ADOPTION OF CONSTRUCTION INDUSTRY 4.0 AMONG SMALL AND MEDIUM SIZED CONTRACTOR IN MALAYSIA

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DEDICATION

It is specially dedicated to my parents.

For their endless love, support encouragement

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ABSTRACT

The construction industry revolution which entails nothing less than a transformation of humankind that grasps fully by speed and breadth. However, the technological revolution that took place is still not fully acceptable by the construction industry. Therefore, this paper empirically aims to evaluate the application of small and medium industries of industry 4.0 determine the best strategy plan based on the perceived impact of performance on implementation. Three (3) objectives has been discussed include the adoption, perceived performance impact and strategy to overcome the impact by using quantitative methods were used for this study. A total of 50 questionnaires were distributed; however, only 76% (38) respondents answered the question completely. Based on the results, shows that Building Information Modeling has the use of the highest technology that has been used in the construction industry. In addition most of that construction companies need to address the technological impact of perceived materials, materials and tools; processes and operations; business strategies and models; people, organizations and cultures; rules and policies; and public procurement, with the implementation of Revolution 4.0 hampered by system shortages, financial problems, limited demand for innovation among SME players, lack of trust in foreign partners and limited ability to adapt foreign software. Besides that, there is a big difference focusing on categories by referring to the score factor and weighting factor between perceived performance effects and strategies to overcome the impact of the construction industry 4.0. Based on the data obtained, the highest score factor on high impact for Industrial Revolution 4.0 is implementation rules and basics 'with 45.76 with an average weight of 25%. This is categoriez as the most important due to the complexity and interconnectedness previous cross the construction sector needs to collaborate and understand on the emerging trends. However, strategies to control the impact or Industry 4.0, the highest score factor is regulations and policies with 39,104. Meanwhile, based on average weight, the highest was 0.333 or 33% for the ‘public procurement’ and ‘business model innovation’ categories. In short, transforming the construction industry into digitization and digitization may not have much of an impact, but the long-term benefits gained throughout the application should not be forgotten.

ABSTRAK

Revolusi industri pembinaan bukan perkara baru atau baru. Peredaran dan perubahan dalam teknologi telah mengubah keseluruhan kitaran proses pembinaan dengan integrasi yang berbeza-beza. Namun, revolusi teknologi yang berlaku masih tidak dapat diterima sepenuhnya oleh industri pembinaan. Oleh itu, makalah ini secara empirik bertujuan untuk menilai penerapan industri kecil dan sederhana industri 4.0 serta menentukan rancangan strategi terbaik berdasarkan kesan yang dirasakan prestasi terhadap pelaksanaan. Kaedah kuantitatif digunakan untuk kajian ini. Sebanyak 50 borang soal selidik diedarkan; namun, hanya 76% (38) responden yang menjawab soalan sepenuhnya. Berdasarkan hasilnya, ini menunjukkan bahawa Building Information Modeling mempunyai penggunaan teknologi tertinggi yang telah digunakan dalam industri pembinaan. Hasilnya menunjukkan bahawa syarikat pembinaan perlu menangani kesan prestasi teknologi bahan, bahan dan alat yang dirasakan; proses dan operasi; strategi dan model perniagaan; orang, organisasi dan budaya; peraturan dan polisi; dan perolehan awam, dengan menerapkan Revolusi 4.0 terhambat oleh kekurangan sistem, masalah kewangan, permintaan terhad untuk inovasi di kalangan pemain syarikat kecil dan sederhana (PKS), kurangnya kepercayaan pada rakan asing dan kemampuan terhad untuk menyesuaikan perisian asing. Terdapat perbezaan besar yang memfokuskan pada kategori dengan merujuk kepada faktor skor dan faktor pemberat antara kesan prestasi yang dirasakan dan strategi untuk mengatasi impak industri pembinaan 4.0 Berdasarkan data yang diperoleh, faktor skor tertinggi untuknya memberikan kesan yang tinggi terhadap Industrial Revolution 4.0 adalah 'peraturan dan asas' dengan 45.76 dan berat purata 25%. Walau bagaimanapun, strategi untuk mengawal impak atau Industri 4.0, faktor skor tertinggi adalah peraturan dan kebijakan dengan 39,104. Sementara itu, berdasarkan berat purata, yang tertinggi adalah 0.333 atau 33% untuk kategori ‘perolehan awam’ dan ‘inovasi model perniagaan’. Ringkasnya, mengubah industri pembinaan menjadi digitalisasi dan pendigitalan mungkin tidak banyak memberi kesan, tetapi faedah jangka panjang yang diperoleh sepanjang aplikasi tidak boleh dilupakan.

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SME	-	Small and Medium Enterprise
PCA	-	Principle Component Analysis

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Industry 4.0 revolution evaluation of small and medium enterprises (SMEs) where the information obtained will be collected in particular through internet surveys. The information needed is like general information that is about awareness, perception, attitude, etc. Next, to investigate more detailed information about enterprises, and manufacturing (decision making, smart manufacturing technology, data security, e.g.).

1.2 Problem Statement

Many countries had established their own readiness model to make sure whether they are ready to embrace it. German national academy of science and engineering has contributed to the development of the Industrie 4.0 Maturity Index that will enable companies to assess their current Industrie 4.0 capabilities (Jones and Pimdee, 2017). Malaysia lagged and to catch up, and it needs to run faster than our competitors. Thus, Malaysia had developed Industry 4WRD Readiness Assessment which focuses on determining their state of readiness in the adoption of Industry 4.0 technologies (Malaysia Productivity Corporation (MITI), 2018). But it is too general as it focuses on Industry 4.0, which is a vast area of study instead of Construction 4.0. More, the assessment purpose is to assess their capabilities and awareness to adopt Industry 4.0 technologies and concept but not tracking their level of revolution.

One of the critical outcomes developed within the Construction Industry Transformation Plan (CITP) is productivity. Despite being part of the crucial sector that will help to establish Malaysia economic, the construction industry was reported

among the lowest productivity sector (Malaysia Productivity Corporation, 2018). Under CITP Programmed, government targets to doubling the productivity rate and matched by higher wages. Industry 4.0 can be seen as a helper in driving Construction Industry in the development of infrastructures, buildings and cities in Malaysia (Shaffii, 2017).

In Malaysia's development towards industry 4.0, small and medium enterprises (SMEs) are also given special attention as SMEs cover most of the manufacturing companies (98.5%) as well as employment (42%) (Ministry of International Trade and Industry (MITI), 2018). Although most large manufacturing firms are already anticipating the benefits and risks of adopting Industry 4.0 practices, small and medium enterprises (SMEs) in Malaysia are still taking precautionary measures in venturing. Knowing that there is great economic potential from Industry 4.0, SMEs in this industry are still far behind and less aware of it. Indirectly this will make SMEs in Malaysia far behind. With the implementation of Industry 4.0 has the potential to change SMEs, especially in the manufacturing sector, among others can increase production productivity, increase efficiency, and reduce costs. In addition, the implementation is also able to increase the capacity of an organization, management system and production level while maintaining quality and improve better monitoring, further developing innovators and manufacturers of Industry 4.0 technology.

However, the level of transformation required is very large for small and medium enterprises (SMEs). Industrial Implementation 4.0 can change business processes as well as operating models. this requires SMEs to collaborate and participate in a wider production network along with other SMEs, including large firms or multinational companies. By adapting digitalization in the manufacturing process system can improve and establish direct relationships with end users in turn produce more innovative and customized products.

Revolution of Industry 4.0 has changed the overall competitive landscape in the construction industry, where with the implementation of Industry 4.0 can reduce its competitive advantage between large and small and medium enterprises (SMEs).

In addition, Countries and manufacturing firms specializing in the use of in-house technology adapted from the Industry 4.0 concept will benefit from global competitors. However, this competitiveness depends on the ability of small and medium enterprises (SMEs) to adapt to market and technological trends. The transformation of the manufacturing industry, through Industry 4.0, is also in line with United Nations' Sustainable Development Goals (SGDs), especially in support of Goals 9 and 12.

Goal 9: Build resilient infrastructure, promote sustainable industrialisation and foster innovation. Inclusive and sustainable industrial development is the primary source of income generation, allows for rapid and sustained increases in living standards for all people, and provides the technological solutions to environmentally sound industrialization (Mohd Fateh,et al., 2016). Without technology and innovation, automation will not happen, and without industrialisation, the development will not occur.

Goal 10: Ensure sustainable consumption and production patterns. Sustainable consumption and production are about promoting resource and energy efficiency, sustainable infrastructure, and providing access to essential services, green and decent jobs and a better quality of life for all (Mohd Fateh, et al., 2016). Its implementation helps to achieve overall development plans, reduce future economic, environmental and social costs, strengthen economic competitiveness and reduce poverty.

In the implementation of Industry 4.0, top management must be sensitive to the digitization trend where top management must be open-minded and always sensitive in determining the company's strategy and direction (Rajnai and Kocsis, 2018). Industry 4.0 revolution evaluation of small and medium enterprises (SMEs) where the information obtained will be collected in particular through internet surveys. The information needed is like general information that is about awareness, perception, attitude, etc. Next, to investigate more detailed information about enterprises, and manufacturing (decision making, smart manufacturing technology, data security, e.g.).

1.3 Aim and Objectives

The aimed of this study is to evaluated Small and Medium Enterprise' adoption of industry 4.0 besides determining the best strategic plan based on the impact of perceived performance on the adoption.

This objective can be divided into several sub-objectives:

a) To identify the adoption of industry revolution among SMEs contractor
b) To determine the perceived performance that impacts the industrial revolution in construction toward SMEs.
c) To develop strategy to control the impact of the industrial revolution among SMEs.

1.4 Scope of Work

This research focusing on the impact of industrial revolution among SME, Contractor in Malaysia, ending with appropriate managerial approaches to the development of an organisational culture supporting toward the concept of Industry 4.0 (Revolution).

According to Knight, (2001) studies have mention that SME's involvement plays an important role in the economic and social structure of developed countries. In addition, SMEs are a sub-sector that must adapt to the rapid changes in technology and construction engineering in order to compete with larger companies. In embracing the concept of industry 4.0 among SMEs is able to encourage more competitive and balanced development. Therefore, SMEs, which are mostly contractors and subcontractors, must have high skills and understanding of Industry 4.0. This is because adapting the revolution towards Industry 4.0 can change the way communication between SMEs and large companies (CREAM) 2014).

1.5 Significant of Study

This project is going to be an applied research project, leading the author through a unique experiment considered new in Malaysia and most of the developing countries. The one common element that all industrialisation revolutions share is the need to increase productivity and quality. Industry 4.0 is all about doing things differently. By leveraging on Industry 4.0 technologies, businesses are able to attain growth without compromising quality, cost or time. There are numerous benefits that come with the adoption of Industry 4.0 but the services identified to change the fundamental equation of manufacturing can be classified into six categories which is productivity, agility, innovation, customer experience, costs and revenue (Malaysia Productivity Corporation, 2018).

Based on the above argument, this study is focused on the level of adaptation and awareness of contractors from SMEs about Industry 4.0In addition, it focuses on the level of impact of industry 4.0 and identifies strategies that can be taken to control or overcome the effects of the Industry 4.0 revolution. This can be the most significant part of this research as it will be apple to close the gap in the Industry Revolution and contribute to the body of knowledge in this field. Therefore, this will give this research an added value to all similar research studies conducted in the relative areas.

1.6 Research Gap

Studies on Industry Revolution are common currently, emerging popular among developed countries but started to be recognized recently in Malaysia. It was first publicly introduced in 2011 as "Industrie 4.0" by Germany. Germany is the first country in the world that has applied the policy to its industry (Methavitakul and Santiteerakul, 2018). However, there are frequently new gap discovered and filled by current researchers in an advance application these days. The present research reveals that "Internet of Things (IoT)", "Cyber-Physical System (CPS)", "Information and Communications Technology (ICT)", "Enterprise Architecture

(EA)", and "Enterprise Integration (EI)" are among the popular topic in BIM research field (Lu, 2017).

After a comprehensive review is made, have identified a few missing elements in Construction 4.0 by research. That is to include a SMEs contractor innovate their business model, the Industrial Revolution toward Construction 4.0.

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