MALAYSIAN SMART MANUFACTURING ECOSYSTEM READINESS ASSESSMENT FOR INDUSTRY 4.0

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This Thesis Is Submitted in Partial
Fulfilment Of The Requirements For The Award Of Bachelor Of Technology Management (Technology Innovation) With Honours

Faculty of Technology Management and Technopreneurship
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

JANUARY 2023

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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APPROVAL

‘I hereby declare that I have read and go through this dissertation/report/thesis and certify that, this dissertation/report/thesis is satisfactory in the sense of scope and quality as a partial fulfilment the requirements for the award of Bachelor of Technology Management (Innovation) with Honours and will submitted to the Universiti Teknikal Malaysia Melaka.’

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'I have hereby stated that my
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is the result of my personal study except with the explanations or information from other research as cited in the references clearly. The thesis has not been accepted for any degree and is not concurrently submitted in the candidature of any other degree.'

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DEDICATION

I would like to express my deepest appreciation to my precious family members who have always aided and inspired me all the time in various spiritual, economical, and motivational ways. In addition, I would also like to devote my sincere gratitude to my beloved supervisor, Mrs. Nor Ratna Binti Masrom, who are willing to spend much time and patiently guided me in the whole process of this research and my classmates/friends who share their knowledge during the study. Without their blessing and support, this study is difficult to complete.

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ACKNOWLEDGEMENT

I would like to take this opportunity to express my sincere gratitude to my beloved supervisor, Mrs. Nor Ratna Binti Masrom, for her guidance and advice. Thank you for sharing useful information and experiences that always inspired me to work hard towards the completion of the project. I would also like to thank my committee Dr. Nurulizwa Binti Abdul Rashid, who provided valuable comments and recommendations for my project, my deepest appreciation. Also, I would not forget to thank my family members, classmates, and friends who are always willing to help me and encourage me along the way to complete my thesis. Without their motivation and support, I would not have been able to successfully complete this thesis.

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ABSTRACT

The Smart Manufacturing Ecosystem (SME) plays an important role in achieving the company's goal towards industry 4.0 (I4.0). Industry 4.0 revolves around “a network of manufacturing resources (manufacturing machines, robots, conveyors and warehousing systems and production facilities) that are autonomous, able to control themselves in response to different situations, self-configuring, knowledge-based, sensor-equipped and spatially distributed and which also incorporates related planning and management systems". Therefore, this research is to examine the readiness assessment of Malaysia's smart manufacturing ecosystem for industry 4.0 and aims to determine the relationship between the independent variables. This study was conducted using quantitative methods. This research will focus on employees working in manufacturing firms in Malaysia who are in positions at the executive level and above because they are more responsible in making decisions. In conducting the study of this research project, a quantitative method was chosen for data collection, and the Statistical Package for Social Sciences (SPSS) version 26 was used for data analysis. The constructed questionnaire was distributed to 120 of the target subjects via a URL or Google Form link via email and other network-based applications. Therefore, the results cross tabulation shows that the three variables in this. In conclusion, through this research, it is hoped to provide guidelines to Malaysian manufacturing firms for them to know the criteria required for companies to apply and use the smart manufacturing ecosystem (SME) for industry 4.0 (I4.0) in their work that can produce effective ways and efficient business.

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Keyword – *Smart Manufacturing Ecosystem, Industry 4.0, SPSS.*

ABSTRAK

Ekosistem Pembuatan Pintar (SME) memainkan peranan penting dalam mencapai sasaran syarikat kearah industry 4.0 (I4.0). Industri 4.0 berkisar tentang "rangkaian sumber pembuatan (mesin pembuatan, robot, penghantar dan sistem pergudangan dan kemudahan pengeluaran) yang berautonomi, mampu mengawal diri mereka dalam tindak balas kepada situasi yang berbeza, konfigurasi diri, berasaskan pengetahuan, dilengkapi sensor dan tersebar secara spatial dan yang turut menggabungkan sistem perancangan dan pengurusan yang berkaitan". Oleh itu, penyelidikan ini adalah untuk mengkaji penilaian kesediaan ekosistem pembuatan pintar Malaysia untuk industry 4.0 dan bertujuan untuk menentukan hubungan antara pembolehubah bebas. Kajian ini dijalankan dengan menggunakan kaedah kuantitatif. Penyelidikan ini akan memberi tumpuan kepada pekerja yang bekerja di syarikat PKS di Malaysia yang berada dalam jawatan di peringkat eksekutif dan ke atas kerana mereka lebih bertanggungjawab dalam membuat keputusan. Dalam menjalankan kajian projek penyelidikan ini, kaedah kuantitatif telah dipilih untuk pengumpulan data, dan Pakej Statistik daripada Sains Sosial (SPSS) versi 26 digunakan untuk analisis data. Soal selidik yang dibina diedarkan kepada 120 daripada subjek sasaran melalui URL atau pautan Borang Google melalui email dan aplikasi berasaskan rangkaian lain. Oleh itu, hasil daripada penjadualan silang menunjukkan ketiga-tiga pembolehubah dalam kajian Kesimpulannya, melalui penyelidikan ini, diharapkan dapat memberi garis panduan kepada firma pembuatan Malaysia untuk mereka mengetahui kriteria yang diperlukan untuk syarikat mengaplikasi dan menggunakan ekosistem pembuatan pintar (SME) untuk industri 4.0 (I4.0) dalam kerja mereka yang boleh menghasilkan cara yang berkesan dan cekap menjalankan perniagaan.

Kata kunci – *Ekosistem Pembuatan Pintar, Industri 4.0, PKS, SPSS.*

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LIST OF ABBREVIATIONS

I4.0	Industry 4.0
NIST	National Institute of Standards and Technology
IoT	Internet Of Things
RBV	Resource-Based View
SP	Smart Product
SF	Smart Factory
DDS	Data Driven Services
PLC	Programmable Logic Controllers
SMS	Short Production System
MESA	Manufacturing Enterprise Solutions Association
ICT	Information And Communications Technology
CPS	Cyber-Physical System
IT	Information Technology

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CHAPTER 1

INTRODUCTION

1.1. Introduction

This chapter explains about background of the study, research problem, research question, research objectives, significant of the study, limitation of the study and operational definitions. To complete a Bachelor's Degree Dissertation (Projek Sarjana Muda (PSM)) in Faculty of Technology Management and Technopreneurship (Bachelor of Innovation), researcher chooses to investigate the Malaysian smart manufacturing ecosystem readiness assessment for Industry 4.0.

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1.2. Background Of Study

Industry 4.0, also known as smart manufacturing, refers to the merger of operational technology and information to monitor physical production processes and employ data to make prescriptive, corrective, and adaptive decisions in order to cut operational costs. The term "industry 4.0" is a reference to the fourth industrial revolution, or more precisely, the transition to manufacturing that is smart and intelligent (Tay, Alipal and Lee, 2021). The implementation of Industry 4.0 necessitates the integration of vertical and

horizontal data throughout the whole of an organization. Vertical digitalization may be observed in a variety of sectors, including manufacturing, procurement, supply chain management, design, product life cycle management, logistics, operations, and quality. Vertical digitalization can also be seen in operations and quality. They are all linked to one another to ensure that a steady stream of data is provided. The process of integrating data from several parties, including as customers, suppliers, and strategic partners, might be considered part of horizontal digitalization. In order to integrate a company, its systems, networks, and operational processes will need to be upgraded or replaced, respectively. In the context of the smart and intelligent manufacturing model, digitally integrating a business system is insufficient. The integrated system requires end-to-end engineering transformation, strong data services, and analytics in order to convert the data that is created by systems, sensors, and machines into meaningful insights that may yield a return on investment (Tay, Alipal and Lee, 2021).

According to the National Institute of Standards and Technology (NIST), "smart manufacturing" is a fully integrated collaborative production system that can adjust in real time to changing circumstances in the plant, the supply chain, and consumer expectations(Tay, Alipal and Lee, 2021). Because linked systems are being used in smart manufacturing, the danger to cyber security is also increased. This is why implementing Industry 4.0 requires tight coordination with the company's IT specialists. To guarantee that best practices for cyber security are used throughout the company's digital ecosystem, IT experts must work in collaboration with senior management. An organization's internal culture revolution is one of the most important aspects of Industry 4.0 adoption in manufacturing. This calls for strong leadership that is dedicated to managing change and making the required investments in technology and education to effectively adopt smart manufacturing processes(Tay, Alipal and Lee, 2021).

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1.3. Problem Statement

According to Anshari and Almunawar, (2022), there is a positive association between the preparedness of digital ecosystems and the adoption of open innovation by small and medium-sized enterprises (SMEs). Despite the fact that knowledge management is one of the most important factors in determining whether or not a nation will be successful in implementing the open innovation paradigm, According to a recent study, "smart manufacturing systems" have been actively contributing to the improvement of manufacturing technology in the modern industrial era. Technology that enables smart manufacturing boosts both operational efficiency and production, and it also has a significant influence on economies throughout the world. It has been discovered that the advent of the Internet of Things and the Industrial Internet of Things has been playing a significant role in improving manufacturing systems that are equipped with smart manufacturing systems (Phuyal, Bista and Bista, 2020).

There is research has been done, one of the most critical issues that requires further exploration is the interpretation of the term “industry 4.0”, based on its contribution at the manufacturing and business level, the value of the futuristic use cases, and the available technological enablers. It is widely known that different technological initiatives, developed around the globe, have been described as I4.0 advancements. These various forms of ingenuity have obscured the original I4.0 inspiration, and as a result, the methodology needed to achieve key developments and business visions has not yet been clearly defined (Konstantinidis et al., 2022).

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1.4. Research Question

The following research question is being addressed in this study:

i. What is profile Malaysian smart manufacturing ecosystem readiness for Industry 4.0?

ii. What is level the Malaysian smart manufacturing ecosystem?
iii. What is the difference between the local and international ownership in terms of smart manufacturing?

1.5. Research Objective

The research's objective was determining the Malaysian smart manufacturing ecosystem readiness assessment for Industry 4.0. The following are the research objective:

i. To profile Malaysian smart manufacturing ecosystem readiness for Industry 4.0.
ii. To measure level the Malaysian smart manufacturing ecosystem.
iii. To study the difference between the local and international ownership in terms of smart manufacturing.

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1.6. Scope Of Study

The research's scope is the distribution of questionnaires to analyse the Malaysian smart manufacturing ecosystem readiness assessment for Industry 4.0. The respondents will be in Malaysian manufacturing company businesses who hold executive-level or above positions. This research will be conduct to all Malaysian manufacturing firms.

This research will utilize the resource-based view (RBV) theory. The study discovered that the Resource-based view (RBV) hypothesis has become the dominant paradigm in the smart manufacturing, allowing us to comprehend how firm create efficient results. Furthermore, it provides us with vital information on how efficient the performance and how it managed.

1.7. Significant Of Study

1.7.1. Practical Contribution

According to the findings of this study (Anshari and Almunawar, 2022), SMEs in Indonesia This research examined some of the most important challenges that small and medium-sized businesses (SMEs) face when it comes to implementing open innovation, which is necessary for Industrial Revolution 4.0. The paper focuses on the ways in which the preparedness of the digital ecosystem effects the adoption of open innovation by SMEs in Indonesia. The research conducted by Tay, Alipal, and Lee (2021) looked at the data collected from seven different manufacturing businesses that were participating in Industry 4.0 projects in order to determine the many possibilities available for the companies' plans. According to the findings of the research, the application of Industry 4.0 in manufacturing companies is still in the experimental stage. [Citation needed]

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1.7.2. Theoretical Contribution

The Resource Based View (RBV) of a company is based on the idea that a company's success is dictated by the resources available to it. The way these resources are utilized and arranged allows the company to function well and might even provide it a competitive edge. (ICAEW, 2016)

1.8. Limitation Of Study

There are various limitations to doing this research, researcher faced with some limitations such as time constraint, lack of skill and knowledge and the respondent honesty. Researcher has limit time of research due to the short period given in implementing her study. Researcher has some difficulties to

find as much as information and details related to her study in each timeframe. Then, this research only focuses on manufacturing firm in Malaysia respondents, thus the result is more focused on manufacturing firms than on respondent from other industries.

1.9. Operational Definition

a) Smart Manufacturing

Smart manufacturing is the notion of orchestrating physical and digital processes within factories and across other supply chain functions to optimize current and future supply and demand requirements. This is accomplished by transforming and improving ways in which people, process and technology operate to deliver the critical information needed to impact decision quality, efficiency, cost, and agility.

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b) Industry 4.0

Industry 4.0 is revolutionizing the way companies manufacture, improve, and distribute their products. Manufacturers are integrating new technologies, including Internet of Things (IoT), cloud computing and analytics, and AI and machine learning into their production facilities and throughout their operations.

1.10. Chapter Summary

Finally, this background completed the research's background, which is connected to present status of Malaysian smart manufacturing ecosystem readiness assessment and Industry 4.0. There are additional explanations of why this study is being performed. Furthermore, this chapter presents three study questions and goals. This research is limited by a few factors, including respondent honesty and time constraints. This research is important because it gives information on the smart manufacturing ecosystem readiness assessment on the industry 4.0 in Malaysian.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will discussed about the literature review and relevant theoretical model. The researcher discussed about the variables, measurement, and definition of industrial 4.0, smart product, smart factory and data driven services. The independent variable is clearly defined it.

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2.2 Definition

2.2.1. Industrial Revolutions

The machining process of the early ages to the automated manufacturing industries of today: the manufacturing industries have come a long way in a relatively short amount of time. Manufacturing and industrialization systems have now reached their fourth generation since the beginning of the industrial revolution. These systems have progressed via many innovations and iterative tests over the course of the last few years. During this time span, there have been several advancements and adjustments made thus far. Figure 2 presents a timeline that details the many years of the industrial revolution. Within each of these ages are

highlighted significant accomplishments and innovations that are shared by the more recent revolution.(Tay, Alipal and Lee, 2021)

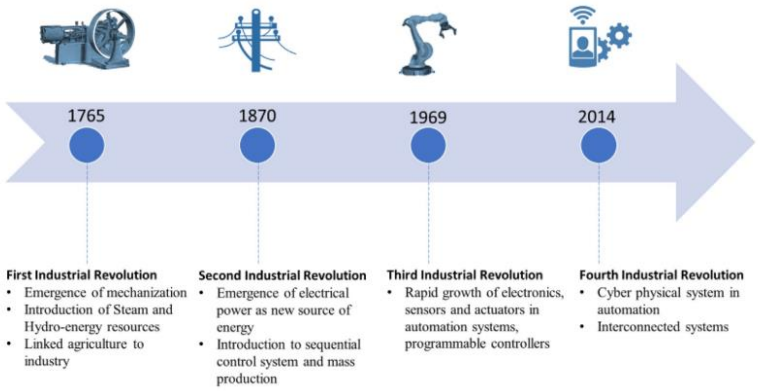

Figure 2.1: Chronology of Industrial Revolution.

Sources: (Phuyal, Bista and Bista, 2020)

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a) First Industrial Revolution

In the first half of the 18th century, the United Kingdom was the first country in the world to begin the process of industrialization. At that time, the cotton industry was transitioning from a worker-based cottage industry to an economy based on machines. This transition took place in the cotton industry. The commencement of the new manufacturing process coincides with the time period known as the "first industrial revolution" in Europe and America, which is generally considered to have occurred between 1760 and 1820. During this time period, the textile industry was the first industry to make use of modern production technology. As a result, it was one of the largest sectors in terms of capital investment, output, and the number of job opportunities it provided. The creation of coal, iron, railways, and textiles were the important advancements of the first industrial revolution. The discovery of the spinning jenny in 1764 by James Hargreaves, which produced numerous spools of thread