

CHAPTER I

INTRODUCTION

1.1 Problem Description

In the era of industry 4.0 technology, most of the large companies are improving business innovation by involving an advance technology such as Internet of things (IoT) in maximizing the efficiency and effectiveness of their business operations. Furthermore, IoT has a lot of applications in heterogeneous fields such as in manufacturing industry, banks, households, and health care in forms of IoT smart cities, IoT home devices, industrial IoT and energy IoT. For instance are smart meters for effective water supply, crowd sensing for measuring accident, virtual reality technology for increasing employees performance, and e-health system for monitoring patients (Perwej, et al., 2019).

According to The McKinsey Global Institute (2015), more than nine billion connected devices are expected to expand throughout the world and will continue to rise until the range of 25 billion to 50 billion devices in 2025. This could be said as a rapid development due to the paradigm of evolution concept of "Internet of Things" that was first appeared in 2006 (Dachyar, Saragih, & Zagloel, 2019; Vermesan, 2015). From those studies, it is implicated that company will have more options to select which IoT that is suitable and will benefit their business. Thereafter, it will lead to the company's added value for serving better quality products or services. However, Regardless of how many IoT forms that have been implemented in the world, in this paper, digital twin technology will be more focused.

In 2002, Grieves introduced the concept of "Conceptual ideal for Product Lifecycle Management", which developed into the concept of "Information Mirroring Model" in 2006, and finally "Digital Twin" as a final concept in 2010 (Martinez, et al., 2018). The use of the Internet of things (IoT) in the form of Digital Twin is seen as an effective and efficient breakthrough for business operations. Digital Twin itself was determine as "Virtual substitutes of real world objects consisting of virtual representations and communication capabilities making up smart objects acting as intelligent nodes inside the internet of things and services" by Stefano Borgo in 2016 (Negri, Fumagalli, & Macchi, 2017). From that term, it could be said that users only have to focus on the virtual reality objects if they want to do some tests for changes without having any trouble with its physical objects.

Some of the forms of digital twin technology have already been introduced by some companies. For instance, Microsoft through its products, HoloLens and Azure for predictive analytics, device management and sophisticated visualizations, 3D printing process by ABB corporate research for optimization and improvement of essential components' designs, and smart factory by DHL for production coordination remotely (Microsoft, 2017; Stackowiak, 2019). Those products are intended for healthcare, manufacturing, and retail industries and have already been used by some companies such as TetraPak and Heineken.

In Indonesia, the use of Digital Twin is not widely used by manufacturing companies, so that the application of this technology can be added value for them. For instance, in the factory services division of PT. Pupuk Kaltim focuses on providing factory goods and services. The division provides 13 services that are divided into 3 departments (engineering and quality control, metal manufacturing, and administration and business, so, the opportunity for implementing Digital Twin Technology is definitely high. The main target in implementing Digital Twin is on business processes, employees, and management decisions.

The Majority Digital Twin research focuses on general concept and framework about how this platform will benefit the users. Nevertheless, the influences focused on specific industries business models and how those will be integrated in business operations are still limited. This paper will discuss about the influence and usefulness of Digital Twin Technology in factory services division of PT. Pupuk Kaltim, then analyzing the benefits and challenges of that implementation to know what options exist for manufacturing companies for using a Digital Twin Technology and then determine whether Digital Twin is useful to be implemented in factory services division of PT. Pupuk Kaltim in order to improve efficiency and effectiveness in their business operations.

1.2 Research question

In this study, the main question that needs to be answered is:

What options exist for Factory Services Division of PT. Pupuk Kaltim to use Digital Twin Technology in order to improve efficiency and effectiveness in their business operations?

The sub questions for this paper are:

1. What are the options for Factory Services Division of PT. Pupuk Kaltim for implementing digital twin in order to improve efficiency and effectiveness?

2. What are the benefit and challenges for using Digital Twin Technology in Factory Services Division of PT. Pupuk Kaltim?

1.3 Research Methodology

Literature reviews and are going to be conducted in this research for a better understanding to explore the potential use of the digital twin technology and what option from the various kind of Digital Twin that could contribute to business operations of factory services division of PT. Pupuk Kaltim. The literature review that is extensively used journals published online (Science direct, Research gate, etc.) and divided into two main steps:

1. Looking into journals about concept and frameworks of Digital Twin
2. Looking into journals about application of Digital Twin technologies that have possibilities to be applied in the chosen company
3. Looking into journals about the proven outcomes of digital twin implementation in various companies

The other documentation as supported sources is discussed in chapter III.

Rabah, et al. (2018) revealed about the Developing a Digital Twin and Augmented Reality industrial solution as a part of predictive maintenance framework. Introducing the context, the motivation, and the study that were developed, and elaborating proof of concept in special industrial implementation.

Munoz (2009) has also studied about the accelerate of the ergonomics of workers, increase the productivity of current quality control production lines and reduce working stress of workers. Compare the proposed mixed reality-based user interface with current interfaces used in important factories such as Mercedes-Benz, analyzing the benefits and drawbacks of each interface.

From the existing literature review, the data is then collected and adjusted to the company's operational needs. In order to ensure that the research only focus on the crucial issues, the search terms are narrowed into articles that related to Digital Twin implementation in manufacturing company, digital twin tools, and the variety use of digital twin.

In order to retrieve the relevant articles required, those following keyword have been used in various combinations:

- Digital Twin tools
- Digital Twin components
- Digital Twin framework
- Digital Twin implementation process
- Digital Twin application
- Digital Twin enabling technologies
- Digital Twin advantages
- Digital Twin challenges
- Digital Twin outcomes
- Digital Twin providers

1.4 Research objective and study contributors

Digital Twin began to be widely adopted by many manufacturing companies because of its effectiveness and efficiency in facilitating operational business activities in various aspects, ranging from employees, machines, and business processes.

In Indonesia itself, the use of Digital Twin is still fairly new and requires big steps to be applied in large companies, although there are already various digital twin providers. Therefore, in this paper, Digital Twin in manufacturing companies will be discussed more to introduce the benefit and outcomes of using the technology in producing goods and managing business processes. Furthermore, Factory Services Division of PT. Pupuk Kaltim is chosen in this paper.

This research is expected to help companies to find which Digital Twin that suitable and useful for their business operations. We will also look into benefit and challenges that companies should be considered to adopt this technology. Finally, company could increase their efficiencies and effectiveness.