose respondents are as follow:

i. Architect
ii. Mechanical & Electrical (M&E) Engineer
iii. Civil & Structure (C&S) Engineer
iv. All registered with the Board of Architect Malaysia (BAM) or Board of Engineer Malaysia (BEM).

1.5 Methodology of Study

This study determines the present PtD knowledge, attitude and practice (KAP) of Malaysia designers to Prevention Through Design (PtD) principle in OSHCIM. The flow chart for the research activities carried out is shown in Figure 1.1:

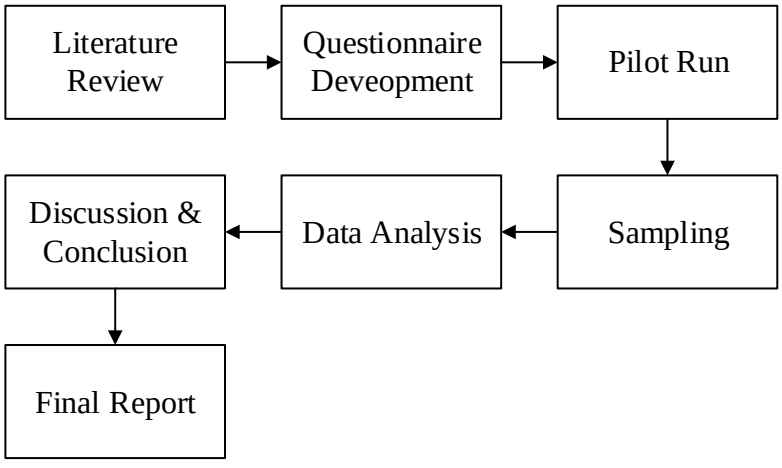

Figure 1.1 Methodology Flow Chart

i. Initial data collection, including an introduction, objectives, scopes of the study, problem statement, research questions, literature review, identification of scope and sample acquired.

ii. Development of questionnaires survey conducted to obtain information. The discussion will be involving few DOSH/CIDB Officer, matter expert in construction safety and based on previous research.

iii. Execution of the pilot study for the questionnaire that has been established.

iv. Sampling process by distributing the questionnaire forms to all possible respondent.

v. The process of data analysis, discussion and development of findings of the way forward based on the information obtained.

vi. Preparation of the final report.

1.6 Significance of the study

This study will assist the related government agency, related to OSH (Department of Occupational Safety and Health - DOSH), construction (Construction Industry Development Board- CIDB), professional bodies (Board of Architecture Malaysia - LAM, Board of Engineer Malaysia - BEM, etc.) commerce association (Real Estate and Housing Developers' Association – REHDA, Master Builders Association Malaysia – MBAM, etc.) and higher learning institute (IPTA & IPTS) to recognize the significance of PtD principle in construction industries, especially from the designer's point of view. This study could allow them to set out policy and make arrangement for the betterment of the construction industry player as well as the workers in the industry.

i. The findings are expected to help and strengthen the OSHCIM initiative with continuous improvement.

ii. The assimilation of PtD principle among the stakeholder.

iii. The nourishment of future Malaysia construction stakeholder through exposure the PtD concept at an early stage in career.

iv. The results of this study may provide a clearer picture to help improve the OSH performance at the construction site.

v. The recommendations resulting from the study can be applied to improving OSH issues in the workplace.

1.7 Arrangement of Report

This research work is composed of five chapters which cover the general introduction, literature review, research methodology, data presentation and analysis, and conclusion and recommendations. The various chapters have been briefly highlighted as follows:

Chapter One: Introduction

This chapter presented the general introduction of the study, included the problem statement, the aim, and objectives, and the methodology of the research. In this chapter, the researcher will clearly define the problem statement and come out with the aims and objectives of the studies and propose a methodology of the research. The scope and limitation will be clearly defined to avoid any uncertainties in the future. Lastly, the flow of methodology, as proposed in Figure 1.1, will be the basis of research from the problem identification to conclusion and recommendation.

Chapter Two: Literature Review

This chapter comprised a historical and relevant literature review from previous studies on Prevention Through Design (PtD). It also includes an overview of Malaysia construction industries, the current OSH performance in the industries and previous research regarding PtD. It will detail out the concept of PtD and its correlation with designers as one of the stakeholders. The finding regarding knowledge, attitude and practice (KAP) from previous research will be elaborate, and finally, the researcher will also elaborate the PtD obstacles and enablers and critically discuss the findings concerning Malaysia designers in construction industries.

Chapter Three: Research Methodology

In general, this chapter presented and justified the research strategy and the techniques for collecting data. It will set out the procedures for performing the study for the methodology of research and analysis to be used and discuss the approach suggested. This should explicitly state how relevant information and sample data are being obtained, such as through literature review, questionnaire survey, formal interview, and explaining data collection method and techniques.

Chapter Four: Data Analysis and Results

This chapter examines and analyzes the findings from the literature review study, questionnaire survey and interview in relation to the current body of knowledge on the principle of Prevention Through Design from the designers' point of view regarding the research objectives outlined. The result will then be tabulated and explained, where necessary, into graphs or diagrams.

Chapter Five: Conclusions and Recommendations

This chapter presents the study's conclusion and recommendations based on literature review, observations and analysis in line with the research questions and objectives. It will conclude all results leading to the attainment of the study's objectives. It also provides several recommendations to boost future research.

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