



Faculty of Manufacturing Engineering

**A STUDY ON THE AWARENESS OF MALAYSIA'S
MANUFACTURING INDUSTRIES IN IMPLEMENTING
INDUSTRY 4.0**

Nurhazimah Binti Mohd Hamka

Master of Manufacturing Engineering (Industrial Engineering)

2017



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NURHAZIMAH BINTI MOHD HAMKA

**A thesis submitted in fulfillment of the requirements for the degree of Master of
Manufacturing Engineering (Industrial Engineering)**

Faculty of Manufacturing Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2017

DECLARATION

I declare that this thesis entitled “A Study on The Awareness of Malaysia’s Manufacturing Industries in Implementing Industry 4.0” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :

Name : Nurhazimah Binti Mohd Hamka

Date :

APPROVAL

I hereby declare that I have read this dissertation/report and in my opinion this dissertation/report is sufficient in terms of scope and quality as a partial fulfillment of Master of Manufacturing Engineering (Industrial Engineering).

Signature :.....

Supervisor Name :... Dr. Effendi Bin Mohamad.....

Date :.....

DEDICATION

Special thanks to my supervisors and treasured friends. For my beloved parents, my siblings, my families and anyone involved in this project for all their supports and encouragement in the completion of this report.

ABSTRACT

Today, there are many challenges faced by the manufacturing sector with respect to the disruptive concepts like Cyber-Physical Systems, Internet of Things, Cloud-based Manufacturing, which is also known as the Industry 4.0. The concept of Industry 4.0 was first introduced at Hannover Fair (Germany) and it was seen to be a high-tech approach, which would lead to an intelligent manufacturing. The main aim of Industry 4.0 is improving the existing processes and products by using modern digital technologies and providing more opportunities for developing novel business models. Currently, the manufacturing sector ought to alter their policies and adapt the trending transformations if they wish to face their competitors. Several companies have begun investing in the essential Industry 4.0 resources because they faced a steady decline in their productivity levels when using conventional techniques. In this study, the researchers have aimed to investigate the Industry 4.0 implementation and determine the awareness levels of the Malaysian manufacturing industries with regards to this concept. The researchers have investigated all the different sectors in the Malaysian manufacturing companies, whether they are Small and Medium-scale Enterprises (SMEs), Government Link Companies (GLCs) or national and multinational corporations. In this study, the researchers used a survey-based research technique, where they used a sample size of 91 Malaysian manufacturing industries. The researchers carried out the survey amongst the employees and the managers, who represented their company. Few questionnaires were prepared and circulated amongst all the companies between May and June 2017. More than 50 of the Malaysian manufacturing industries completed the questionnaires and participated in the personal interviews. All results obtained after the survey were analysed using the Descriptive Statistic Analysis. Based on the results, it could be seen that 50.5% of the respondents were familiar and aware of the Industry 4.0, while 49.5% were unfamiliar with the concept. Furthermore, the results showed that the familiarity and the awareness of the Industry 4.0 amongst the managers was dependent and was influenced by their foreign-owned company type and sector as the multinational companies possessed a higher amount of advanced assets which led to a higher production. An additional 6 factors like data-driven services, smart operation, smart factory, smart product, employees and the strategy and organisation also contributed to the company's digital transformation, which was further benefitted by various exponential technologies. The findings of this study were very useful for future research as they helped in establishing a future model framework for the assimilation of the Industry 4.0 concept amongst the Malaysian manufacturing industries.

ABTRAK

Industri pembuatan pada hari ini dikatakan sedang menghadapi pelbagai cabaran di mana sektor ini sedang tergugat dengan kewujudan konsep-konsep baru seperti Internet of Things (IoT), Cyber Physical Systems atau Cloud Manufacturing yang juga merujuk sebagai Industri 4.0. Industri 4.0 diperkenalkan buat pertama kalinya di Temasya Hannover, Jerman sebagai pendekatan yang berteknologi tinggi yang dikuasai oleh teknologi pembuatan secara pintar. Industri 4.0 mensasarkan penambahbaikan produk atau proses yang sedia ada dengan menggunakan teknologi digital yang moden dan menyediakan pelbagai peluang untuk memajukan model perniagaan yang baru. Sektor perindustrian pada masa kini perlu mengubah dasar-dasar mereka dan menyesuaikan diri dengan lebih cenderung ke arah transformasi ini jika mereka ingin berhadapan dengan pesaing-pesaing lain. Beberapa syarikat sedang giat melakukan pelaburan untuk memenuhi keperluan sumber yang berkaitan dengan Industri 4.0 disebabkan mereka menghadapi penurunan yang stabil pada tahap produktiviti mereka apabila menggunakan teknik-teknik konvensional. Melalui kajian ini, para penyelidik telah menyasarkan kajian berkenaan dengan pelaksanaan Industri 4.0 dan menentukan tahap kesedaran industri-industri pembuatan di Malaysia berkaitan dengan konsep ini. Para penyelidik telah melakukan kajian terhadap pelbagai sektor pembuatan di Malaysia termasuk syarikat daripada skala sederhana dan kecil perusahaan (PKS), syarikat hubungan kerajaan, syarikat nasional dan syarikat multinasional. Melalui kajian ini, para penyelidik menggunakan teknik penyelidikan berasaskan tinjauan dengan menggunakan 91 saiz sampel di kalangan industri pembuatan di Malaysia. Para penyelidik menjalankan tinjauan ini dikalangan pengurus dan kakitangan yang mewakili syarikat masing-masing. Beberapa soal selidik telah disediakan dan diedarkan di semua syarikat di antara bulan Mei hingga Jun 2017. Lebih daripada 50 buah syarikat daripada industri pembuatan di Malaysia disoal selidik dan ditemuramah secara peribadi. Keseluruhan hasil tinjauan tersebut dianalisis menggunakan kaedah Analisis Statistik Huraian. Berdasarkan keputusan, ia mungkin dilihat bahawa 50.5% daripada responden biasa dan sedar berkenaan dengan Industri 4.0, manakala 49.5% tidak biasa dengan konsep ini. Tambahan pula, keputusan ini menunjukkan bahawa kebiasaan dan kesedaran berkaitan dengan Industri 4.0 di kalangan kakitangan bergantung dan dipengaruhi oleh syarikat asing dan sektor syarikat di mana syarikat multinasional lebih cenderung kepada memiliki aset-aset yang lebih maju yang membawa kepada hasil pengeluaran yang lebih tinggi. Tambahan pula, 6 faktor seperti perkhidmatan data pacuan (data driven service), gerakan pintar (smart operation), kilang pintar (smart factory), produk pintar (smart produk), kakitangan yang berkemahiran serta dan strategi serta organisasi yang menyumbang kepada transformasi digital syarikat yang seterusnya dimanfaatkan oleh pelbagai teknologi yang maju. Hasil daripada penemuan kajian ini sangat berguna untuk penyelidikan pada masa akan datang di mana ianya dapat membantu dalam mewujudkan rangka kerja model (framework) untuk diasimilasikan konsep Industri 4.0 dikalangan industri-industri pembuatan di Malaysia.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURES

AM	-	Additive Manufacturing
AR	-	Augmented Reality
CPS	-	Cyber-Physical Systems
CPSS	-	Cyber-Physical Production System
CREST	-	Collaborative Research In Engineering, Science And Technology
GDP	-	Gross Domestic Product
GLCs	-	Government Linked Company
ICT	-	Information And Communications Technology
IT	-	Information Technology
ITA	-	Investment Tax Allowance
IoS	-	Internet Of Service
IoT	-	Internet Of Things
LCC	-	Low Cost Countries
MITI	-	Ministry Of International Trade And Industry
MIDA	-	Malaysian Investment Development Authority
MOSTI	-	Ministry Of Science, Technology And Innovation
R&D	-	Research And Development
SMEs	-	Small And Medium Enterprise
SIRIM	-	Rearrange Scientific And Industrial Research Institute Of Malaysia
PS	-	Pioneer Status
3D	-	3 Dimension

CHAPTER 1

INTRODUCTION

This chapter introduces the background information about this study, the information of this report is organised to disclose the originality of the study. Description are given on the background of the study, problem statement, research question, objective, scope of the study and significance of the study.

1.1 Background

Industrial sector is important for the development of the economy in every country. Industry, in this context, is lead to the manufacturing sector, where provides added value through the transformation of materials into complete products (Bahrin et. al., 2016) to the consumer. In Malaysia, manufacturing industry is a backbone of Malaysia economy that has been targeted by governments (Aziz et. al., 2000) since it contributed by 12.8 percent of gross domestic product (GDP) in 2014. Today, the traditional method in manufacturing industry is left out of the existence of the digital transformation in operation stage that accelerated by exponentially growing technologies.

The term of Industry 4.0 publicly known in year 2011 in Hanover Fair (Jadzdi, 2014; Bahrin et. al., 2016) that being attended by an association of business, politics and academic party that aim to promote Industry 4.0 ideas which aim to enhance the competitiveness of manufacturing industry in Germany toward the digital industry. The German government has been actively promoting Industry 4.0 trend to their industrial

sector as one means of increasing their competitiveness. There are many appellations apart of Industry 4.0 which are digital operation.

This concept has been widely discussed for most global industries and the information technology (IT) industry perspective. Some reviewer purpose the similiar concept under Cloud-based manufacturing Internet of Things (IoT) and cyber-physical system (CPS). Industry 4.0 is the next phase in industrial revolution where (Bahrin et. al., 2016) the IoT play as important role as the potential factor that feed the data into it and give value to industrial sector to encourage a low volume, high mix production in a cost-efficient alternative.

This is a new era of revolution that concern on the end to end digitisation of entire the physical assests and their integration into digital ecosystems with value chain partners (Pricewater Cooperation, 2016). The introduction of the usage of sensors, expansion of wireless communication and networks, cloud and big data, the implementation of intelligent robots and machines have increased the potential in transforming the manufacturing practice. Figure 1.1 shows the framework of the components and contributing digital technologies in Industry 4.0 revolution.

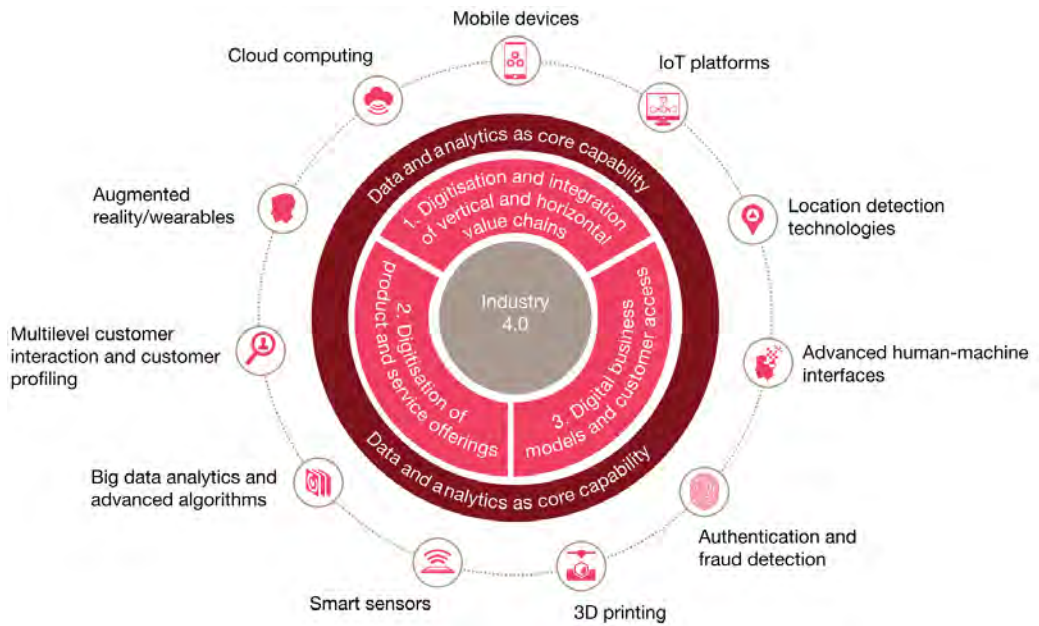


Figure 1.1: Industry 4.0 Framework and Contributing Digital Technologies (Pricewater Cooperation, 2016)

1.2 Problem Statement

Nowadays, the industrial sector needs to expose to transformation towards Industry 4.0 if not, they will left behind their competitors. As the time passes speedily, the demand grew rapidly, many products were invented and give significant to the development in the structure of mass production. Most of the companies are investing in significant resources towards this fourth industrial revolution because that traditional productivity has been widely exhausted. According to Wee et. al., (2015), lean development act as catalyse with Toyota's system widely implemented. In 1980 the trend for outsourcing and offshoring and in 1990 industry being said make their high profitability by transformation towards low skill manufacturing to low cost countries (LCC). In 2000s, the offshoring system start to decline due to rise LCC wages and freight cost.

Today's, customer responsiveness and time to market are the factor of competition between the companies. They are invest towards the potential technologies resources to meet target of LCC labor cost levels. Most of the industrial sector are redesigning their operational networks thus, they move close to research and development (R&D) effort

customers and customer. The pressure on industrial sector rise and they are looking for a new chance to increase their productivity and performance. The industrial sector have to start generating new applications and find the alternatives to gain these technologies to their competitive benefits that are not only beneficial to consumers but also to the business. China as the one of develop country was sustain their rank as an industrial powerhouse was shift their traditional manufacturing practice to modern computerised machines and robots (Rubaneswaran, 2017).

1.3 Research Question

In order to develop the objectives of the research, several questions have been constructed. The questions include:

- i. What are the factors need to be considered as contributors toward the future digitalization in Malaysia's manufacturing industry?
- ii. How this digital changes towards Industry 4.0 could boost Malaysia's global competitiveness ranks with others developed country
- iii. Do Malaysia's manufacturing industry aware towards implement Industry 4.0 around the world?

1.4 Objective

This research has been developed based on several objectives which are:

- To study the implementation of Industry 4.0 in global aspect
- To assess managerial awareness and familiarity on the Industry 4.0 concept in Malaysia's manufacturing industry

1.5 Scope

A survey-based research is conducted on a few types of companies that exist in Malaysia, including multinational companies, national companies, Government Linked Companies (GLCs), and Small and Medium Enterprises (SMEs). This study is conducted on various types of industries located in Malaysia, such as automotive, aerospace, transportation and logistics, oil and gas, food and beverages industry, chemicals, electric and electronics, civil engineering and construction, metal-based industry, agriculture, and others. Multinational companies, national companies, and GLCs groups already consider this topic as very important, but for SMEs groups, since this concept is not yet considered relevant to them. Instead, SMEs groups have the ability to apply this concept more efficiently due to their ability to develop and implement IT infrastructure and systems more easily from the beginning stage. Large companies, such as multinational companies, face more difficulty in dealing with their existing, organically grown structures (Bahrin et al., 2016).

1.6 Significant of Study

The importance of this study is as follows:

- i. For those who want to understand about Industry 4.0 concept in Malaysia manufacturing industry?
- ii. As a reference tool to determine implications, identify challenges and discover opportunities related to Industry 4.0 concept?
- iii. As a reference tool to prove the potential of Malaysia's manufacturing industry in implementing Industry 4.0 concept although exposed to this challenging global economy?

CHAPTER 2

LITERATURE REVIEW

This chapter are summarize about 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 informations from past studies, journal research, internet source and reference books, it will show a path and guide for the project in the future.

2.1 Manufacturing Industry

The growth in manufacturing industry is increase compare to non-manufacturing industry. Industry can be said as the part of an economy activity that concert on production of materials goods that highly mechanised and automatised (Lasi et. al., 2014). Manufacturing activity usually happens in a huge-scale production line that include machinery and skilled worker (Brooks, 2016). The manufacturing usually happens on a large-scale production line of machinery and skilled worker. The characteristics of manufacturing operations are consumption of output, a number of an extra worker or extra time needed to fulfill the demands and choosing the job that uses more equipment but less number of labors. The manufacturing operations performance is measured based on production activities and utilization of resource as product are made (Kumar et. al., 2009).

Acording to Global Agenda Council, manufacturer's sustainable competitiveness depends on its capabilities with respect to cost, delivery, flexibility, and quality. In today business, most of organizations need to focus on systematic and high efficient manufacturing system in order to compete between competitors and to sustain in the global

market. This is due to manufacturing industry is seen by society as a major means of generating economic growth and jobs creation (Moreira et. al., 2013).

2.2 History of Industrial Revolution

The manufacturing industry has been building innovative advances that called revolutionary. The first mechanical loom from year 1784 until now which is 233 years ago (Drath et. al., 2014); there are four stages in the ongoing process called the Industrial Revolution (Bahrin et. al., 2017). Flexibility is one of the main drivers behind this change of revolution stage. First industrial revolution is concentrated in usage of powerful vapor machine (Rubaneswaran, 2017) in the end of 18th century. While, the second revolution in early 19th century concern on development in electrical usage to transform assembly line and third revolution in the late of 10th century revolve to use of information technology (IT) to continue more further in the automated production line. As the world keep changing, so does the technology, the fourth industrial revolution will see Internet of Things (IoT) overhaul not only business but, almost entire aspect in daily life.

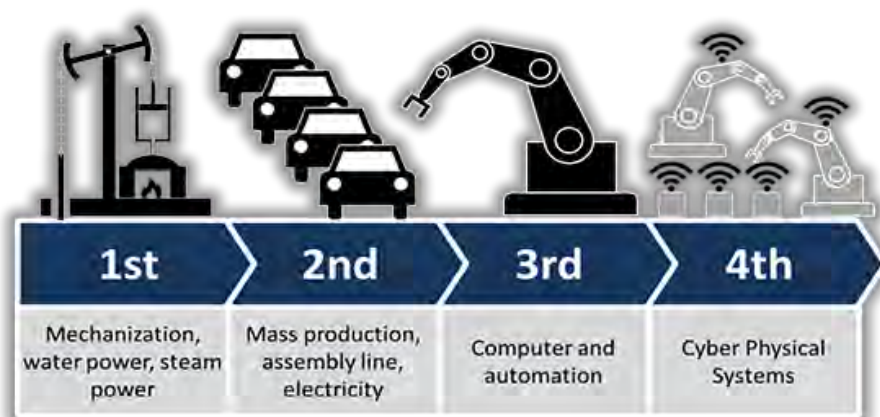


Figure 2.1: The four stages of the industrial revolution (<http://fasa.co.za/fasablog/what-the-future-holds/>)

The development of technology has become convenient for future generation that gives high impact on the development of a country especially in industrial sector. From mass production, the manufacturing practice has been able to change toward green manufacturing to sustainable manufacturing. These practice has been evolving as they are keep improving to ensure an efficient of industry system. Figure 2.1 shows an overview of the four industrial revolutions.

2.2.1 Industry 1.0

The Industry 1.0 was mechanize looms driven by steam engines, followed by fabric production left in private home in favor of central factories (Drath et. al. 2014; Gandhi, 2015). According to Wahl (2015), the first industrial revolution was about the transformation from hand production job shops to steam engine powered machinery enabling mass production. The first practical steam-powered engine was a water pump, developed in years 1698 by Thomas Savery (Zuhlke, 2013). According to Industrial Report 2016 by Khan Academy, the design of Newcomen engine is improve in 1712, the Watt steam engine was developed as shown in Figure 2.2 sporadically from years 1763 to 1775.

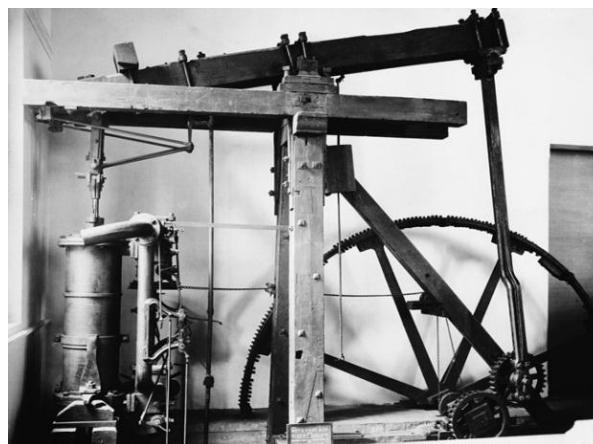


Figure 2.2 James Watt's "Sun and Planet" steam engine. (Robinson, et. al. 1969)