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Value Chain Analysis to Identify Internet of Things Use Cases in The Indonesian Pharmaceutical Industry

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ABSTRACT

The coronavirus pandemic has not only boosted the revenue of many pharmaceutical companies, it has also boosted their reputation. The value of pharmaceutical innovation is unquestionable, especially after the COVID-19 vaccine has been developed at such a rapid pace. Moreover, the coronavirus pandemic has exposed weakness in the industry's global supply chains which is still far from normal while consumer confidence is recovering, leaving the implication that businesses in this sector are likely to face a number of major risks through the end of the year. The purpose of this study is to provide insights regarding challenges faced by the Indonesian pharmaceutical industry as driver to conduct value chain analysis in order to identify the prioritized internet of things use cases so pharmaceutical companies in Indonesia will be able to drive both top-line and operational efficiencies, where most findings were captured via online interviews and desk research methods combined with value chain analysis. One critical finding includes prioritized IoT use cases involving monitoring activities in production flows, production areas, production quality control, and equipment.

Keywords: *Internet of Things; Value chain analysis; Pharmaceutical industry; Use cases; Coronavirus pandemic*

INTRODUCTION

The coronavirus pandemic has become one of the most serious problems in the world, including Indonesia, where various methods have been taken to prevent the spread of the virus, including implementing Internet of Things (IoT), which is expected to become an effective solution to reduce human contact and turn manual work into digital in order to increase efficiency and transparency.

Technological advances are applied in almost all fields, including the pharmaceutical industry. There are a lot of chronic diseases that are threatening the world for various reasons, resulting in developments in the health sector. In addition, extensive research has been carried out on various information technologies, particularly IT-enabled tools such as Internet of Things (IoT), artificial intelligence (AI), big data analysis, which contribute significantly in promoting the pharmaceutical industry.

Globally, pharmaceutical companies are facing common challenges across competition, regulation, and operations. First, major concerns related to competition include the increase of price pressure from tightening market price regulations and patent expiries of major blockbuster medicines, new business models and ecosystems which are challenging the current way of business, and innovations together with competition outside of the pharmaceutical business. Second, although regulation is meant to provide better governance, diverse and fast changing global regulations in manufacturing and supply chain compliances bring complex regulatory requirements, while pharmaceutical quality manufacturing standards require efficient, agile, and flexible manufacturing to meet

higher demand for medication efficacy and patient's quality of life. Third, operations have increasing challenges in production flexibility, time-to-market and operational cost, which create complex value network given the fact that a lot of data related to operational activities exists but it is not accessible or useable easily.

The challenges above are not widely discussed in research in Indonesia and the lack of research on the use of IoT in the pharmaceutical industry in Indonesia has been identified as a research gap because there are still many production processes that are still done manually.

Based on the research background described above, the author formulated the problem that would be answered in this study, i.e. "What are the relevant IoT use cases which can be applied in the Indonesian pharmaceutical industry by learning from the success stories in the global players in order to overcome challenges across competition, regulation, and operation?"

The completion of this study is expected to identify the relevant IoT use cases which can be applied in the Indonesian pharmaceutical industry by learning from the success stories in the global players to overcome challenges across competition, regulation, and operation.

If it is discussed from the technical standardization point of view, IoT can be described as a global infrastructure which helps information society through enabling advanced services by interconnecting physical and virtual things based on existing and evolving interoperable information and communication technologies (International Telecommunication Union, 2012). Through its capabilities to do exploitation of identification, data retrieval, processing and communication, IoT optimizes "things" to offer the services to a wide range of applications, while ensuring that security and privacy requirements are met. IoT can connect operators with various sensors or sensors with the network, then the operators can do something with the data captured (Cheng, 2013). In general, IoT includes three main demands, namely: first, a shared understanding of the situation of its users and their applications. Second, pervasive communication networks and software architectures to capture and process contextual information, and finally, analytics tools in IoT aimed at autonomous and intelligent behavior (Gubbi, 2012). IoT technology in the consumer market is often associated with products under the "smart home" concept, including devices and appliances (such as lights, thermostats, home security systems, cameras, refrigerators, air conditioner, and other home appliances) that support one or more common device ecosystems, and can be controlled via ecosystem-related devices, such as smartphones and smart speakers. IoT is also used in healthcare systems (Deepika, 2019) for tracking "things" in a healthcare setting in real-time (Laplante, 2018).

International Telecommunication Union believes that the vast expanse of ICT has provided the communication anytime or anywhere, meaning it adds an "any THING" dimension to information and communication technologies (ICTs) that have provided "any TIME" and "any PLACE" communication (Figure 1).

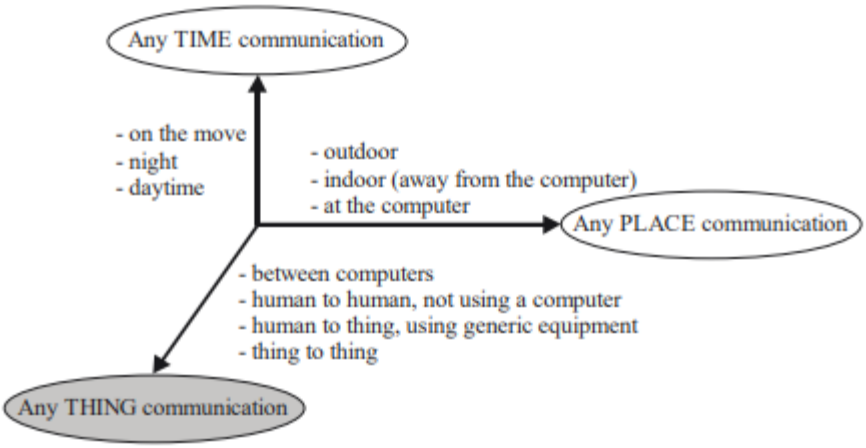

Figure 1. IoT Dimensions

IoT, previously a concept that was only debated and discussed in laboratories, think tanks, and technology companies, is now becoming mainstream. Enterprises and consumers want to use its solutions to improve the efficiency and effectiveness of operational activities, manage physical assets, and improve health, safety, and welfare; where technological advances applications, including 5G mobile networks, edge computing, and advanced analytics, are believed to increase the impact of IoT. To provide better understanding about the economic value of IoT, McKinsey Global Institute (MGI) estimates that the global economic value of IoT will reach a total of

$5,500-12,600 billion by 2030 with factories as the largest contributor with a percentage of 26% (Chui, 2021). Factories in this case also includes those which produce the pharmaceutical products which becomes the main focus of this research.

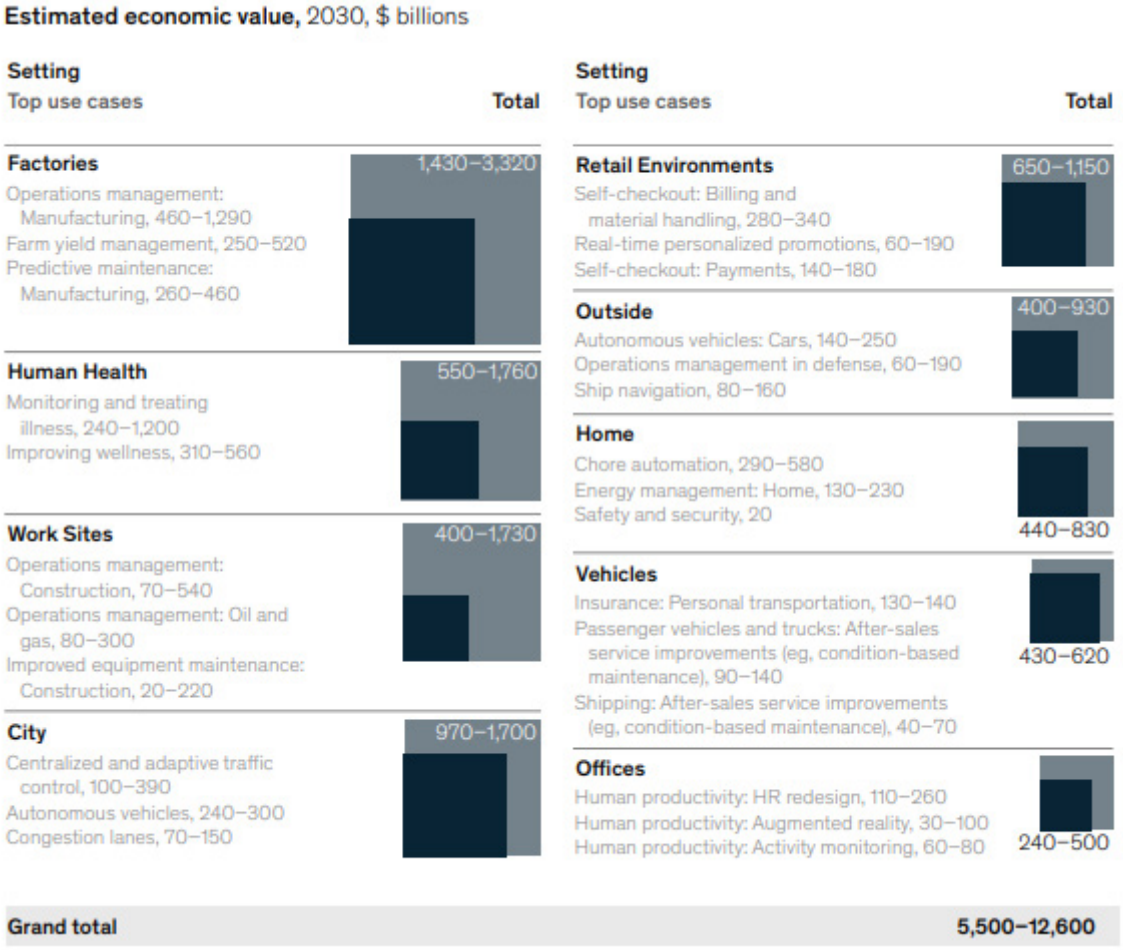

Figure 2. Estimated Economic Value of IoT in 2030

Based on survey to 717 enterprises in Asia which are in the process of deploying IoT solutions, Rehak (2019) concluded that IoT is a success story for enterprises in Asia Pacific, but it's still early days by considering that the adoption rates are still less than 30% of enterprises in most region, although 57% of enterprises in the region stated that improving efficiency and productivity was a top three IoT goal for them. This finding is also supported by Canali (2022) who then cited that IoT continues to be broadly deployed based on his survey in 2022 covering 490 respondents in Asia, Americas, and Europe as ninety percent of them said that IoT was core to digital transformation or was being deployed across multiple areas in their organization. Enterprises continue to be optimistic about the return of investment (ROI) of their IoT projects, as warning concerns about COVID-19 have shifted which benefits enterprises are prioritizing in their IoT solutions. However, enterprises are struggling with the growing complexity of IoT solutions, which require supports from IoT vendors as they do not want to see projects delayed due to the expectation od delivering ROI from IoT projects within two years. In Figure 3, Sehlstedt (2020) identified the IoT applications in the healthcare industry, where collaboration among healthcare providers, medical technology, and pharmaceutical industry will be the key to the effective deployment of the IoT solutions here (Taylor, 2018) based on the fact that we are currently in the fourth industrial revolution with the implications of increasing digitization, which will enable better management of population health data and increase patient engagement, product development and other commercial activities (Grover, 2019). According to Ong (2021), convenience and comfort, continuous monitoring, and smart health management are key drivers for IoT solution adoptions in the healthcare industry.

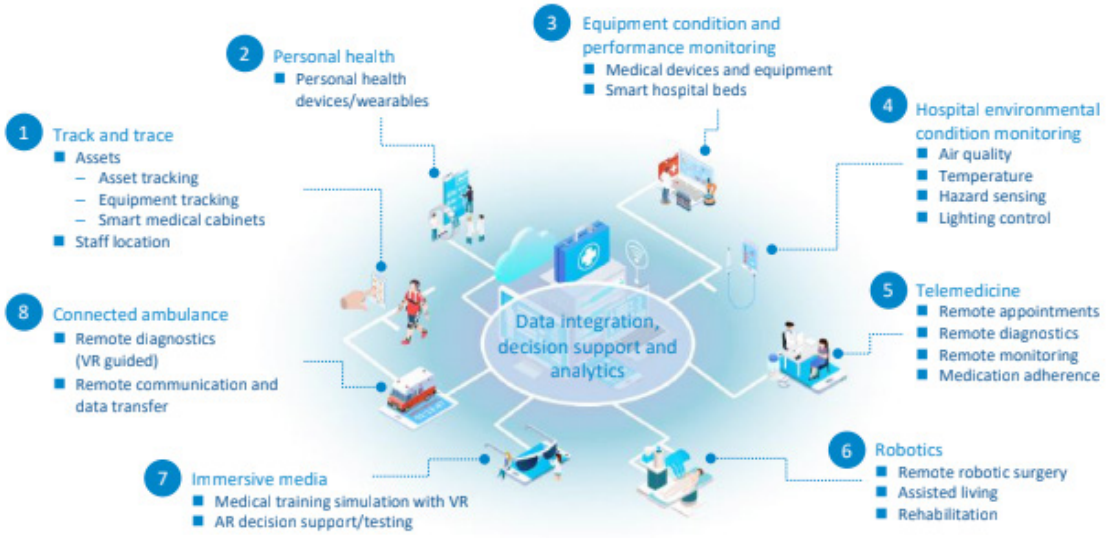

Figure 3. Different Types of IoT Solutions Relevant for Care Providers

To maximize economic value of IoT in factories, value chain concept cannot be ignored. A value chain is defined as a series of tasks commenced by companies operating in a particular industry to deliver a valuable product/service to the final customers (Porter, 1985). The value chain concept was developed based on an organizational process interpretation by viewing a manufacturing or service organization as a system, involving each configuration with inputs, transformation processes, and outputs. Inputs, transformation processes, and outputs include the possession and consumption of resources – funds, labor, resources, appliances, buildings, land, administration, and management. Consequently, how value chain activities are performed determines costs and affects profits, where Porter's value chain grouped Inbound Logistics, Operations, Outbound Logistics, Marketing and Sales, and Service into primary activities (i.e. activities which are essential in adding value and creating a competitive advantage), while secondary activities (i.e. activities which make primary activities more effective) include Procurement, Human Resource Management, Technology Development and Firm Infrastructure. The value chain concept continued to evolve until the emergence of global value chains (GVCs) in the late 1990s which provided a stimulant for accelerated change in the international trade and investment landscape, with large and comprehensive consequences for governments and companies (Gurría, 2012).

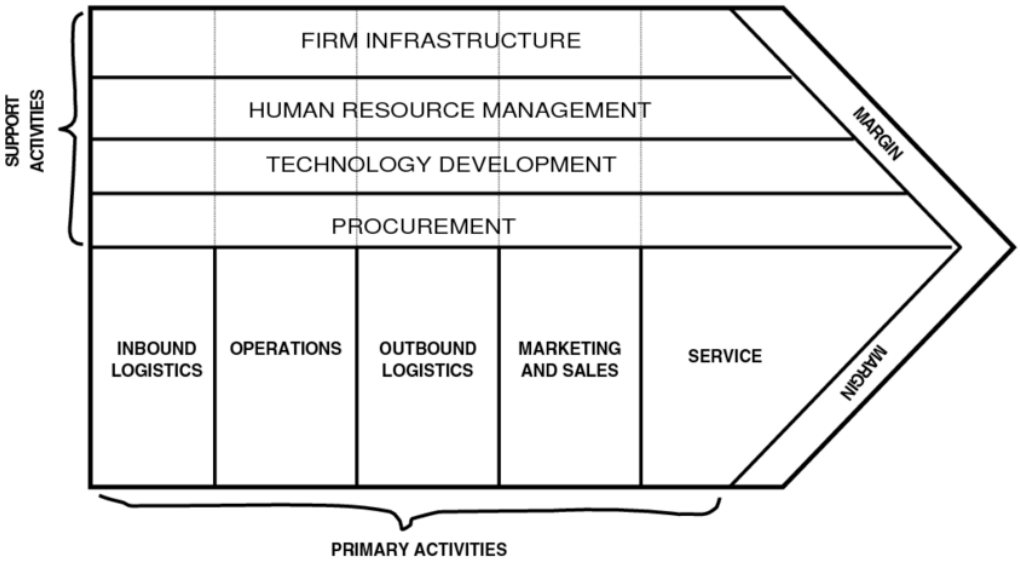

Figure 4. Michael Porter's Value Chain

METHODS

In line with the aim of this study, value chain analysis is the best approach or tool in strategic decision making and analysis that highlights the basis on which businesses can create value for their customers. Moreover, this framework can also be utilized to identify sources of competitive advantage for a business. Data sources used to complete the value chain analysis came from both primary research (in-depth online interviews with more than 50 key stakeholders in 20 global pharmaceutical companies) and secondary research (documentation from 20 pharmaceutical companies' websites, annual reports, etc). The primary data for this study came from two stakeholders, i.e. key management team from certain prominent pharmaceutical company in Indonesia together with business consultants.

RESULT AND DISCUSSION

During in-depth interviews with key management teams and business consultants which were intended to identify the competitive advantages of pharmaceutical company, the authors also inquired about things that have gone well and improvements that are still required across the value chain. In conclusion, there are several challenges identified in the value chain (particularly in the main activities) identified in this study as summarized in Figure 5, including:

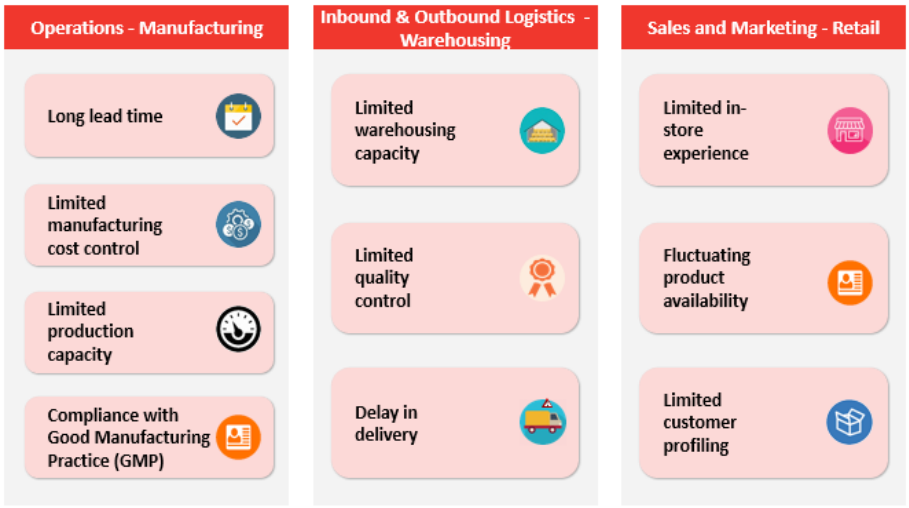

Figure 5. Key Challenges of Pharmaceutical Industry in Indonesia across Value Chain

IoT use cases	Description and challenges/opportunities addressed	Strategic relevance	Ease of implementation.
Production flow monitoring	Monitor production floor with sensors / RFID tags to track & simulate real-time drug production flow & identify bottlenecks	High	High
Production area monitoring	Monitor production flow with CCTV cameras to ensure clean & hygienic drug manufacturing area	Mid	High
Product quality monitoring	Monitor production quality with optical sensors to enable real-time detection of toxic substances in manufactured drug	High	High
Continuous production	Optimise fulfilment time with sensor embedded in production equipment to perform real time drug sampling & testing	Mid	Mid
Continuous quality control	Optimise fulfilment time with optical-based analytics to enable in-line quality testing of drugs	Mid	Mid
Process automation	Automate routine factory processes with cognitive bots & autonomous robots to minimise cost & improve accuracy	Mid	Low
Incident request automation	Automate incident requests triggered by integration with ticket management systems	Mid	Low
Equipment monitoring	Monitor equipment with sensors to track their status, usage & performance (e.g. utilisation)	High	High
Predictive maintenance	Optimise equipment utilisation with advanced analytics to notify maintenance personnel ahead of expected breakdowns	Mid	Mid

Figure 6 IoT Use Cases

Based on literature review, the author identified several IoT use cases which are relevant to pharmaceutical industry in Indonesia as described in Figure 5. However, by considering the strategic relevance and ease of implementation, the uses cases findings were simplified into some prioritized ones, including:

1. **"Production flow monitoring"**, i.e. monitoring production process with embedded sensors to obtain real-time parameters across each production stage.
2. **"Production area monitoring"**, i.e. monitoring production line area with CCTV cameras to ensure clean and hygienic drug manufacturing environment.
3. **"Production quality monitoring"**, i.e. monitoring production quality with embedded sensors to enable real-time detection of impurities in manufactured drug.
4. **"Equipment monitoring"**, i.e. monitoring equipment with sensors to track their status, usage, and performance.

In term of the expected outcomes from the IoT implementation, the pharmaceutical industry in Indonesia can refer to the success stories and impacts enjoyed by global players as follows:

a. **Johnson-Johnson**

IoT implementation:

- Building a flexible, secure digital business enabled by IoT
- Developing smart products based on data captured through IoT
- Creating new customer engagement model

Impacts:

- 11% increase in revenue
- 50% reduction in manufacturing space

b. **Pfizer**

IoT implementation:

- Innovating R&D via IoT
- Connecting entire supply chain network
- Deploying smart manufacturing
- Developing IoT partnership

Impacts:

- 25-50% cost savings in manufacturing
- 30% reduction in clinical trials development cost

CONCLUSION

There are two key findings from this study to be considered as suggestions for pharmaceutical industry in Indonesia to focus on. First thing, we have observed that top prioritized value chain activities for IoT initiatives are Operations – Manufacturing, Inbound & Outbound Logistics – Warehousing, and Sales & Marketing – Retail.

Secondly, IOT in Indonesian pharmaceutical industry is still nascent in nature, the strategic ambition and digital initiatives of companies in related industry can be expedited by adopting IoT which refers to success stories of global leaders who have adopted IoT and showed significant tangible impact, driving both top-line and operational efficiencies. Prioritized IoT use cases include production flow monitoring, production area monitoring, production quality control, and equipment monitoring.

Since this research was conducted in a COVID-19 pandemic situation, the author acknowledge the limitation that most of the findings were collected through online interviews and desk research. As the implication, it is possible that insights from other key management teams are not optimally captured. Therefore, it is highly recommended for further research in the future to combine face-to-face and online interviews to comprehensively capture key issues and identify competitive advantages so as to provide better results and impact for businesses. Even though the COVID-19 pandemic phase has ended, many companies around the world including Indonesia still need to adapt to different economic conditions, where these adjustments can be supported through IoT solutions.

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