UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ENABLERS OF THE INTERNET OF THINGS (IoT)
ADOPTION: A STUDY ON THE THIRD-PARTY LOGISTICS
(3PL) INDUSTRIES IN JOHOR

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I hereby acknowledge that this project paper has been accepted as part of fulfilment for the degree of Bachelor of Technology Management (Supply Chain Management and Logistics) with Honors.

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ENABLERS OF THE INTERNET OF THINGS (IoT) ADOPTION: A STUDY ON THE THIRD-PARTY LOGISTICS (3PL) INDUSTRIES IN JOHOR

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DECLARATION OF ORIGINAL WORK

I hereby declare that all the work of this thesis entitled "**enablers of the Internet of Things (IoT): A study on the third-party logistics (3pl) industries in Johor**" is originally done by myself and no portion of the work encompassed in this research project proposal has been submitted in support of any application for any other degree or qualification of this or any otherinstitute or university of learning.

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DEDICATION

I would like to appreciate the dedication of my beloved family members who educated me and motive me to learn until degree level. And also, I express a deep sense of gratitude to my lecturer whom also my supervisor for my final year project, Datin Dr. Suraya Binti Ahmad and my fellow friends. They have provided me fully support and advice throughout this research. Without their blessing and encouragement, this research is impossible to complete within short period of time.

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Last but not least, I would like to express my appreciation to all respondents who had contributed their time and efforts in filling the questionnaires. They had provided valuable feedbacks that assist me in finishing this research. With the assistance and supports from the respondents, I have successfully fulfilled all the components of a questionnaire. Once again, Iam grateful and honestly thankful to all.

ABSTRACT

Internet of Things (IoT) is a system or software that enables the linking and exchanging the information with others by utilizing the internet. IoT system can assist the third-party logistics (3pl) industries to handle their work efficiently because it can help the industry in tracking the data conveniently. Due to the increase of the customer demand especially during the Covid-19 pandemic, IoT service plays an essential role in accelerating the process of logistics in 3pl industries. This research is to study the success factors of 3pl industries in the application of IoT in Johor, Malaysia and to determine the relationship between independent variables (perceived usefulness, perceived ease of use and safety) and dependent variable (success factors of 3pl industries in the application of IoT). Data was collected from 169 respondents who are worked in the 3pl industries and know about the IoT system through questionnaire survey. The relevant data for this investigation were gathered using a stratified random sampling method. Besides, there are several analysis methods had been used in this research which as Cronbach's Alpha analysis, descriptive analysis, Pearson's Correlation analysis and Multiple Regression analysis. The result shows that all the independent variables have a significant relationship with the dependent variable. There were strong relationship between perceived usefulness and perceived ease of use with the application of the IoT in third-party logistics industries. Thus, the contribution of the finding is the 3pl industries will be more understand about the importance of Internet of Things (IoT) and identify the success factors in the adoption of IoT in the industries.

Keywords: *Internet of Things (IoT), third-party logistics (3pl) industries, perceived usefulness, perceived ease of use, safety, success factor of 3pl industries in the application of IoT*

ABSTRAK

Internet of Things (IoT) adalah satu sistem atau perisian yang membolehkan pautan dan pertukaran maklumat dengan orang lain dengan menggunakan internet. Sistem IoT boleh membantu industri logistik pihak ketiga (3pl) mengendalikan kerja mereka dengan cekap kerana ia boleh membantu industri menjejaki data dengan mudah. Disebabkan oleh peningkatan permintaan pelanggan, perkhidmatan IoT memainkan peranan penting dalam mempercepatkan proses logistik dalam industri 3pl terutamanya semasa pandemik Covid-19. Penyelidikan ini adalah untuk mengkaji faktor kejayaan industri 3pl dalam aplikasi IoT di Johor, Malaysia dan untuk menentukan hubungan antara pembolehubah bebas (kebolehgunaan, penggunaan mudah diguna dan keselamatan) dan pembolehubah bergantung (faktor kejayaan industri 3pl dalam aplikasi IoT). Data dikumpul daripada 169 responden yang bekerja dalam industri 3pl dan mengetahui tentang sistem IoT melalui tinjauan soal selidik. Data yang berkaitan untuk penyiasatan ini dikumpul menggunakan kaedah persampelan rawak berstrata. Di samping itu, terdapat beberapa kaedah analisis yang telah digunakan dalam penyelidikan ini seperti analisis Alpha Cronbach, analisis deskriptif, analisis Korelasi Pearson dan analisis Regresi Berganda. Keputusan menunjukkan bahawa semua pembolehubah bebas mempunyai hubungan yang signifikan dengan pembolehubah bersandar. Terdapat hubungan kukuh antara persepsi kegunaan dan persepsi kemudahan penggunaan dengan aplikasi IoT dalam industri logistik pihak ketiga. Oleh itu, sumbangan penemuan adalah industri 3pl akan lebih memahami tentang kepentingan Internet of Things (IoT) dan mengenal pasti faktor kejayaan dalam penggunaan IoT dalam industri.

Kata kunci: Internet of Things (IoT), industri logistik pihak ketiga (3pl), kebolehgunaan, penggunaan mudah diguna dan keselamatan, faktor kejayaan industri 3pl dalam aplikasi IoT

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ABBREVIATION	MEANING
IoT	Internet of Things
3PL	Third-Party Logistics
CPU	Central Processing Unit
UAE	United Arab Emirates
GPS	Global Positioning System
GSM/GPRS	Global System for Mobile/ General Packet Radio Services
RFID	Radio-frequency Identification
LF	Low Frequency
GIS	Geographic Information System
AS/RS	Automated Storage & Retrieval System
NFC	Near-field Communication

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter will perform the background of the study, problem statement, research questionsand objectives, scope and limitation of the study, the significant of study and summary.

1.2 Background of Study

According to legend, the earliest Internet of Things machine was a vending machine atCarnegie Mellon which connected to APRANET in 1970 (Fruhlinger, 2020). In 1999, Kevin Ashton who is a British technologist developed the phrase "Internet of Things" (Fruhlinger, 2020). Initially, the development of IoT was behind the concept. There have been some challenges that influenced the further progress of IoT deployment which are the requirement of costs and the power usage. It is because each internet-connected device has the requirementof a CPU and the method to interact with other internet-connected devices (Fruhlinger, 2020).Today, the adoption of RFID tags has become a great step in the development of IoT due to itsinexpensive cost and as a little transponder that can be attached to any device in helping link to the internet (Fruhlinger, 2020). By having ubiquitous Wi-Fi and 4G, it can connect in any place easily through the wireless connection (Fruhlinger, 2020).

In recent, the Covid-19 pandemic has accelerated the adoption of cutting-edge technology in many industries in order to ensure the operation of the company continuity. Internet of Things (IoT) as the main driver of achieving Industry 4.0 and Smart City development have been invested in many industries to win against the competition during the period of pandemic Covid-19. According to the survey by Gartner who is a leading consultation globally by investment in IoT technology and have the potential in enhancing to RM6,100 billion by 2020 (MyGovernment,

2022). In the area of Asia Pacific, the expectation in the development of IoT is at a rate of 34.1% per year and reach RM203 billion by 2020 (MyGovernment, 2022).

The IoT is a system or software that enables the linking and exchanging the informationwith others by utilizing the internet. By 2020, the number of devices connected through the Internet of Things is estimated to reach 50 billion (Ismail, 2019). A significant amount of information from a variety of places or sources can be gathered easily by the devices through the help of IoT (M, 2019). The IoT assists a corporation or an industry to track their data conveniently (M, 2019). In this case, many industries can handle their work more efficiently by having the help of the IoT systems. Therefore, Malaysia has a road map that is expected to applicate the IoT service among the industries as an additional source for the growth in economics.

According to a recent survey conducted by GT Nexus and Capgemini, 70% of retail and industrial firms have already initiated a digital transformation program in their supply chain operations. Asset tracking is nothing new. Freight and transportation companies use barcode scanners to monitor and manage their inventory. However, new advances are making these scanners obsolete since they can only collect data on broad kinds of things rather than specificones (Meola, 2022). When combined with other IoT technologies, modern asset tracking systems (discussed further below) give significantly more valuable and essential data.

1.3 Problem Statement

Many firms are failing to fulfill increasing order volumes due to the COVID-19 epidemic and fast development in e-commerce since they don't function at the pace required toexecute the orders. They chose to outsource part of their operations rather than risk losing consumers to rivals. And there's no denying that the worldwide epidemic has compelled businesses to rethink their operations in order to survive (Group, 2022). However, as the 3PL industry has grown, customer expectations for on-time and reliable delivery have risen, posing additional challenges (Limited, 2021).

Increasing customer expectations for speedy shipment and real-time

visibility into delivery progress are causing huge issues for 3PLs that haven't kept up with technology (DispatchTrack, 2021). Furthermore, because of COVID-19 lockout zones and travel limitations, 3PL operations suffered from a lack of end-to-end visibility, particularly in last-mile deliveries. These interruptions have an impact on planning, predictability, and consumer satisfaction (Limited, 2021). Furthermore, a lack of coordination among shippers, carriers, and end customers might have a negative impact on the supply chain's seamless operation. As a result, third-party logistics providers will recognize the advantages of investing in smarter technology and software solutions that may deliver a higher return on investment (Flatworld Solutions, 2022).

As shown in the nine pillars of the fourth industrial revolution (IR4.0), the main aspect to assist the industries in enhancing their productivity output is the internet of things (IoT) (Alaloul, Liew, W.A. Zawawi, & Mohammed, 2018; Ibrahim, Esa, & Mustafa Kamal, 2019). The government in Malaysia has implemented various initiatives to support the development of the internet of things (IoT) to help different sectors of industry transition to digitalization (BH Online, 2018). A variety of industries in Malaysia like agriculture, smart cities, manufacturing, oil and gas, and services of healthcare and retail have been provided testbeds in implementing the IoT systems. It is because those well-documented issues in these industries can be addressed with the help of IoT (Malaysiakini, 2021).

According to Alliance News via COMTEX (2022), it stated that the global IoT in the Warehouse Management market is estimated to be worth USD 3.22 billion in 2020 and has an expected growth of about 15% between 2021 and 2027 (MarketWatch News Department, 2022). The statistics stated above are caused by the increase in demand and requirements in the global and consumers, many industries especially 3pl industries must deal with the shortages such as employees, in transporting or handling the items from the fragmented market (Deloitte, 2020). Therefore, IoT service plays an essential role in accelerating the process of logistics in 3pl industries in order to tackle the massive challenge for the following years regarding work efficiency to meet the demand of consumers.

The fact that 70% of 3PL organizations still rely on manual paper-based procedures and simple tools like Excel to function demonstrates how difficult technology adoption remains (Vinculum, 2021). However, without the help of technology, it will occur numerous difficulties in many sectors of industries, especially logistics. It is because freight visibility in logistics is essential and it relies on the help of technology. Therefore, the technology like IoT is the need for the logistics industry in the future world. For instance, IoT provider like Roambee has provided their services to many of the 3pl industries in Malaysia such as DHL, KUEHNE+NAGEL, and CEVA logistics by offering shipment visibility and a comprehensive look at customers' cargo during shipping (Roambee Corporation, 2022).

1.4 Research Questions

The researcher determined three research questions in this study:

i.   What is the importance of the application of IoT in logistics?
ii.   What are the IoT applications for logistics?
iii. What are the success factors of 3PL industries in the application of IoT?

1.5 Research Objectives

In this research, there are three research objectives to be figured out:

i.   To identify the importance of the application of IoT in logistics.
ii.   To determine the IoT application for logistics.
iii. To understand the success factor of 3PL industries in the application of IoT.

1.6 Scope and Limitation of the Study

In this research paper, the success factors of 3PL industries in the application of IoT are being focused on. The target respondents will be the workers or managers in the 3PL company in Johor. This is because the 3PL company has applied IoT technology in their company. The researcher will conduct

questionnaires to the respondents.

The limitations that emerged during the study of the research are the respondents' inaccurate information and time limitation. logistics and not be able to cover all the logistics in Malaysia. There also existed time limits for researchers due to the amount of finished time being short which is only 10 months.

1.7 Significant of Study

The study's findings are intended to encourage the 3PL industries about the application of IoT. It is essential to raise the knowledge about the importance of IoT in the 3PL industries since the IoT technology is advanced in helping to increase the efficiency of work.

Furthermore, the various of IoT applications for logistics also be determined in this research for a further understanding of 3PL industries. The 3PL industries can integrate the IoT technology strategically in the process of supply chain management.

Besides, developing the success factor of 3PL industries in the application of IoT can help to increase 3PL's confidence in utilizing the IoT device in their workplace. The 3PL can immediately benefit from the knowledge of IoT by lowering the costs and increasing the qualityof service.

1.8 Summary

At last, the outline of the research is covered in this chapter. It went over the study's background, problem statement, research questions, research objectives, scope and limitation of the study, and the significance of the study for the topics of the success factors of 3PL industries in the application of the IoT. The literature review for this study will be discussed in the next chapter. The information presented will be more comprehensive and clear.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, the literature review and the appropriate theoretical model will be discussed. The definition of supply chain and logistics, the definition of IoT, the application of the Internet of Things, and the background of the technology acceptance model (TAM) are presented in the literature review. Besides, the dependent variables and independent variables were developed after reviewing the relevant research. The literature review is also necessary for developing a research methodology, whether qualitative or quantitative. The research framework for generating the hypothesis and describing the theory is the finest description in this chapter.

2.2 Supply Chain

A supply chain can be defined as a network that connects to all of the people, companies, resources, activities, and technology that contribute to the production and the sale of goods or services (Kenton, 2021). The supply chain can be a complete process of making and distributing the goods or services, from the earliest stages of acquiring raw materials to the ultimate delivery of the goods or services to the customers. To put it another way, it's a diagram of the whole supply chain that depicts everything from raw materials being turned into useable materials to the final product or service being delivered to customers and other stakeholders along the way (Corporate Finance Institute, 2022).

A company that maps out the supply chain is essential in order to have a strategic plan.It is because defining the supply chain accurately is critical for a company to reach success in their market in the future. Corporate-level strategy development sometimes necessitates judgments on whether or not to focus on a particular line of business or expand into adjacent or unrelated markets. Besides,

raw material extraction and manufacturing are two separate sectors within the supply chain. To have a better understanding of the many stakeholders engaged in each step of the supply chain, a firm may use the supply chain to gain an advantage in new markets that the company may wish to join in the future (Corporate Finance Institute, 2022).

2.2.1 Supply Chain Management

Keith Oliver first created the "Supply Chain Management (SCM)" as a phrase and utilized the term in the Financial Times interview during the year 1982. After that, numerous domain experts throughout the globe redesigned SCM by establishing integrated systems that therefore expanded specialized supply-chain alliances via Original Equipment Manufacturers (OEM) (Bhardwaj, 2020). For now, supply chain management has become more essential elements in the business process. This chain has several connections that need special knowledge and abilities. A company's total expenses may be reduced, and profitability can be increased, with good supply chain management. When one of the links in the chain fails, it mayhave an adverse effect on the whole chain, resulting in a significant financial loss (Kenton, 2021). Based on the report of Deloitte in 2014, stated that 79 percent of organizations with high-performance supply chains beat their rivals in emerging areas like the UAE and Middle East (Badwi, 2021). Thus, in order to reach the achievement, there have four major elements in the supply chain that should be known.

i.   **Integration**

Strategic planning must begin with integration, which is essential across all phases of communication, information exchange, data analysis, and storage. The technologies that need to connect the whole supply chain should be focused on by the company and make sure the pick of technology is adaptable enough to alter andexpand with the company (Badwi, 2021).