

THE IMPACT OF INDUSTRY 4.0 TOWARDS ORGANIZATIONAL  
PERFORMANCE IN MANUFACTURING INDUSTRY

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## DECLARATION

I hereby declare that the work have been done by myself and no portion of the work contained in this research project report has been submitted in support of any application for any other degree or qualification of this or any other university or institute of learning.

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## DEDICATION

I would like to appreciate the dedication of my beloved families who educated me and motivate me to learn until this level, the lecturers and friends who give me support and advice throughout the research. Without their blessings and encouragement, this research is impossible to complete in short period of time.

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## ABSTRACT

Digitalization of manufacturing process is the need for today's industry. The manufacturing industry are currently changing from mass production to customized production. The advancement in manufacturing technologies in the industries help in increasing productivity and organizational performance of the industry. This research aims to identify the impact of Industry 4.0 towards organizational performance in manufacturing industry. This research used explanatory research as research design to meet the research objectives. The sampling method is cluster sampling where the questionnaire distributed to manufacturing firm in Melaka. Primary data was collected from the manufacturing industry in Melaka by distributing questionnaire through online to 308 respondents. Statistical Product and Service Solution (SPSS) Version 25.0 was used to analyse the data collected. Multiple regression analysis is being used to test the relationship between independent variables and dependent variable. The results from multiple regression and correlation analysis reveals the organizational performance can be influenced by the six independent variables. Lastly, operational perception made a small but definite positive relationship towards organizational performance. There was a moderate positive relationship between emerging of business model towards organizational performance. Integration of value chain has a strong positive relationship towards the organizational performance. Hence, through this study, researcher can conclude operational, integration of value chain and emerging of business model have significant relationship towards enhancing organizational performance of manufacturing industry.

## ABSTRAK

Digitalisasi proses pembuatan adalah keperluan untuk industri hari ini. Industri pembuatan sedang berubah dari pengeluaran besar-besaran ke pengeluaran yang disesuaikan. Kemajuan teknologi pembuatan dalam industri membantu meningkatkan produktiviti dan prestasi organisasi industri. Kajian ini bertujuan untuk mengenal pasti kesan Industri 4.0 ke arah prestasi organisasi dalam industri perkilangan. Kajian ini menggunakan penyelidikan penjelasan sebagai reka bentuk penyelidikan untuk memenuhi objektif penyelidikan. Kaedah persampelan adalah pensampelan cluster dimana soal selidik diedarkan kepada firma pembuatan di Melaka. Data primer dikumpulkan dari industri perkilangan di Melaka dengan menyebarkan soal selidik melalui talian kepada 308 responden. Penyelesaian Produk dan Perkhidmatan Statistik (SPSS) Versi 25.0 digunakan untuk menganalisis data yang dikumpul. Analisis regresi berganda digunakan untuk menguji hubungan antara pembolehubah bebas dan pemboleh ubah bergantung. Hasil daripada analisis regresi berganda dan korelasi menunjukkan prestasi organisasi dapat dipengaruhi oleh enam variabel bebas. Akhir sekali, persepsi operasi membuat hubungan positif yang kecil tetapi pasti ke arah prestasi organisasi. Terdapat hubungan positif yang positif antara munculnya model perniagaan ke arah prestasi organisasi. Integrasi rangkaian nilai mempunyai hubungan positif yang kuat terhadap prestasi organisasi. Oleh itu, melalui kajian ini, penyelidik dapat menyimpulkan operasi, integrasi rangkaian nilai dan munculnya model perniagaan mempunyai hubungan yang signifikan ke arah meningkatkan prestasi organisasi industri perkilangan.

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## CHAPTER 1

### INTRODUCTION

#### 1.0 Introduction

This chapter covers background of this research including the three industrial revolution and Industry 4.0. The objectives of this research and problem statement are about the impact towards the organizational performance when the industry have implement Industry 4.0.

#### 1.1 Background of research

The current manufacturing industry possess important roles mainly in European country. 32 million job were created and the GDP accounted by industry was 17% (E. Commission, 2015). The high- tech manufacturing countries is Germany. There are many factories and manufacturing companies in Germany (MacDuffie, 1995). Nowadays, the manufacturing process has become more digitalise and automated, more complex and more sustainable where the machine can be operated in a more efficient, simple and persistent way.

The first industrial revolution until the third industrial revolution were in the form of mechanisation, electricity and information technology. In 1760, first industrial revolution has begun. The first industrial revolution began with invention

of steam engine. With steam engine, the old manufacturing process were allowed to transit to a manufacturing process which are new. The transition involved using of coal and the main transport were trains. The invention of the internal combustion engine were in 1900 where the second industrial revolution began. Electricity and oil are used to power mass production. In 1960, the third industrial revolution were started. The production were automated by using information technology and electronics devices. Old way to join parts together are by welding and screwing. Fourth industrial revolution are involving automation, and robotics are control by the operator by connecting to computer with algorithms. 3D printing can create object which are solid by building the material layer by layer. With cyber- physical system, smart factory were introduced in Industry 4.0. The factories manufacturing process can be observed and decentralized decision can be made. (Prisecaru, 2016)

Table 1.1: Short Description on Industrial Revolution from 1760 to the Present.

	Transition Period	Resources	Main Achievement	Developed Industries	Transport Means
I: 1760-1900	1860-1900	Coal	Steam Engine	Textile, Steel	Train
II: 1900-1960	1940-1960	Oil Electricity	Internal Combustion Engine	Metallurgy, Auto, Machine Building	Train, Car
III: 1960-2000	1980-2000	Nuclear Energy Natural Gas	Computers, Robots	Auto, Chemistry	Car, Plane
IV: 2000-	2000-2010	Green Energies	Internet, 3D Printer, Genetic Engineering	High Tech Industries	Electric Car, Ultra-Fast Train

Source: Prisecaru, 2016



Industry 4.0 will have impact towards different levels in organization, employee and customer. There will be more interaction in every network point. It also allow connection in an ecosystem- the suppliers, customers, investor and other third party experts. The different sources of information can easily integrated by stakeholders and enable them to make more general decision and even begin to predict rather than react. The impacts of Industry 4.0 towards levels of organization are in operations improvement and revenue growth. Operational improvements can enhance the productivity level, managing costs and risk reduction. For revenue growth, it can include revenue improvement and wholly new revenue stream such as expands to different markets by using technologies. Workers need to do more challenging jobs in Industry 4.0 (Mark& Brenna, 2017). Digitalisation in Industry 4.0 will slowly replace the low gross jobs and low skilled workers while the less replaced jobs will be jobs required more skills and high paid (Wolf, 2015).

In conclusion, evolution to Industry 4.0 will be scary and challenging. Changes occurs with the fusion of technologies in Industry 4.0. Innovation will increase the revenue of entrepreneurs and improvement of life quality (Jee, 2017). In Industry 4.0, it will have many advantages and will also encounter many problems. Revolution towards Industry 4.0 will disrupt the labour markets as labour has been substituted by automation (Brynjolfsson, McAfee& Spence, 2014). Challenges in Industry 4.0 where like hacking and cybersecurity (Lambert, 2017). Disruptive innovation can be used to describe Industry 4.0. It will impact various industries such as business. Disruptive innovation reshape how business operates. Thinking has to be really moved out of the box (Jules, 2017). The main effect of Industry 4.0 will impact on consumer expectations of consumers, quality and more collaboration and innovative activities in organization (Min, David& Kim, 2018)

## 1.2 Problem Statement

According to Global Manufacturing Competitiveness Index (GMCI) 2016, Deloitte Touché Tohmatsu Limited (Deloitte Global) and the Council on Competitiveness (the Council), result in GMCI research show that factor influence manufacturing on driving economics are infrastructure. Germany as one of the top performing nation demonstrated the influence of their strengths across the global manufacturing trends. According Ministry of International Trade and Industry (MITI) website and Small-Medium Enterprises (SMEs) Corp Malaysia 2017 survey, manufacturing sector in Malaysia ranged between 2.0 (mass production) and 3.0 (automation). As Germany have higher technological infrastructure, therefore they have achieved a higher industrial production index compared to Malaysia.

According to Department of Statistics Malaysia, the Industrial Production Index (IPI) increased 2.6% in July 2018 when comparing with the same month of previous year. The growth in July 2018 was supported by an increase in the index of manufacturing (5.2%) and the index of electricity (4.5%). The manufacturing sector output increased by 5.2% in July 2018 after recording a growth of 4.5% in June 2018. Industrial Production in Malaysia averaged 2.69% from 2007- 2018, reaching a record high of 14.20% in March 2010.

German Government's strategic initiative to transform its secondary industry (manufacturing) as a leader in advanced manufacturing (or cyber physical system) provider as well as for its domestic manufacturing to be more efficient and cost effective. In August 2018, production in industry decreased by 0.3% by referring to provisional data of the Federal Statistical Office (Destatis). In August 2018, production in industry excluding energy and construction was down by 0.1%. From 1979- 2018, the industrial production in Germany averaged 1.61% from 1979- 2018, reaching a record high of 15.30% in December 2010.

### **1.3 Research Question**

1. What is the perception on Industry 4.0 towards organizational performance in manufacturing industry?
2. What is the criteria for a manufacturing industry to implement Industry4.0 in increase their organizational performance?
3. What is the benefit for a manufacturing industry to implement Industry 4.0?

### **1.4 Research Objective**

1. To investigate the perception on Industry 4.0 towards organizational performance in manufacturing industry.
2. To find out the criteria for a manufacturing industry to implement Industry 4.0 in increase their organizational performance.
3. To study the benefit for a manufacturing industry to implement Industry 4.0.

### **1.5 Scope and Limitation**

This research will focus on how implementing of Industry 4.0 will have effect towards organizational performance. The target respondents will be the managers such as supply chain and production managers, engineers, designers and supervisors of the manufacturing sector located in Melaka area.

The limitation of this research includes, the researcher might face difficulties in collecting data while some of them might not willing to share with the researchers for the purpose of study. This research is also limited to Industry 4.0 while most Malaysia's manufacturing sector are just ranged between 2.0 (mass production) and 3.0 (automation).

## **1.6 Significance of Research**

This research is a study on the impact of Industry 4.0 towards organizational performance in manufacturing industry. It can contribute to existing research in several ways which are it will give different perception of Industry 4.0 to the manufacturing industry. Secondly, this research will contribute to the manufacturing firm on what criteria of Industrial Revolution 4.0 needed for them to increase their organizational performance. Lastly, this research will study on the benefit will have for a manufacturing industry to implement Industrial Revolution 4.0.

## **1.7 Summary**

This chapter discussed about what is Industry 4.0. This chapter will defined out the research questions and research objective. This research will only focused on the manufacturing firm in Melaka and there are also a few limitation faced during the research. The details topic about Industry 4.0 will be further elaborated in next chapter which is the literature review.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.0 Introduction

This chapter will discuss the topic of Industry 4.0 in detail. In literature review, the details of about the impact of implementation of Industry 4.0 towards organizational performance in manufacturing industry were supported by journals. A theoretical framework will be drawn in the end of the chapter.

#### 2.1 Industrial Revolution

According to English Dictionary of Cambridge, Industrial Revolution is described as period of time where mostly work began to be done by machines in factories rather than at home. In American English way of saying, Industrial Revolution defined as stages in which developing of machinery leads to major changes in agriculture, industry, transportation, and social conditions.

The first industrial revolution is considered as an important advancements. Since end of 18th century, water and steam-powered mechanical manufacturing facilities started first industrial. At the start of 20th century, second industrial revolution started where electricity has used-to powered mass production. Third industrial revolution began around 1970 mid,. Automation in manufacturing

industries have popularized where they started to use information technology (IT) and electronics. The development took almost two centuries to develop from first industrial revolution until the third industrial revolution. With the increasing of research about Internet of Things (IoT) and cyber-physical systems (CPS), government, industries and society have slowly noticed the trend towards the “Fourth Industrial Revolution” and works towards the benefit to get the outcome (Atzori, 2010; Khaitan& McCalley, 2015& Siemieniuch, 2015).

Industry 4.0 is a changes in manufacturing industry where it bring a novel perception about how industries can gain maximum output through collaboration of new technologies Industry 4.0 is a project from German which combined information technology with manufacturing (Adolph, 2016). It is currently one of the most popular topics in speaking area of German (Dais, 2014; Drath& Horch, 2014). To be counted as Industry 4.0, factories must include principles such as information transparency, interoperability, decentralized and have decision making technical assistance. Information transparency is there will be a virtual copy of the physical world through sensor data in order to situate the information. Connection and communication between people, machine, devices and sensors are known as interoperability. Decentralized decision making is important in Industry 4.0 where factories must have ability to use technologies like cyber- physical systems in decision making. Lastly, a factory which considered as Industry 4.0 should have technical assistance skill in supporting humans in decision making, problems solving process and have ability to help humans in their difficult and unsafe task (Bernard, 2016).

## **2.2 Technologies of Industry 4.0**

The nine pillars of technologies in Industry 4.0 are transforming industrial production. The nine technologies are Internet of Things (IoT), cyber- physical system (CPS), big data, cloud computing, additive manufacturing, augmented reality, cybersecurity, autonomous robots, simulation and horizontal and vertical system

integration. Cyber- physical system (CPS) is the one which makes the whole factory adaptable (Wang, 2015a& Ivanov, 2016).

### **2.2.1 Internet of Things (IoT)**

K. Ashton was first created the term Internet of Things (IoT) in the context of supply chain management. IoT is physical entities and several complicated network of software embedded or implemented within “things” in terms of “Internet of Things”. It includes sensors and electronic products like smart phones, tablets and computer. It also include any things which have the ability to perform computing or non- computing activities by software elements. They expected to accomplish collaboration with part of the cyber infrastructure and other similar entities (Yajun& Cecil, 2016). IoT and cloud manufacturing are interlinked as an essential technology unit (Qu, Lei, Wang& Chen, 2016). When usage of sensors increase, it allows communication with other physical system and workers as it will provide real- time data for preventive maintenance (Lin, 2016). Usage of IoT helps in organize and coordinate flows of the information. In smart manufacturing, cyber-physical system (CPS) will according to information from IoT technology and find application in order to achieve and access to different resources in manufacturing, connects to different parties to assist innovations by using social networks, use RFID to control processes in order to have a more flexibility manufacturing process, to improve assembly of micro- devices productivity and manage the production and logistics processes (Tao, 2014; Lu and Cecil, 2016; Qu et al.,2016; Kamigaki, 2017& Yang, 2017).

### **2.2.2 Cyber- Physical System (CPS)**

The combination of physical world and virtual world is a significant part of Industry 4.0. Cyber-physical systems (CPS) made this fusion possible. Using of cyber- physical system to communicate over Internet of Things (IoT) in factories to

assist machines and helps people in problem solving are defined as smart factory. (Hermann, Pentek& Otto, 2015). CPS are networks which interacts through digital communication networks between elements such as sensors, machine tools and assembly systems, and parts. CPS working as a system and form a part which refer to Internet of Things (IoT). It is conceptually similar to CPS in aspect of it consists of embedded systems and able to communicated through a network. The leader which supports essential information and equipment to let cyber- physical system become reality is National Science Foundation (NSF). Cyber- physical system combine computing, sensing and networking into tangible objects and infrastructure, connecting them to the Internet and each other. CPS having the potential to reshape our world with more responsive, accurate, consistent and efficient system, enabling a revolution of “smart” devices and systems Cyber physical systems has been increasingly used in promoting sustainability. Advances in cyber-physical systems will enable competence, usability, flexibility and safety. CPS also drive innovation and competition in a range of application domains including agriculture, aeronautics, building design, civil infrastructure, energy, environmental quality, healthcare and personalized medicine, manufacturing, and transportation. (National Science Foundation, 2018).

### **2.2.3 Big Data**

Manufacturing companies should know the importance to have skills in data analytics. Wide variety of skill sets needed in order to develop the algorithms and data interpretation (Liu and Xu, 2017; Lee, 2017a, 2017b). From view of Industry 4.0, big data will play a significant role (Kagermann& Wahlster, 2013). In order to meet the new mode, big data nneed to have more power to make decision and optimize the process. Big data and cloud computing are two elements that could not be separated. Big data could not function by only one computer as it can be only operated by distributed architecture. The feature of big data are Software as a Service (SaaS) which use in distribute processing, Platform as a Service (PaaS), cloud storage and Infrastructure as a Service (IaaS) (Yuri, Cees& Peter, 2014). Firstly, enterprises can search for demand by using big data by analyse the data of their