THE READINESS OF MALAYSIA MANUFACTURING COMPANIES IN IMPLEMENTING INDUSTRY 4.0

Submitted in accordance with the requirement of the University Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering

by

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Tajuk: **THE READINESS OF MALAYSIA MANUFACTURING COMPANIES IN IMPLEMENTING INDUSTRY 4.0.**

Sesi Pengajian: **2017/2018 Semester 2**

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DECLARATION

I hereby, declared this report entitled "The Readiness of Malaysia Manufacturing Companies in Implementing Industry 4.0" is the result of my own research except as cited in reference.

Signature   : …………………………

Author's Name   : TAN YON SHERN

Date   : 11 JUNE 2018

APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of Universiti Teknikal Malaysia Melaka as a partial fulfillment of the requirement for the degree of Bachelor of Manufacturing Engineering

The member of the supervisory committee is as follow:

…………………………………….

(Principal Supervisor) – Signature & Stamp

ABSTRACT

Industri pembuatan memainkan peranan penting dalam pembangunan ekonomi Malaysia. Cabaran industri pembuatan daripada persekitaran, sosial, teknologi dan ekonomi telah memulakan integrasi teknologi dalam pengeluaran untuk meningkatkan kecekapan operasi. Transformasi industri pembuatan ke Industri 4.0 untuk meningkatkan kelebihan daya saing pemain pembuatan di Malaysia. Kesediaan industri pembuatan dalam Industri 4.0 boleh mencerminkan sambungan struktur syarikat dengan dimensi Industri 4.0. Ia membantu untuk menentukan keupayaan syarikat dari struktur organisasi untuk melaksanakan Industri 4.0. Akhirnya, ia berkesan menunjukkan pembangunan syarikat-syarikat ke arah Industri 4.0. Syarikat-syarikat itu terdiri daripada GLC, National, SME dan Multinasional yang meliputi semua syarikat pembuatan di Malaysia. Daripada model, ia mencerminkan cabaran pelaksanaan Industri 4.0 untuk digunakan sebagai rujukan dalam menangani bahagian kelemahan. Soal selidik dibina untuk mengumpul maklum balas daripada syarikat berkaitan. Melalui penyelidikan, didapati bahawa syarikat-syarikat pembuatan Malaysia tidak serasi dalam beberapa dimensi. Manakala, syarikat-syarikat telah terlibat secara aktif dengan IOT untuk menaik taraf pengeluaran dan menyediakan perkhidmatan yang berorientasikan pelanggan. Struktur organisasi syarikat bermula menyesuaikan diri dengan perkembangan baru teknologi. Kos pelaburan yang tinggi telah menurunkan kesediaan syarikat untuk melabur dalam Industri 4.0 dan menyebabkan sebahagian besar syarikat tidak ada kemajuan dalam pelaksanaan Industri 4.0. Syarikat-syarikat juga menunjukkan pelaksanaan perkhidmatan awan dan keselamatan standard yang rendah untuk melindungi database syarikat daripada mencuri. Ia disebabkan kos perkhidmatan pengkomputeran mega yang tinggi dan kesedaran yang rendah untuk penggunaan analisis data besar. Syarikat pembuatan menunjukkan motivasi positif ke arah pembangunan Industri 4.0 daripada tahap pemula.

ABSTRACT

Manufacturing industries play an important role in the development of Malaysia economy. The challenges of manufacturing industries from environment, social, technology and economy are initiated the integration of technology into the production to improve the efficiency of operation. The transformation of manufacturing industries into Industry 4.0 used to improve the competitive advantage of manufacturing players in Malaysia. The readiness of manufacturing industries in Industry 4.0 can reflect the connection of the company structure with the dimensions of Industry 4.0. It helps to determine the capability of companies from the organizational structure to implement Industry 4.0. Ultimately, it effectively indicates the development of companies in the direction of Industry 4.0. The companies are consisted of GLCs, National, SMEs and Multinational which covers all the manufacturing companies in Malaysia. From the model, it reflects the challenges of implementing Industry 4.0 for companies which can be used as reference to counter the weakness parts. A solid questionnaire is constructed to collect the feedbacks from relevant companies. Through the research, it is found that Malaysia manufacturing companies are incompatible in some dimensions. While companies have been actively engaged with IoT to upgrade the production and provide customer-oriented service. At the same time, organizational structure of companies gradually fast adapting to the new development of technologies. The high investment cost has lowering the willingness of companies to invest in Industry 4.0 which resulted most of the companies are no progress in the implementation of Industry 4.0. The companies also showed low implementation of cloud service and standard security to protect the database of companies from stealing. It is mainly caused by high cost of cloud computing service and low awareness to the adoption of big data analytics. The manufacturing companies shows positive motivation toward the development of Industry 4.0 from beginner level.

DEDICATION

Only

my beloved father, Tan Cheng Poh

my appreciated mother, Yew Siew Ngoh

my adored sister and brother, Theng and Ken

for giving me moral support, money, cooperation, encouragement and also understandings

Thank You So Much & Love You All Forever

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ACA	-	Accelerated Capital Allowance
AEA	-	Automation Equipment Allowance
AM	-	Additive Manufacturing
AR	-	Augmented Reality
ARAM	-	Augmented Reality Aided Manufacturing
BI	-	Business Intelligence
CAD	-	Computer Aided Design
CAM	-	Computer Aided Manufacturing
CAPP	-	Computer Aided Process Planning
CIM	-	Computer Integrated Manufacturing
CIA	-	Confidentiality, Integrity and Availability
CPS	-	Cyber Physical System
CM	-	Cloud Manufacturing
DISF	-	Domestic Investment Strategic Fund
E&E	-	Electrical and Electronic
ERP	-	Enterprise Resource Planning
GDP	-	Gross Domestic Product
GLCs	-	Government Linked Companies
HLTF	-	High Level Task Force
IaaS	-	Infrastructure as a Service
IAMS	-	Industrial Additive Manufacturing System
IBM	-	International Business Machines
IoT	-	Internet of Things
IIoT	-	Industrial Internet of Things

IMP3	-	Industrial Master Plan 3
IT	-	Information Technology
KKMM	-	Kementerian Komunikasi dan Multimedia Malaysia
MIDA	-	Malaysia Investment Development Authority
MITI	-	Ministry of International Trade and Industry
MNCs	-	Multinational Companies
MOF	-	Ministry of Finance
MOHE	-	Ministry of Higher Education
MOHR	-	Ministry of Human Resource
MOSTI	-	Ministry of Science, Technology and Innovation
PaaS	-	Platform as a Service
PDM	-	Product Data Management
PLC	-	Programmable Logic Controller
RFID	-	Radio Frequency Identification
RMK 11	-	Rancangan Malaysia Kesebelas 11
SaaS	-	Software as a Service
SCADA	-	Supervisory Control and Data Acquisition
SCARA	-	Selectively Compliant Arm for Robotic Assembly
SMEs	-	Small and Medium Enterprises
SSL	-	Secure Sockets Layer
TWGs	-	Technical Working Groups
3D	-	3 Dimensional

CHAPTER 1

INTRODUCTION

This chapter analyzes the background of the study which the related information is explicitly stated in an organized structure. This section comprised of the background, problem statement, research question, objective, scope of the study and significance of the study.

1.1 Background

Industry 4.0 is first proposed by German professionals in the field of engineering during Hanover Fair in 2011. This concept is fully recognized by German government to improve the competitive of country in worldwide and been included in the national policy called High-Tech Strategy (Alan, 2015). Industry 4.0 is known as a new manufacturing paradigm which operation system tend to self-optimized and fully automation. Integration of Internet of things (IoT) and Cyber Physical System (CPS) promote the data analysis between the supply chain from sensor, customer and machine (Heiner et al., 2014).

New era of industrial revolution is a new chapter to the transformation of manufacturing industries as it develops artificial intelligent operating system and integration between product chain from top to bottom stages. IoT, cloud and big data analytics are the key factors that stimulate the development of smart manufacturing process. The job scope of machine not only manufacturing while it starts to self-learning in communication and error correction.

Furthermore, Industry 4.0 changed the traditional centralized manufacturing to decentralized manufacturing structure that develop flexible production and customization to the requirement of customer (William, 2014).

According to the National Statistic Department, manufacturing industry is one of the main stream that contributed 23.5% to the GDP of Malaysia economy in 2017. The economy of Malaysia is highly driven by manufacturing and service industries. The steady growth of manufacturing sector is important to sustain the economy of Malaysia and stay competitive advantage in global market. As manufacturing industries are responsible to provide created employment opportunities in the market and continuous skill enhancement in human resource (Chew, 2005). Industrial transformation is necessary to improve the strength of manufacturing industry in term of productivity and efficiency.

1.2 Problem Statement

Manufacturing industries face the challenges from environment, social, technology and economy. Manufacturing companies need to improve the management of whole value-chain by integrating the virtual and physical structure closely for delivering sustainable growth in the market. (David, 2012). The horizontal and vertical integration is one of the pillars in Industry 4.0 which digitizing the production from supplier to customer. At the same time, reduce the any delay in the production and improve the efficiency of operation.

The intensive competition between global manufacturing players have triggered change in the structure of the economy model which emphasized cost controlling and productivity. Integration of technology and innovation is powerful way to revamp the value chain of manufacturing industries included managing the organizational structure systematically and production planning (Phil, 2010).

Nowadays, advanced countries such as Japan and German put effort in keeping up the trend of Industry 4.0 by upgrading existing manufacturing system to digitization level. It is challenging to survive in the global market as the significant increase of labor cost and aggressive open market competition. Malaysia realizes the importance of converting into high

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value added manufacturing industries with the collaboration of Industry 4.0. MITI has organized various activities included talks and seminars related to Industry 4.0. The purpose of these events is to provide knowledges and information for the transformation of manufacturing industries into Industry 4.0.

With the encouragement of Malaysia government, manufacturing industries has more spaces to plan about the transformation of advanced operation level. Before the execution, it is important to examine the readiness of implementing Industry 4.0 in responding to the structure of companies. Evaluate the appropriate dimensions which can be a guide to improve in embracing Industry 4.0. The cooperation between government and manufacturing industries is essential in developing an ideal industrial digital environment.

1.3 Research Question

To develop the objectives of the study, three questions have been constructed. The questions are:

    I.   What are the factors influencing Malaysia manufacturing companies in implementing Industry 4.0?

    II.   What are the impacts of Industry 4.0 in the structure of Malaysia manufacturing companies?

    III.   What is the preparation of Malaysia manufacturing companies in Industry 4.0?

1.4 Objective

The objectives of the study are:

    I.   To investigate the dimensions of Industry 4.0 in Malaysia manufacturing companies.

    II.   To analyze relationship of Malaysia manufacturing companies in responding to the dimensions of Industry 4.0.

    III.   To determine the readiness of Malaysia manufacturing companies for implementing Industry 4.0.

1.5 Scope

The survey focuses on the four type of Malaysia's manufacturing companies which comprised of Government Linked Companies (GLCs), multinational companies, Small and Medium Enterprises (SMEs) and national companies. Manufacturing is the only industry been focused thorough study. Among the seven fields to be engaged are electrical and electronic (E&E) products; non-metallic mineral products, basic metal and fabricated metal; petroleum, chemical, rubber and plastic products; food, beverage & tobacco; textile, wearing apparel & leather; transport equipment & other manufacturers; wood, furniture, paper products & printing. These manufacturing fields are selected depend on the importance of economic value to the development of Malaysia.

1.6 Significant of Study

The importance of this study is as follows:

I.   As a guide to analyze the readiness of Malaysia manufacturing companies in implementing Industry 4.0.

II.   To determine the structure of Malaysia companies in embracing the revolution of industry 4.0.

III. As a guide to trace the challenges of Malaysia manufacturing companies in approaching the industrial revolution.

CHAPTER 2

LITERATURE REVIEW

This chapter are stated the recent knowledge that related with Industry 4.0. This chapter focuses on any information which are related to the concept of project. By refer the information from past studies, journal research, internet source and reference books, it will be the evident and supports to the study.

2.1 Classification of Malaysia Manufacturing Industries

Manufacturing industries are important to the development of the economy in every country. In this context, manufacturing sector creates value through the conversion of raw materials into industrial products and distribute to customers (William, 2014).

Malaysia manufacturing sector is mainly driven by three sub-sectors. Among the sectors are electrical and electronic (E&E) products; non-metallic mineral products, basic metal and fabricated; metal petroleum, chemical, rubber and plastic products. As these products are contributed 40% to 50% of sales value in manufacturing sector (TheStar, 2017). According to Department of Statistics Malaysia, monthly manufacturing statistics showed the ratio of seven sub-sectors from manufacturing sector. It is consisted of food, beverage & tobacco (12.0%), textile, wearing apparel & leather (13.2%), transport equipment & other manufacturers (3.0%), wood, furniture, paper products & printing (13.8%), petroleum, chemical, rubber & plastic

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(18.0%), non-metallic, mineral products, basic metal & fabricated metal products (7.9%) and E&E (7.5%). A summary of the categories of Malaysia manufacturing sector is shown in Figure 2.1.
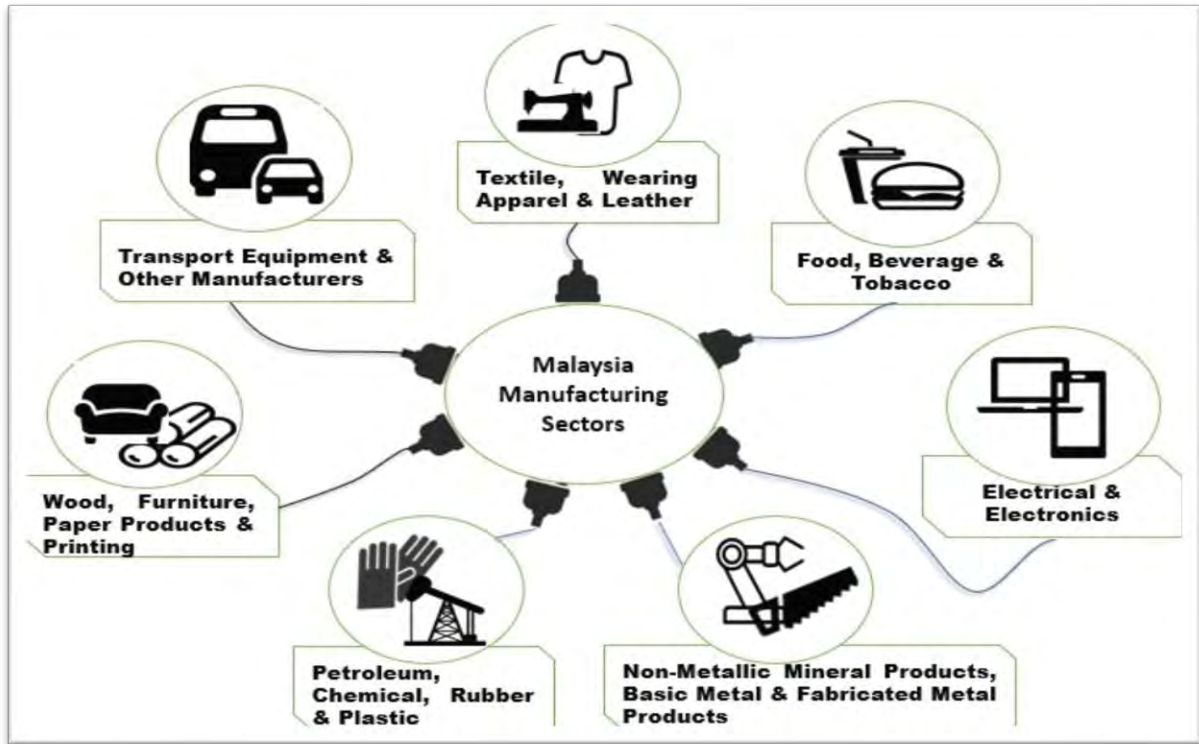

Figure 2.1: Categories of Malaysia Manufacturing Sectors (TheStar, 2017).

2.2 Industrial Revolution

The first industrial revolution is initiated by Britain around 1760-1840. The use of iron and steel have been used intensified together with the great invention of steam power. At the same time, new mechanical machines like power loom and spinning jenny have been invented to increase the production (Britannica, 2017). At 1870-1914, the second industrial revolution brought drastic change to the technologies and economy aftermath of the War and Reconstruction. The invention of electricity has accelerated the development of manufacturing sector and the trade between countries increased as the growth of telegraph and railway. The era of mass production is established by Henry Ford with the launch of assembly line in production (Ryan, 2016).

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Around 1974, another wave of industrial revolution exploded which called as third industrial revolution or digital revolution. The significant event of third industrial revolution is the introduction of first programmable logic controller (PLC) in 1969. PLC is industrial control system that acts as central decision maker that receive data from input device and respond to the output device (AMCI, 2017). It symbolizes the age of information technologies and beginning of robotic manufacturing. The electronic devices are widely applied to automate the production with the aid of computerized network that transmitted information to user (Charles, 2013). Currently, forth industrial revolution is initiated with the development of CPS which integrate the embedded computer with physical machine.

The industrial revolution is getting complex and integrate all the operation within production. The data generated from the system is critical to the identify the potential problems and opportunities. A diagram about the stages of industrial revolution from 1.0 to 4.0 is shown in Figure 2.2.
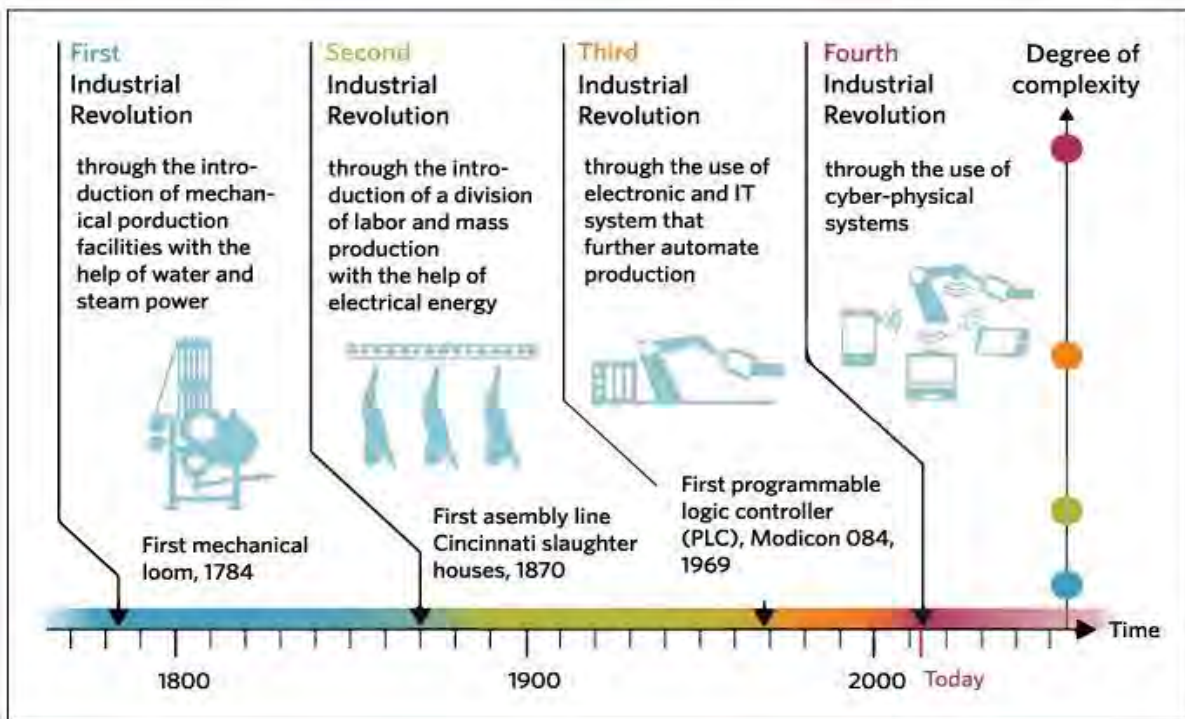

Figure 2.2: Industrial Revolution from Industry 1.0 toward Industry 4.0 (Siemens,2013)