IMPLEMENTATION OF BLOCKCHAIN EMPOWERS LOGISTICS SUSTAINABILITY: A CASE STUDY OF DHL COMPANY

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APPROVAL

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DEDICATION

This thesis is dedicated to my family,

for the immense support and motivation throughout the whole process.

This thesis is also dedicated to my supervisor

Profesor Madya Dr Amiruddin Bin Ahamat,

who had been a tremendous and wonderful guide and motivator all the way.

Last but not least, this thesis is

dedicated to those who believe in the

power of knowledge.

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Thank you.

ABSTRACT

Blockchain has gained considerable attention in recent years, sparking a new wave of growth in various industry. The integration of cutting-edge technology and modern logistics enables logistics sector to evolve in a sustainable manner. Yet, the lack of knowledge and challenges that emerged in loop make it difficult to apply blockchain to the industry on a big basis. In this research, blockchain implementation was proposed to enhance DHL's logistics sustainability, thereby examined the awareness of DHL on the benefits acquired via blockchain implementation while striving for logistics sustainability. Researcher further investigated the challenges and solutions taken by DHL as the demand from governments, communities, and customers all around the globe to achieve sustainability standards grows. The primary data source was semi-structured interviews with four interviewees, along with secondary data resources including DHL's archive documents which relevant to sustainable logistics and blockchain in logistics. The study's findings first revealed blockchain is implemented in DHL for the use of data transparency along with traceability, smart contract, and acts as cryptocurrency payment. Aside from enhanced transparency and traceability, Blockchain brings DHL for a better operation efficiency, save time and money, and high security level that logistics sustainability was illustrated environmentally, economically, and socially. Meantime, lack of knowledge and awareness were identified as the most burdensome challenges among others and collaboration was found to be the most effective solution taken to tackle the challenges mentioned. This study beneficially contributed for knowledge for researcher and readers, industries, particularly logistics service providers, and policies makers.

Keywords: Blockchain, Sustainability, Logistics Sustainability, Blockchain Implementation, DHL, Benefits of Blockchain, Challenges of Blockchain, Solution.

ABSTRAK

Blockchain telah menarik perhatian yang besar dalam beberapa tahun kebelakangan ini, mencetuskan gelombang pertumbuhan baru dalam pelbagai industri. Integrasi teknologi canggih dan logistik moden membantu sektor logistik berkembang secara lestari. Namun, kekurangan pengetahuan dan cabaran yang muncul dalam gelung menjadikannya sukar untuk mengaplikasikan blockchain kepada industri secara besar-besaran. Dalam penyelidikan ini, pelaksanaan blockchain dicadangkan untuk meningkatkan kemampanan logistik di DHL sementara mengkaji kesedaran DHL mengenai faedah yang diperoleh melalui pelaksanaan blockchain apabila berusaha untuk kelestarian logistik. Dengan permintaan daripada kerajaan, komuniti, dan pelanggan di seluruh dunia untuk mencapai standard kelestarian berkembang, penyelidik seterusnya menyiasat cabaran dan penyelesaian yang diambil oleh DHL. Sumber data utama adalah wawancara separa berstruktur dengan empat wawancara, bersama dengan sumber data sekunder termasuk dokumen arkib DHL yang berkaitan dengan logistik mampan dan blockchain dalam logistik. Penemuan kajian mendedahkan blockchain di DHL digunakan untuk ketelusan data bersama dengan kebolehkesanan, kontrak pintar, dan berfungsi sebagai pembayaran cryptocurrency. Selain meningkatkan ketelusan dan kebolehkesanan, Blockchain bermanfaatkan DHL untuk kecekapan operasi yang lebih baik, menjimatkan masa dan wang, serta tahap keselamatan yang tinggi yang menggambarkan kelestarian logistik secara alam sekitar, ekonomi, dan sosial. Sementara itu, kekurangaan pengetahuan dan kesedaran didapati sebagai cabaran paling membebankan antara lain dan kerjasama sebagai penyelesaian paling berkesan untuk menangani cabaran-cabaran. Kajian ini menyumbang secara bermanfaat untuk pengetahuan (penyelidik dan pembaca), industri (penyedia perkhidmatan logistik), dan dasar.

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
API	Application Programming Interface
AI	Artificial Intelligence
BLESS	Baseline Exo-System System Service
Bio-LNG	Bio-Liquefied Natural Gas
BoE	Blockchain of Excellence
CBSCA	Canadian Blockchain Supply Chain Association
CO^2	Carbon Dioxide
CEO	Chief Executive Officer
CE	Circular Economy
CSR	Corporate Social Responsibility
EST	Eastern Standard Time
EDI	Electronic Data Interchange
FDA	Food and Drug Administration
4G	Fourth Generation
GPS	Global Positioning System
GHG	Greenhouse Gas
GDP	Gross Domestic Product
ICT	Information and Communications Technology
IT	Information Technology
IEA	International Energy Agency
ISO	International Standards Organization

IoT	Internet of Things
IP	Internet Protocol
LSP	Logistics Service Provider
MYT	Malaysia Time
MIDA	Malaysian Investment Development Authority
NLTF	National Logistics Trade Facilitation
NTP	National Transport Policy
NPTS	Network Proactive Tracking System
RFID	Radio Frequency Identification
SHERLOC	Shipment Explorer Indicators
SC	Supply Chain
SC & L	Supply Chain & Logistics
3PL	Third-Party Logistics
TCP	Transmission Control Protocol
USA	United States
WHS	Warehouse Management System

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

The first chapter encompasses the introduction of the research topic regarding blockchain implementation that empowers logistics sustainability through a case study of DHL company. Deutsche Post DHL Group, DHL, a Germany headquartered courier company that linked communities in over 220 nations and territories globally. In conjunction to deliver effective global express, freight transportation and logistics, DHL has made significant investments in blockchain adoption for its business operation, which ensures logistical and supply chain sustainability at the same time. In this chapter, it illustrates the background of study, problem statement, research questions, research objectives, scope of study, definition of terms, significance of study, and summary of this chapter.

1.2 Background of Study

According to Statista Research Department (2022), the worldwide logistics industry was valued more than €8.4 trillion in 2021 and is projected to grow to more than €13.7 billion by 2027. And thus, by 2020, the entire cost of logistics throughout the globe had risen to a whopping $9 trillion, which was 10.7 percent of the worldwide GDP ($85.24 trillion) on that particular year. With the rapid development of market economy in this 21st century, logistics industry has risen from being a terminal industry in the past to a pioneer industry that guides production and promotes consumption. It is currently a comprehensive industry with a focus on modern transport supported by advancements in technologies and management concept while aiming to enhance the flow of commodities, services quality, operational expenses, and more (Potapova et al., 2022).

Logistics, a term that refers to the coordinated procurement, movement, and storage of raw materials, semi-finished products, and completed items, as well as the accompanying information flow throughout a company and its marketing channels (Nowakowska, 2019). Companies are overburdening logistics by expanding the operational level flows that need to be properly handled in the context of globalisation and the development of a complete offer. The rising complexity of logistics systems, coupled with higher demands on their flexibility due to the need to decrease stockpiles, greater quality expectations, and the continuation of more interlocking operations, needs more resilient logistics systems (Klumpp, 2018). Since that, business organisations have come to realise that a sustainable logistics management can successfully give them a competitive advantage.

Sustainable development is a major trend for the coming years and decades. In this globalized era, humanity is confronted with three major crises of demographic changes, environmental deterioration, resource scarcity, as well as sustainable development. In terms of sustainable development, sort of green and sustainable logistics initiatives has been taken to mitigate the negative environmental and social impacts of freight transportation (Olszewski-Strzyżowski, 2022). Environmental pollution such as contaminants, traffic congestions, sound, visual discruption, facilities malfuntion, and resource wastage are unavoidable outcomes of logistics activities (Ren

et al., 2020). The use of fossil fuels in transportation is responsible for 37 percent of the CO2 emissions that are produced by the end-user industries, as shown by statistics provided by the IEA. (Mak et al., 2022). In the Sustainability Report 2021 by Maersk, emissions of global greenhouse gas (GHG) for logistics industry accounted for 3.5 billion tonnes annually. Therefore, it is imperative to provide environmentally friendly solutions for the future development of logistics. Sustainable logistics must be intimately linked with sustainable transportation, reverse logistics, waste management, sustainable packaging and distribution, green monitoring and evaluation, as well as sustainable information sharing (Baah et al., 2021). Many studies in past decades proven the benefits that obtained from sustainable practices that embraced by organization. Thus, modern logistics development should prioritize sustainable development issues, create a benign growth trend, and safeguard resources and the environment (Treiblmaier, 2019).

In a deeper view, sustainability in logistics is not just limited in environmental factors, but also includes economy, social and governance factors (Ziolo et al., 2019). All blocks are connected and dependant on each other to achieve sustainable development. Based on the corporate strategy plans that aiming for sustainable logistics, transportation and warehousing are the examples that linked all the 3 sustainability pillars (David et al., 2021). First, by undertaking load planning or container fill decisions, it can greatly avoid empty miles that aids in environmental and economic sustainability. A well-planned transportation route that provides the quickest and most cost-efficient routes not only minimize the fuel consumption, greenhouse gases, it also further reduces the company's unnecessary fuel expenditure and drivers' wages. In terms of warehousing, it proven the interconnection between the 3 sustainability pillars. When a company equipped with a warehouse that utilizing efficient warehouse management system (WMS) with the existence of barcodes and RFID, it actually provides transparency towards the top management of the company. Top managements such as managers are able to track the situation of the warehouse like the stock in hand, they are hence able to have appropriate decisions-making when ordering the stock (Folinasa et al., 2022). As a result, the implies that managers able to order for a sufficient amount of stock in once which helps in reduce the wastage of warehouse space, reduce in the transportation costs as stock is transported in once and further contributes to environmental dimension as the emission of transportation is

reduced (de Barros Franco et al., 2022). Yet, transparency is often an issue in logistics industry (Jain et al., 2020).

The invention of blockchain is the turning point to the innovative development of logistics service provides in history of logistics sustainability. Traditional supply networks are notoriously difficult and opaque, therefore introducing and developing blockchain technology to improve logistics and make the supply chain more sustainable is of significant interest to everyone engaged in the process (Rane et al., 2020). Blockchain, is a novel distributed data storage technology that originates from Bitcoin, the digital currency that invented by Satoshi Nakamoto. It is recognized as a technology that strives for decentralization, real-time peer-to-peer transmission, consensus method, encryption security, and other computer technology application model (Wei, 2022). The extensive functions of blockchain can be illustrated in all sort types of data sharing, such as contracts, cargo tracking, as well as financial transactions tracking (Elghaish et al., 2021).

Apart from providing higher transparency and security, blockchain implementation is equipped with the potential to accelerate the physical movement of goods (Tijan et al., 2019). The major advantage of blockchain technology is the absence of intermediaries between the parties participating in a business transaction, both financial and non-financial. Blockchain technology solutions aid in the strengthening of partnerships, especially in cross-organizational processes, by enabling companies to keep total control over diverse activities and the status of transactions at any given moment in time. Thus, blockchain technology is said to be advantageous in terms of decentralization, distribution, trustlessness, data immutability, traceability and so on (Xu et al., 2020). Undeniably, this has made it the best-suited to be implemented for a series of complex and sophisticated activities when planning, organizing, controlling and coordinating both the inbound and outbound information along with goods movement that cannot be separated from the support of information technology.

1.3 Problem Statement

The logistics field nowadays has transformed dramatically in latest decades owing to the rapid pace of technology advancements (Jamkhaneh et al., 2022). Being a competitive advantage, logistics industry must provide measurable and quantifiable service in terms of quality, time, and cost (Reklitis et al., 2021). Company must pay effort in controlling the logistics process variables and manage to deal with uncertainty to lead in its industry. Logistics systems in nowadays seem to be dynamic in making flexibility in order to meet the criteria such as complicated chained processes that required for a more robust logistics infrastructure (Raja Santhi & Muthuswamy, 2022). Sustainable logistics are critical in order to keep up with rapidly shifting framework factors in light of the present situation. New concepts like adaptability and sustainability are also making their way to the forefront and becoming part of the logistics integration process (Raja Santhi & Muthuswamy, 2022).

Sustainability is seen from a variety of angles, including social, economic, and environmental (Khan et al, 2022). The 3 sustainable pillars are often utilized when it comes to measure sustainability (Cavalieri et al., 2022). In logistics, environmental sustainability are the aspects that being most discussed by scholars (Paukku, 2021). Businesses now find it more difficult to ignore this ongoing problem (Manupati et al., 2020). Although sustainable logistics can be achieved through collaboration with multiple stakeholders as it helps to save costs, boost efficiency and profitability (Konstantakopoulos et al., 2021), there are still challenges existing. The utmost challenge is the manually typed logistic data. Namely, orders are manually marked on paper forms and manually entered into systems for many electrical appliance manufacturers throughout the fulfilment process (Ji & Wang, 2017) to match all operations, production, and logistics elements. Real-time data cannot be gathered in such situation, and ideal solutions cannot be assessed with long-term economic sustainability in mind (Tan et al., 2020). Not to mentioned that as paper forms are utilized in recording logistics data, it also indicates that more trees are chopped down to manufacture paper and caused negative impact towards environmental sustainability (Liu et al., 2021). In the meantime, clients' personal information is at risk if logistical data is leaked. This means that customers' personal information may be retrieved via

the use of paper records. As a result, mistrust among stakeholders may occurred and make it difficult to create cooperative partnerships. (Karam et al., 2021).

When it comes to enhancing sustainability, technologies playing an essential role in terms of environmental, economic, and social (Cavalieri et al., 2022). Digital and innovative technologies notably the Internet of Things (IoT), big data and analytics, as well as artificial intelligence (AI) are seen as facilitating sustainable manufacturing practices (Laskurain-Iturbe, et al. 2021). Tran-Dang et al. (2022) suggests that the real-time and valuable data related to the logistics process that supported by the IoT can be harnessed to improve the operational efficiency of the logistics company in terms of fleet and traffic management, inventory control, asset utilisation, safety, and security.

However, IoT technology is being hampered by several concerns, such as data privacy and security issues, despite the fact that it can link smart devices to gather data for real-time decision-making and can do so by connecting smart devices (Tan et al., 2020). To give a clear illustration, low customer satisfaction on the issues of data leakage is one of the common logistical issues that arise in 2022. According to D.W. Morgan company, there is approximately 100 GB of sensitive data leakage regarding its customers' personal information, company's shipping and transportation information and more (Trend Micro, 2022). This is a worrying phenomenon since the advancement of technologies in logistics industry. Logistics sustainability in terms of transparency and regionalisation during the transportation and shipment is no longer a new issue but it is still a question with unknown resolution until the invention of blockchain (Tan et al., 2020). The social component of sustainable development relies on transparency, trust, and accountability of blockchain to ensure human rights enforcement, food security, and the detection of fraud and abuse (Friedman & Ormiston, 2022). These aspects are advantageous for the economic sustainability as well since they strengthen client loyalty, which in turn reduces the risk of financial exploitation and other dangers.

Yet, it is usually an ill-posed problem in the case of blockchain, which has been introduced slightly late among other ICT devices, making community are more unfamiliar with it (Raja Santhi & Muthuswamy, 2022). Community often lacks understanding and knowledge about how does the blockchain might benefits their business or daily life (da Silva & dos Santos, 2022). Furthermore, the community,

notably those involved in logistics industry, encounters challenges when incorporating blockchain technology into its business. The lack of a relatively perfect system (Balci & Surucu-Balci, 2021) in terms of national policies, industry planning, association guidance, and enterprise collaboration, making the development of enterprises more blind and the industry layout chaotic and disorderly. Although certain support policies have been introduced for the international logistics industry in recent years, there are still lacks in the overall planning of the industry and the qualification requirements for new enterprises. As blockchain is still in its early development in Malaysia (Nor et al., 2021), most businesses are hesitant to invest it into their business operations. They are clueless about the ways to manage the negative impact brings by blockchain such as high energy consumption, high investment cost required, unstable internet connection, and more (Iredale, 2020).

Extensive research has been carried out on blockchain regarding its challenges, implementation, framework advantages and more, but there is no single study exists on the blockchain implementation that contributes to logistics sustainability. Moreover, major research conducted in past are regarding blockchain in sustainable supply chain. To rectify the problem of only general research being studied in past few decades, it is necessary to have a detailed and specific study on how blockchain is implemented and delivers benefits to a company's logistics sustainability. This project seeks to offer an overview of the blockchain implementation to ensure the sustainability of its logistics. Through this study, it enables readers to have better grasp of the ways to deal with the issues that arise when attempting to implement blockchain technology. Also, as mentioned previously, in the logistic industry, sustainability concern is often emphasized on environment pillars. To address the research gap, this study further aims to provide readers have a deep insight regarding another two sustainable pillars which are economic and social.

1.4 Research Questions

In this study, the research questions seek to identify DHL, the global logistics service provider company's blockchain implementation for its logistics sustainability. It is believed that straightforward yet simple research questions as stated below facilitate this research process.

1. How does blockchain being implemented to DHL, the logistics service provider company's logistics operation to ensures logistics sustainability?
2. What are the key advantages in terms of logistics sustainability towards DHL, the logistics service provider company as a result of the blockchain implementation?
3. What are the challenges faced by DHL when implementing blockchain for logistics sustainability and solution taken to address the issues and challenges that arise?

1.5 Research Objectives

The research objectives in this project are to obtain a deeper view about the aspects that contribute to logistics sustainability through the implementation of blockchain in company. The 3 research objectives are shown below:

1. To propose blockchain implementation to enhance the sustainability of logistics operation in DHL.
2. To examine if DHL, the logistics service provider company is aware of and understand the benefits that come with the implementation of blockchain in conjunction with the goals of contributing to logistics sustainability.
3. To investigate the challenges faced and efforts made by DHL to tackle the issues and challenges encountered when seeking to adopt blockchain in its system in conjunction to enhance its logistics sustainability.

1.6 Scope of Research

The study scope in this project is the implementation of blockchain that being widely utilized in company to maintain its logistics sustainability. As a logistics service provider company which expert in logistics field, DHL company is chosen as the target in this study. Being the top leader ranking first in express logistics for 3 consecutive year, DHL company has indeed made a good job in taking sustainable development as the principle of the greatest interest in environmental, social, and governance factors. For illustration, as early as 2007, DHL had established an efficiency rate target for 2020, but it accomplished the aim in 2016 to decrease 30% of total CO2 emissions (DHL, 2017). Total emissions in terms of global and local, green solutions, and staff participation have all been part of DHL's intermediate strategic aim to makes it moves toward its ultimate 2050 target of zero net carbon emissions in all transport-related activity (DHL, 2017).

The focus on this study further includes the advantages in terms of logistics sustainability received by both the DHL employees and top management, as well as DHL's customers through the implementation of blockchain. It focuses on the pros delivered by blockchain towards DHL and its clients, along with the relevance of blockchain adoption in a courier company. This study will be emphasized on how DHL implement blockchain into its business operation in order to minimize the carbon footprint through aims of zero-emissions as well as establishing the highest social and governance requirements without jeopardising its level of service.

Aside from providing details on how DHL dealt with blockchain difficulties, this research also focused on the methods utilized by other logistics companies to overcome the blockchain issues in conjunction to secure its logistics sustainability. For example, DHL has partners with Accenture to unlock the power of Blockchain in logistics (Accenture, 2018). The overarching purpose of DHL and Accenture is to utilize blockchain technology to combat fraudulent medicines. By incorporating serialisation, tracking and tracing characteristics on a blockchain platform, they expect to achieve this objective mentioned (Heutger et al., 2018). This aims to provide viewers a greater thinking and enhance their confidence of how well challenges in blockchain can be solved and enhance the sustainability of logistics.

DHL company, which excels in providing cargo and document shipment, freight transportation, or even solutions and specific professionalism is believed that able to help in enhancing the awareness and knowledge of readers of the advantages brings by blockchain along to ensuring logistics sustainability, and ways to resolve the blockchain issues as well.

1.7 Definition of Terms

1.7.1 Logistics

In this 21st century, where the economic structure is constantly transforming, logistics has evolved from the simple distribution of goods to a range of activities that include the interconnection of information, transportation and shipment, inventories, stockpiling, material packaging and handling, as well as safety control. It has grown into the backbone of the supply chain that stimulate commerce, facilitating efficiency of businesses, and spurring economic progress (Tran-Dang et al., 2022).

1.7.2 Logistics Sustainability

Logistics sustainability, as used in supply chain management, refers to a technique or procedure's capacity to handle environmental problems while maintaining logistical performance efficiency (Kumar, 2022). It is essential as logistical companies in nowadays have been facing the challenges to remain its production efficiency. According to the author, logistics sustainability allows organization to equipped with competitive edge as sustainable method that being utilized when manufacturing their products and providing their services makes them one more step closer to build up a better global future.

1.7.3 Blockchain

Blockchain is an underlying technology that underpins Bitcoin, resembling a decentralized database. It refers to a technological approach that employs decentralization and trustlessness to maintain a trustworthy database collaboratively (Khan et al., 2022). Blockchain technology ensures the reliability of the data stored on the chain, forcing each participant to follow established rules to execute a certain business logic. Blockchain technology ensures the reliability of the data stored on the chain, forcing each participant to follow established rules to execute a certain business logic. A complete record of transactions constrains the behaviour of the participants to rationally restrain the incentive to default, giving the blockchain ledger an inherent reliability. This is undeniably that the speedy, precise and real-time information flow throughout the logistics chain enables companies to have good decision making immediately to the market, thus achieving the virtuous cycle of business flow, information flow and capital flow (Khan et al., 2022).

1.8 Significance of Study

In the perspective of logistics companies, this study is critical to provide a straightforward overview and guidelines on how blockchain technology contributes to logistics sustainability. Logistics companies gain confidence and trustworthy towards the blockchain implementation, which will undoubtedly boost the entire supply chain and logistics performance within the company's operations and customer satisfaction. As a result, this further contribute to Malaysia's GDP starting from now. This not only allows logistics firms to generate profit from delivering superior logistics and transportation services for customers, but it also encourages those courier companies to strive for better service so that they have an opportunity to provide transportation and logistical services for overseas customers in the future.

In a wider view, the logistics companies will benefit from this study since they will have a better grasp on how effectively the blockchain works and further helps in maintaining the supply chain and logistics. This broadens the employees as well as the stakeholders about the potential challenges and solution to be taken when implementing blockchain based on their capabilities. For example, small logistics companies who face high investment cost for launching blockchain able to gain some knowledge and experience from other small companies that facing financial issues yet still managed to implement blockchain into their operation system. By gaining input regarding the courier company's blockchain implementation, the small companies will then consider involving in blockchain implementation.

On another hand, customers will benefit from this study since they will have a better grasp on how effectively the blockchain works and further helps in maintaining the supply chain and logistics. This broadens their understanding regarding blockchain implementation that allowing them to choose the best-suited courier company based on their preferences. For example, customer who needed to transport their high-valued items are willing to pay for more in order to ensure the safety of their products. By knowing the courier company's blockchain implementation, customers have great transparency and trust in the courier company. They are not exploited for high delivery fees but with inaccurate and not trustable services.

1.9 Summary

To sum up, this chapter first briefly explains the background of study regarding the current trend of logistics industry and logistics sustainability as well as the implementation of blockchain in logistics industry. It then followed up by the problem statement which illustrates the relevant issues that lead to the importance of conducting this research. Research questions and research objective are then listed out after the explanation of problem statement. As for scope of research, it is mentioned that DHL Company is selected since the company is the most suitable logistics service providers

company that had implemented blockchain technology and strive in sustainable logistics. Definitions of terms such as logistics, logistics sustainability, and blockchain are provided to give a brief understanding towards readers. Lastly, the significance of study is mentioned to indicate the necessity of this research regarding the implementation of blockchain towards logistics sustainability.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter aims to provide fundamental literature related to the research topic. Numerous scholars have undertaken detailed research on blockchain adoption towards sustainable supply chain regarding its benefits, barriers and more. Yet, those past research are ultimately emphasized on theoretical approach which then lacks empirical analysis regarding blockchain implementation in supply chain sustainability. Moreover, there is no single research on blockchain implementation in logistics sustainability or similar research existed. Therefore, this review thoroughly contrasts as well as evaluates the data information in the existing literature to remedy this research gap. The chapter will first kick off with the topics of logistics, logistics sustainability, challenges in logistics sustainability, blockchain technology, blockchain in logistics, conceptual framework as well as proposed framework developed for this research.

2.2 Logistics

Logistics, the theory and practice of flow management regarding material, information, and financial (Barykin et al., 2022). Along with supply chain management, logistics has emerged as a vital business function with the ability to transfer goods punctually in the right quantities under the satisfactory condition (Humayun et al., 2020). As described by Song (2021), logistics takes place since the transportation and storage of commodities from their origin to the end destination with the aims to conform customers necessity. The author further elaborates that the goal of logistics is to offer clients with timely and cost-effective solutions while aiming to minimize expenses, increase customer satisfaction which then secure the transportation company a competitive edge. Alonso (2019) defined logistics into three sections which are inbound logistics, internal logistics, and outbound logistics. Inbound logistics (supply) occurred when there are logistical activities occurred between the source of raw materials and the plant's entry point (Odunjo, 2020). When it comes to produce a product, internal logistics involves everything from the flow of materials and information to the actual movement of the product itself. After the products is fully manufactured, outbound logistics (distribution) takes place to deliver the end products to clients.

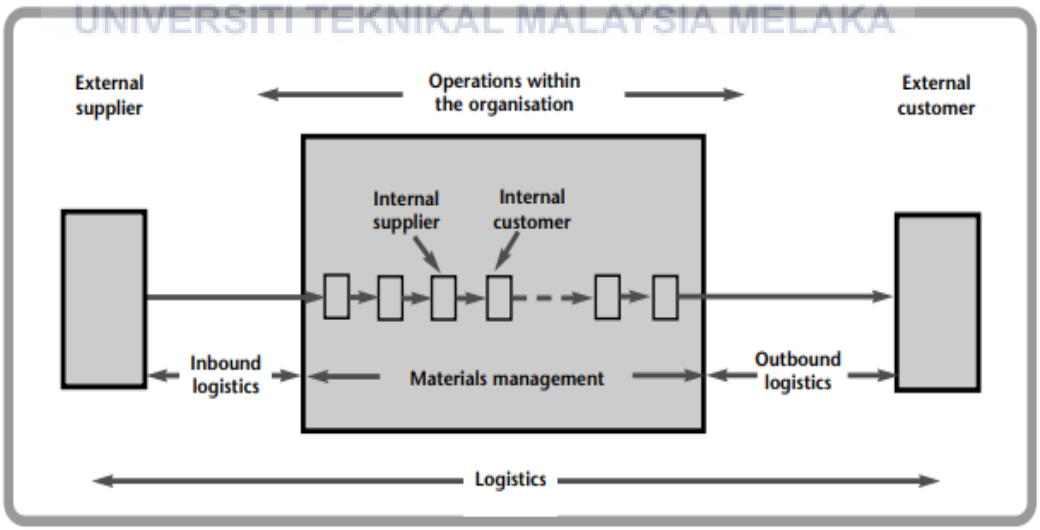


Figure 2.1: *Logistics Process. Sources: Logistics. (2021)*

Tan et al. (2020) outlines that logistics in supply chain includes customers, distributions, manufacturers, and suppliers. In terms of business operation, downstream stakeholders are defined as the buyers of its upstream stakeholders. Simply put, upstream stakeholder is the seller whereas downstream stakeholder is the buyer of its upstream stakeholders respectively. Consider the outbound logistics case of distributors acting as the manufacturers' buyer, there are at least two processes involved when buyers acquire commodities from sellers. These processes are known as sourcing and dissemination. Upon the completion of an order, the sellers then work with a third-party logistics (3PL) provider to ship the products. Multimodal transportation is the norm when transporting items in this era. The term "transportation" encompasses long-haul transport, short-haul transit, and storage. The transaction is completed once the products are delivered to the buyers, and they pay for them. Figure 2.2 depicts the logistics procedure, beginning with raw material procurement and ending with delivery to end customers.

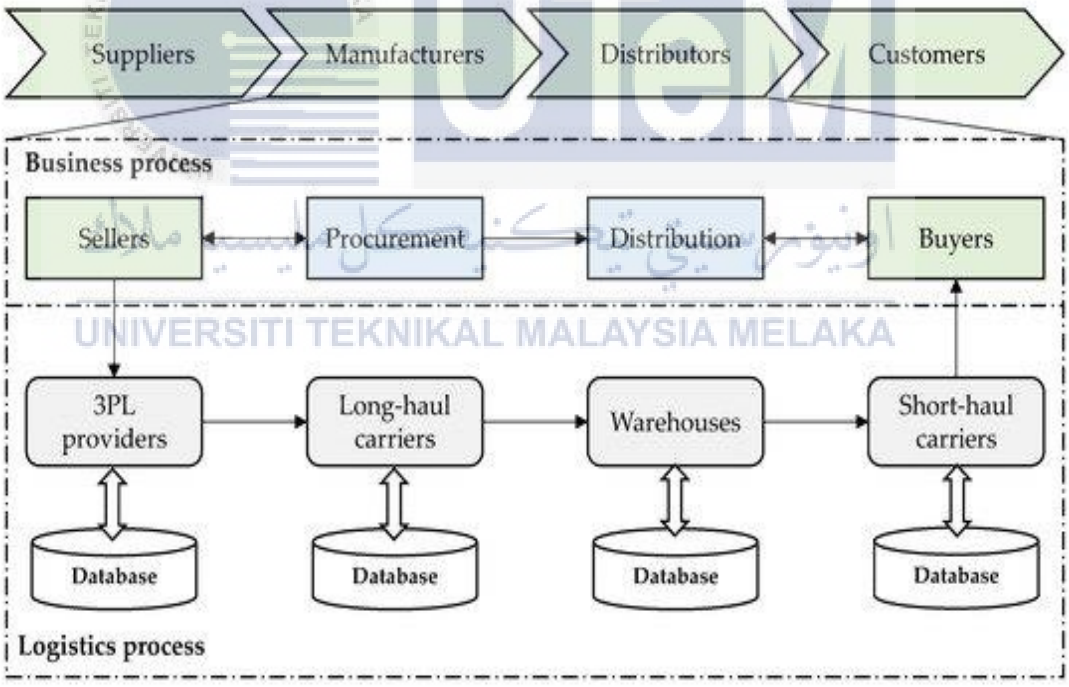


Figure 2.2: *Logistics in Supply Chains. Source: Tan et al. (2021)*

2.3 Logistics Sustainability

From past few decades, sustainability has been grabbing community's interest in both academic and industrial aspects. There has been numerous research conducted to study the concept of sustainable as well as the challenges in attaining sustainability (Kouhizadeh et al., 2021). In the content of supply chain management, logistics sustainability refers to the ability of practices and procedures to address environmental concerns while preserving performance efficiency in logistics activities (Kumar, 2022). To help organizations accomplish their economic and ecological goals, Parhi et al. (2022) describe logistics sustainability as the capability of an approach that offers positive outcomes in terms of production efficiency, and profitability.

According to the first ever study that emphasized on all the three sustainability pillars by Jamali et al. (2022), a cohesive integration of economic, environmental, and social performances are essential to seek for achieving optimum balance in terms of life-saving, moral, environment-related, social-related and economic-related aims. Yet, environmental pillar has been the primary focus of the great majority of research on sustainability, with very little attention paid to the economic and social domains. Ren et al. (2020) uncover that sustainable logistics acts as the initiative to that prioritize on the reduction of environment pollution such as the emission of carbon, climate change, and more. Zwickle and Jones (2018) proposed that this imbalanced degree of study may be traced back to two factors as the environmental aspect is straightforward to comprehend and investigate.

In the opposite view, Orji et al. (2020) proposed that the wide discussion on economic and environmental sustainability had led to the lack of studies that is social-related. When discussing about sustainability in logistics, both the environment and social pillars were receiving much attention than before from the community as well as scholars (Karaduman et al., 2020). However, Jayarathna et al. (2021) suggested all the three pillars should be discussed fairly and focus evenly as every pillar occupy the same weightage. To address one of the gaps, the 3 pillars of sustainability will be equally explained in this research to address the insufficient information provided in past research.

2.3.1 Environmental Dimension

Logistics industry has been identified as a significant contributor to global warming through noise pollution, air pollution, and traffic congestion (Verma et al., 2021; Bencekri et al., 2021). Baah et al. (2020) proposed that it is a need to generate a compilation of initiatives by companies to monitor and mitigate the environmental effect that occurred due to the logistical activities to increase the sustainability in logistics. Based on the authors, there is a linkage between sustainable supply chain practices, green manufacturing, and sustainable logistics practices. To achieve logistics sustainability, minimization of carbon footprints is the utmost priority in environmental dimension. Rehman et al. (2021) revealed that reduction in carbon emissions has a direct connection towards increase in environmental sustainability. Prior to the research related to practices that enhances logistics sustainability by Baah et al. (2020), they suggested that one of the strategies that logistics sustainability in terms of environment dimension can be achieved includes green logistics.

Green logistics are the initiatives taken to reduce carbon emissions, air and noise emissions, and minimize the packages pollution (Aroonsrimorakot et al., 2022). According to Tsatalis (2019), logistics sustainability can be illustrated through green logistics that entails adopting tentative logistics operations like acquiring raw materials and manufacturing items before the goods are being shipped out along with reverse logistics protocols. Based on the findings of Karia (2020), LSPs are responsible for transporting green goods and services from green suppliers and manufacturers to green distributors and retailers, and finally to green consumers throughout the whole of the green supply chain integration. The author further elaborates that the green logistics have the potential to increase logistics performance in conjunction to contribute significant reduction of carbon dioxide emissions with the aids of green fuel, green packaging, green warehouse and green management. Research conducted by Li et al. (2021) proven that green logistics and fossil fuel illustrates an extensive impact towards carbon emissions. The authors further declare that the practices of green logistics not only enhance logistics sustainability in terms of environmental, but it also for economic growth. This proven the existence of linkage between environment and economic dimension in logistics sustainability.

2.3.2 Economic Dimension

Transportation is critical for economic growth and the flow of goods and services. Economic sustainability is reached when an organization able to fulfil the current consumption levels while no compromission of the sustainability in both social and environmental aspects (Park & Li, 2021). Agyabeng-Mensah et al. (2020) indicated that fuel expenses due to excessive usage, transportation fees, legal cost as penalties for breaking regulations, purchase of carbon emission cards, and wastage of resources are the example of poor logistics management linked to economic performance. Hence, this pillar is likely to relate with governance which means organization have to take initiatives in developing a robust management mechanism to guarantees its entirely logistical performance in terms of transparency, traceability, as well as accountability (Choudhary et al., 2019).

A study conducted by Arsić et al. (2020) suggest that a company's capacity to own and operate logistical facilities is critical for its long-term economic viability in the context of a supply chain. In the meantime, Agyaberg-Mensah et al. (2020) demonstrated the role of proper warehouse management to enhance sustainability of logistics in economic pillar. Likewise, Jagtap et al. (2022) revealed that a warehouse constructed with low energy consumption technology such as smart metering system that function with IoT helps to reduce energy costs which further boost the profitability. Technologies are often utilized to achieve economic sustainability along with environmental sustainability (Arya et al., 2020). By avoiding wastage or minimizing emissions, sustainable storage and warehouse encourages the elimination of expense for pollution management, thereby contribute to greater economic performance.

Circular economy (CE) has discovered to be a business model that boosting the achievement for economic sustainability goals. Instead of applying linear economy, most of the companies have implementing CE to cut down their energy consumption expenses while reaching the aims to minimum environment pollution and maximum the production efficiency (Jayarathna et al., 2023). Morseletto (2020) illustrated that by utilizing regenerative and restorative ideas from CE, sustainable development activities including tree planting, solar panel installation, rainwater collection, and

sewage treatment that lessen the strain on the planet's natural resources are connected with the economic performance (de Souza et al., 2022).

2.3.3 Social Dimension

In logistics sustainability, worker exploitation, fair salaries, a healthy and safe environment, equitable treatment, and freedom of association all fall under the umbrella of social responsibility (Saberi et al., 2019; Venkatesh et al., 2020). D'Eusanio et al. (2019) further explained that when it comes to ensuring social and economic sustainability, social sustainability in supply chains considers the circumstances of those participating in the supply chain, like safety and human rights such as workplace protection. Regulations and relationships have been established to limit negative environmental consequences and enforce strict adherence to sustainable transportation principles (Baah et al., 2020).

Missimer et al. (2017) highlighted that job conditions including workplace security and safety concern are related to Artificial Intelligent technologies. A sustainable monitoring and evaluation technology found to be helping a company to reach its logistics sustainability in the sense of an appropriate learning culture, refining company's approach, adaption to the expectations and more (Baah et al., 2021). Meanwhile, Venkatesh et al. (2020) suggests that a high traceability and transparency of logistics is necessary to guarantee the restrict implementation of regulations are being adapted by the logistics partners. Furthermore, to keep logistics operations socially conscious, effective information exchange is vital. According to Huang & Wang (2017), the distribution of sustainable knowledge across the organization's partners provides value for all partners. The sharing of information within business partners encourage that increase transparency is essential to enhance the sustainability of logistics (De Souza et al, 2018). Businesses and supply chain partners are kept up to speed on sustainable policies, plans, and projects via the exchange of sustainable information.

2.4 Challenges in Logistics Sustainability

Sustainability is a challenging multifaceted concept for companies to achieve (Di Vaio & Varriale, 2020). Achieving the goal of developing a sustainable logistics is a difficult task.

Transparency, one of the sustainability times bombs that caused the failure in logistics industry (Venkatesh et al., 2020). The lack of transparency in the management structure might be exacerbated by a lack of equal access to information across supply chain participants. This is especially true for global supply chains, in part because of the rise in outsourcing among companies in order to enhance the operation performance (Khalatur et al., 2021). Although it may be feasible to achieve traceability and dependability at lowest possible cost using conventional supply chain management, it frequently demands a significant investment and administrative effort.

Additionally, the challenges of logistics sustainability related to environmental aspects can be caused by the inefficiency of weather forecasting (de Andres Gonzalez et al., 2021). The lack and untimely weather condition that forecasted leads to interruption in delivery. Similar to de Andres Gonzalez et al. (2021), the framework of strategic decision regarding green supply chain management highlights the dynamic character of enterprises and their connection to the natural environment (Park & Li, 2021). There must be a real-time monitoring system that can update information for all supply chain participants at the same time.

Venkatesh et al. (2020) clarifies that regulation is one of the most significant motivations for adhering to social sustainable activities. Yet, regulators might vary and fail to meet the exact standards as those established by external stakeholders since supply chains are typically constructed around geographically dispersed entities (Venkatesh et al., 2020). Regulations are no more effective to ensure the social sustainability without the efficient monitoring or auditing mechanism. Based on the author, organization are ‘forced’ to establish the trust towards their logistics partners who provide them the information regarding its employees’ welfare in this situation. This indicates that blind spot might come in sudden if the business partners are not honest enough. All in all, logistics in supply chain equipped with high transparency

and traceability that encourages ethical behaviours is essential to ensure the logistics sustainability in terms of social aspects (Park & Li 2021).

There is a case investigated by Cartier et al. (2018) regarding the tracking and traceability of opportunities in Gem industry. Based on the authors, the social challenge raised during the procurement procedure which the unethical behaviour that might lead to human rights abuse is mostly due to the low transparency in supply chain. Moreover, the low in supply chain transparency leads to the high possibility in inaccurate logistics and supply chain information provided. This is because anyone within the organization is allowed to change to organization-related information when there is poor transparency on logistics and supply chain management (Park & Li, 2021).

2.5 Blockchain

Industries such as supply chains, business, healthcare, manufacturing, and data management have been impacted by blockchain technology (Casino et al., 2019). Blockchain, inspired by Satoshi Nakamoto's Bitcoin is a technological solution that functions independently to store, validate, transmit, or link network data (AL & Aldweesh, 2022). It is a data structure that unites blocks in a chain manner, where every single block is hashed to the preceding block and allowing for traceability. Blockchain is employed to ensure that the data is immutable. Transactions between two or more parties are made more secure by the decentralised immutability of the blockchain database (Schmidt & Wagner, 2019). Stakeholders manage to communicate and interact in a safe and transparent manner by chaining transactions together as blocks of data in chronological sequence (Omar et al., 2021). As soon as the transaction is complete, the blockchain is updated accordingly. As transaction cannot be reversed, and only people who have been given permission may access the outcomes (IBM, 2022), this contributes to the formation of a distributed peer-to-peer network in the absence of a central control node.

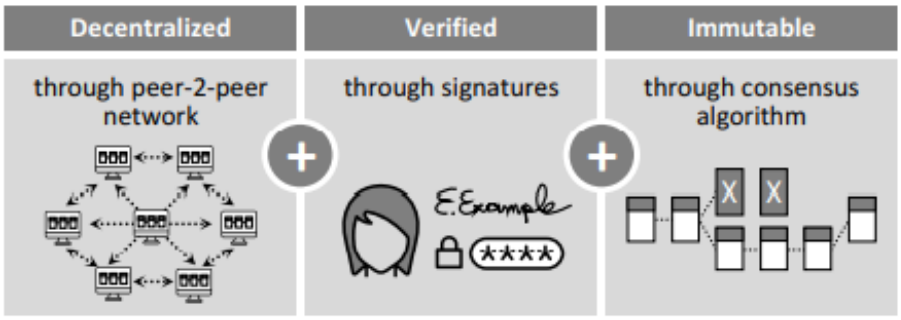


Figure 2.3: *Basic Properties of Blockchain. Source: adapted from Hackius & Petersen (2017)*

Blockchain is being used to help deploy the Internet of Things (IoT). Data privacy and security concerns have hampered the IoT's ability to gather and analyse real-time data for decision-making (Singh et al., 2022). As a result, Uddin et al. (2021) proposed the combination of blockchain and IoT to establish trust between IoT components and business models such as utilizing smart contracts to process and store data safely. For a clear illustration, an IoT electronic business model based on blockchain technology was created to enable low-cost, efficient, and flexible peer-to-peer (P2P) commerce (Latif et al., 2022). Osho et al. (2019) argued that blockchain aids in both financial and non-financial applications. Besides aiding in financial transaction, Liu et al. (2022) revealed that blockchain furthers guarantee that transactions adhere to predefined regulations in the form of smart contract.

Smart contract in blockchain is a key feature that automatically enable the bargaining and execution of digital contracts without any central authority (Wang et al., 2019). The authors further mentioned that blockchain-based smart contracts are highly automated scripts that allow transactions between several parties to be validated This feature is widely utilized. Blockchain's smart contracts automate company operations while decreasing costs and human mistakes, making them one of the most important characteristics of the technology (Manupati et al., 2020). Using smart contracts allows for accountability, trust and traceability since transactions are allowed to be inspected in a secure, decentralised database (Tang et al., 2022). Organizations may save a lot of money by automating contracts instead of doing manually. Smart contracts are equipped with vital effect for the future of logistics management via

reducing costs and boosting supply chain transparency. By utilization of smart contracts for ensuring that sustainability criteria are met throughout the logistics and supply chain (Manupati et al., 2020).

2.6 Blockchain in Logistics

Figure 2.4 illustrates the blockchain implementation for logistics sustainability. The implementation of blockchain for logistics sustainability is made up of 7 layers such as layers of data source, perception, network, blockchain, management, application and user.

The bottom layer, layer of data source depicts the origin of the data about logistical activities. In this layer, the raw data that is essential to support the logistic activities are collected from sort of sources. Goods is the first data sources type that offers insight to enhance logistics sustainability. Based on the amount of goods that purchase by the buyer, data can be obtained through the customer satisfaction. The second type of data source is obtained from logistics operators who in charge of the goods movement. Data can also be obtained from the smart gadgets and devices who manage to provide information timely. Lastly, the data can be collected through the transportation facilitates which are warehouses, carriers and more.

Perception layer is the layer after the data sources layer. In this layer, it grants the capability to track and apprehend the real-time information of the logistical resources by the utilization of a broad variety of IoT gadgets and sensor systems. One example of these sensing devices is the technology known as radio frequency identification, or RFID. In order to generate a one-of-a-kind identifier for a goods, RFID readers and tags, in addition to barcode scanners, are used. Also, IoT devices that interconnected with smart devices allow operators to collect and record the relevant data of logistics activities such as procurement, transportation, sales, flow of information, storage and so on. Webcams are one of the examples used by logistics operator to keep an eye on the conditions of the workplace and ensure the security of

the items. It is possible to track the location of vehicles in real time because to the global positioning systems (GPS) that are installed in trucks. The logistics sector has found a purpose for wearable technology due to the fact that this kind of technology may effectively enhance efficiency and minimise the amount of labour that logistics operators have to do. From a sociological point of view, this may also be considered sustainable development.

The third layer is the network layer which encompasses the 4G network, Internet Protocol (IP) and Bluetooth. All the data information gathered from the previous layer will be transmitted to the blockchain layer. Being the media of communication, this layer is important to convert data of diverse formats and protocols into data with unifying formats.

Blockchain layer is the layer which consists of the element such as consensus, cryptography, incentive, and smart contract. The information that has been gathered is kept in a chain of blocks, which are linked together one after the other in reverse chronological order to create a blockchain. The header and the content make up what is known as a blockchain. The first one keeps all of the meta information, while the second one stores a Merkle tree that is composed of data that has been validated and hashed (Yuan & Wang, 2018). Order information, shipping dates, receipt dates, information about goods, information about operators, and so on are all included in a Merkle tree. Consensus mechanism, algorithms to ensure the consistency of data allow the entire nodes of the blockchain network come to an agreement on data. Incentive mechanism, the one to stimulate all nodes to record and store data. Cryptography, one of the parts in blockchain that secures the data information through the use of digital signatures. Smart contract, the most famous blockchain element that used in coding, ensures the operation of blockchain especially in particular conditions.

Follow up next is the management layer. It is a layer that made up of numerous management techniques to ensure the framework's seamless functioning. From the figure, there is about 4 management tools which are management of blockchain, user, network as well as analytics of big data. The goal of management of blockchain is to ensure the accuracy of the data obtained and gathered in the blockchain layer. It is mainly to keep the blockchain layer well-managed and up to date. For user management, it is in charge of analyzing the logistics process and activity. Besides

detecting users who facing issues and, this management also further used in developing public and private keys. In the management of network, it aims to provide management on governing and managing communication media. In order to process the data that kept in blockchain for applications, big data analytics is employed.

For the application layer, it is to offer a wide range of applications based on the management layer. Logistics traceability, vehicle routing, energy saving management, and collaborative management, are the examples of the component in application layer. Lastly, the user layer implies the stakeholders that involved in the logistics process such as suppliers, manufacturers, 3PL providers, retailers, and customers. All stakeholders can be linked together through the blockchain-enabled applications.

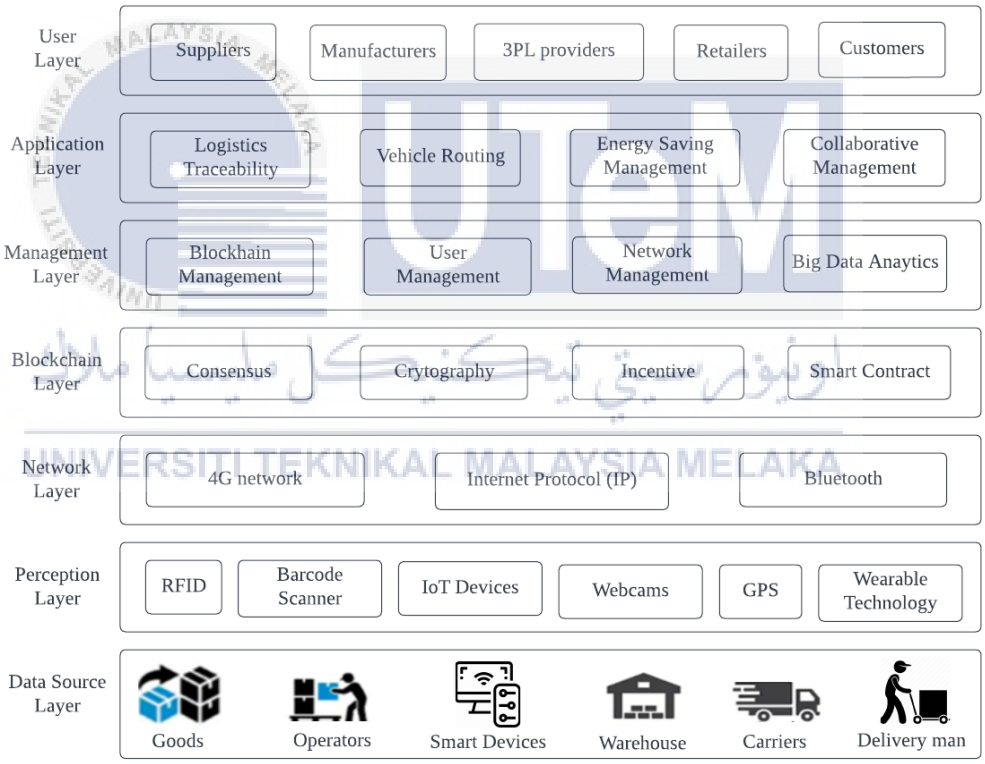


Figure 2.4: *Blockchain in Logistics. Source: adapted from Tan et al. (2020)*

Although blockchain is still infancy, the community is increasingly interested in exploring how it might be used and benefits them. According to Kshetri (2018), blockchain was examined to see whether it may affect important supply chain and

logistics management objectives such as reducing risk and improving the cost, quality and speed of the supply chain. The environmental effect of a product or service may be measured using a life cycle assessment, which Zhang et al. (2017) have done using blockchain. From a standpoint of social sustainability, Venkatesh et al. (2020) employed blockchain to defend workers' rights and ensure safe workplaces. In a comprehensive assessment of blockchain in logistics, Tijan et al. (2019) analysed the most significant issues. By using blockchain technology, an innovative logistics system manages to deal cybersecurity risks and confidentiality leak concerns (Fu & Zhu, 2019). Yet, there has been a lack of interest in using blockchain in sustainable logistics. In spite of the fact that blockchain has been employed in logistics, the majority of research papers concentrate on literature evaluations and give insights for practitioners as well as academics. In order to close the gap, this article proposes a framework that illustrates how does blockchain implementation helps in empowering logistic sustainability.

2.7 Conceptual Framework

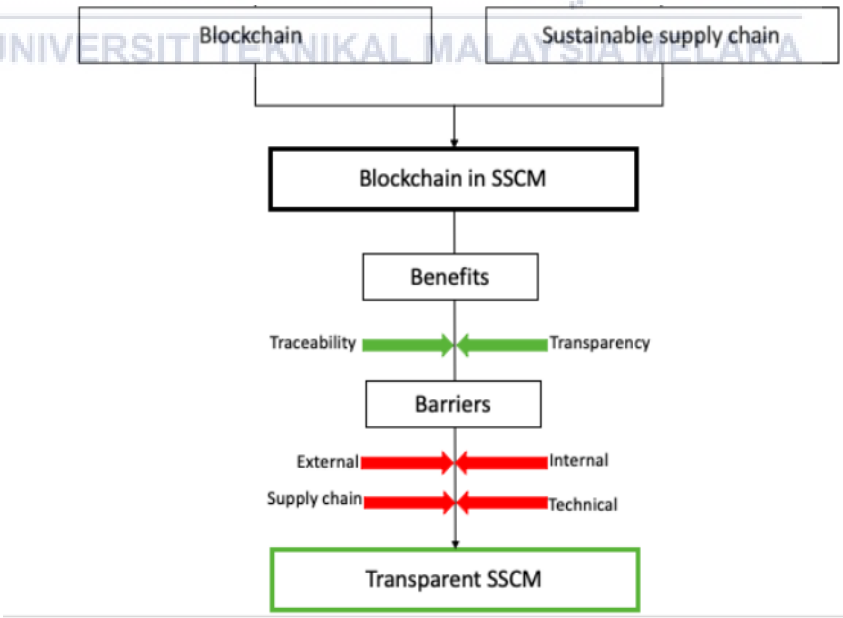


Figure 2.5: *Conceptual framework for Blockchain in Sustainable Supply Chain. Source: adapted from Berg & Myllymaa (2021)*

According to Saberi et al. (2019), implementation of blockchain into supply chain allows transaction to be high in transparency (Berg & Myllymaa, 2021). Adams et al. (2018) summarize that blockchain is often utilized as an application that helps to track social and environmental conditions in advance to reduce the impact of environmental, health and safety issues. In the meantime, hacking, system faults and corruption concerns are the norm in the digital world (Venkatesh et al., 2020). The authors go on to clarify that the usage of blockchain may be utilised to keep an honest and transparent record of sustainable practises as a technique to build secure, persistent, and contaminate records. The successful utilization of blockchain, in conjunction with other emerging technologies, enhances the quality of product as well as safety while meeting sustainability standards (Sharma et al., 2020)

Blockchain technology seeks to offer transparency for documents and transactions, freight scenario, eventually enhancing the efficiency, agility, and creativity of supply chains in logistics industry (O'Sullivan, 2018). However, there are various challenges in the global logistics sector, including lack of transparency or a misunderstanding communication occurred between agents at different tiers of the supply chain. Tan et al. (2020) criticizes that the absence of live data, logistical resources that being utilised inefficiently will contribute to the loss of energy. This further caused flexible choices for satisfying needs, such as receipt dates and transit capacity information, are no longer feasible. Thus, current logistics field is continuously facing with different kinds of difficulties since tight linkages among stakeholders are developed. Real-time data and information collection and dissemination are critical. Blockchain has been leveraged to simplify the procedure to successfully tackle the foregoing problems (Perboli et al., 2018). To address the issues mentioned, the research scope emphasizes on logistics, which is one of the inevitable parts from supply chain process.

2.8 Proposed Framework

In this research, a proposed framework is utilized to study the implementation of blockchain empowers logistics sustainability. The utmost aim of this framework is to introduce the blockchain implementation in logistics sustainability and further elaborate on this application, benefits and challenges when implementing blockchain.

The proposed framework illustrated in Figure 2.6 implies the relationship between blockchain implementation and logistics sustainability. Despite the challenges had been solved by past researchers, yet there are new challenges keep on existing. Thus, this proposed framework is aimed to study the latest challenges and benefits in terms of logistics sustainability that obtained from blockchain implementation.

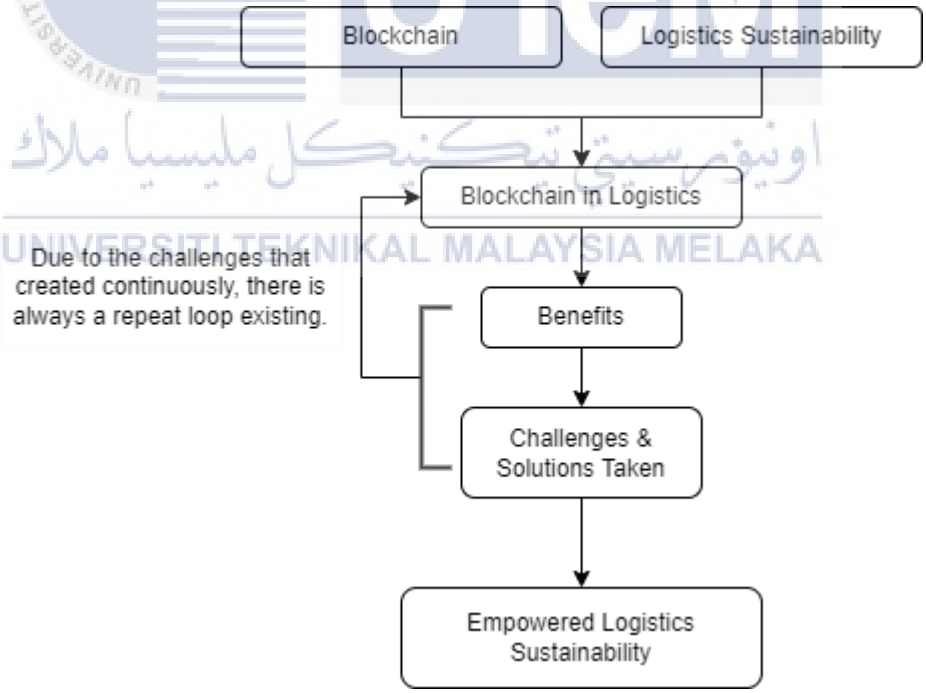


Figure 2.6: *Proposed framework for Implementation of Blockchain to Empowers Logistics Sustainability*

2.8.1 Blockchain Applications

2.8.1.1 Logistics Traceability

Traceability in logistics is a concept that defined as the capability of the goods to be traced all the way since its origin point, current stages (manufacturing process), locations (distributing process) until the point of end consumer (Tan et al., 2020). Logistics traceability underlying with blockchain technology generates a positive outcome in terms of the logistics and supply chain efficiency as the problem such as malfunctions of machine and equipment, and defected materials can be reduced (Tan et al., 2020; Venkatesh et al., 2020). Stakeholders may quickly acquire consistent and trustworthy data and information about the logistics process of commodities thanks to blockchain-enabled logistics traceability. According to Tan et al. (2020), reducing cost and materials is likely for businesses when they have access to accurate and up-to-date information from a variety of sources. This implies that logistics sustainability in the pillar of economic can be achieved by coordinating the wisely use of goods and resources throughout their lifecycles in an environmentally friendly manner. This application may potentially be used by the government to control the logistics industry.

2.8.1.2 Vehicle Routing

Routing numerous automobiles to meet with a group of customers is the primary goal of this application. Vehicle routing application is indeed a significant role which both the logistics and supply chain design relies heavily on it to develop the most cost-effective route. In order to minimise traffic congestion and the output of carbon emissions, vehicle routes have to be adjusted based on the real time available. It is therefore possible to save a substantial amount of energy and safeguard the environment (Tan et al., 2020). As the entire specifications and needs for shipments are stored in the blockchain network, this allows users to access them and set optimization objectives to compute the best outcomes. Additionally, vehicle routing aids in the sustainable logistics in terms of environmental aspects and further increase

in customer satisfaction. This is owing to the structured and quantifiable operation in vehicle route minimize the errors that might occurred and manage to deliver the goods and services to the consumer timely.

2.8.1.3 Energy Saving Management

Monitoring, controlling, and managing energy use is made easier with the help of energy saving management. Because of a lack of solid data on energy usage, conventionally, energy management and control are impossible. There is no way for logistics businesses to measure environmental impact. Real-time energy usage data may be recorded on the blockchain using physical items outfitted with smart sensors. By using data rather of changing it manually, logistical companies may do energy analyses and then utilise their results to come up with energy-saving options. To reduce energy, big data analytics may be used as a comprehensive solution (Wang et al., 2018). Using this software, logistics organisations may, for example, choose the appropriate cars (such as electric vehicles or diesel trucks) for certain circumstances. Environmental pollution may be reduced, and business managers' headaches solved by using energy-saving management practises. To develop a sustainable logistics, it is also one of the most critical steps to do.

2.8.1.4 Collaborative logistics

Collaborative logistics is recognized as the trend in logistics and supply chain management. With the help of this application, logistics providers may interact with one other to provide better and trustworthy service with lower freight costs to a certain group of consumers (Zhe et al., 2022). Collaboration between logistics organisations may cut energy use, reduce greenhouse gas emissions, and boost profitability. Logistics resources and tasks may be traded between several parties in a collaborative logistics market. Traditional cooperative logistics marketplaces find it challenging to

distribute logistical resources and responsibilities because of fluctuating demand and supply. Peer-to-Peer collaborative logistics markets may be formed using blockchain technology and allow for unrestricted trading. Resources are allocated more efficiently, and raw materials are used less, resulting in a cleaner environment, a more environmentally friendly economy and the establishment of sustainable logistics (Krishnan et al., 2021). Using smart contracts to support trade in blockchain-enabled P2P marketplaces is possible. It is the one and only method to brings the logistics industry to strive in a profitable, and risk-managed manner.

2.8.2 Benefits of Blockchain in Logistics Sustainability

According to Arunprathap et al., (2022), the utmost function of blockchain is to provide transparency for every member involved in the network the high accessibility to the same data, offering a single point of truth. Maheshwari (2022) further elaborate the transparency along with security offered through blockchain implementation contribute to physical flow of goods. In terms of transparency, blockchain provide a better tracking system that ease the decision-making process in order to fulfil the requirements of customers (Wan et al., 2022). Ko et al. (2018) concluded that companies are failed to implement blockchain may face the risk being outperformed by their rivals, failing to meet customer expectations, and missing out on the preferential financing, subsidy opportunities (such as a tax credit), and other benefits that come with greater openness and transparency about sustainability claims. Branding and good consumer signals may be unlocked if the blockchain is able to assure transparency (Rejeb & Rejeb, 2020).

2.8.2.1 Environmental logistics sustainability

Wong et al. (2019) clarify that ecological sustainability could be enhanced as blockchain manage to reduce the environmental logistics footprint in various methods. The meticulous monitoring of industrial factors like usage of energy, raw materials processing, and emissions would be enabled via the use of blockchain and smart contracts to combine many environmental protection and control activities. The potential for ecologically friendly production is being unlocked by blockchain technology. Blockchain has the potential to simplify stakeholder engagement in low-carbon energy efforts, enhance environmental protection programmes, and boost consumer access to clean energy, as Ashley and Johnson (2018) point out.

According to Kouhizadeh et al. (2019), organizations may utilise the blockchain to identify non-renewable resources in materials and products then eliminate or invest them in renewable and green alternatives to improve energy circularity. Saberi et al. (2019) mentioned that with blockchain's transparency, it's possible to the ‘greenness’ of the product or service towards environment. Also, firms' engagement in blockchain network displays their dedication towards environmental concerns like climate change, pollution, and energy supply depletion. Besides enhancing solid collaboration in terms of environmental, blockchain technology allows company to have better distribution of resources based on exact production schedules and real-time data collected from production processes, therefore promoting environmental sustainability (Rejab & Rejab, 2020).

2.8.2.2 Economic logistics sustainability

Ellen MacArthur Foundation (2019) indicates that the features of blockchain such as traceability and transparency are advantageous to align supply chains along with economic sustainability (Upadhyay et al., 2021). As the author illustrated, blockchain implementation manage to efficiently cater the component of sharing, optimization, virtualization and exchange as well. Zamani and Giaglis (2018) proposed that market disintermediation is encouraged by blockchain implementation

as it facilitates commercial transactions by linking buyers and sellers directly (Betti et al., 2019). The idea is supported by Hasan et al. (2019) which by utilizing smart contracts and blockchain to replace trusted third parties during transshipment activities in a global supply chain is a feasible and practical approach. A more efficient and automated supply chain may be achieved via the use of blockchain technology (Cole et al., 2019).

By using blockchain disintermediated method, Ashley and Johnson (2018) argued that transaction costs may be significantly reduced, which were previously unachievable. Blockchain's transparency and cost savings have been found to boost business earnings in both pre- and post-adoption studies (Ko et al., 2018). Incorporating blockchain technology into a company's business operations may help it become profitable and produce at lower marginal costs. It is also possible to construct a new, collaborative, and decentralised logistics world using blockchain's digital capabilities, which host a huge supply chain participant, match businesses on-demand, and give greater availability and better usage of logistical resources (Meyer et al., 2019). Since resource sharing businesses will be subject to intense examination, blockchain helps to ensure a fair economic business model and sustain its advantages (Sicilia & Visvizi, 2019).

2.8.2.3 Social logistics sustainability

In the context of the circular economy, the community might consider blockchain to be a social instrument for partnership. Multiple distributed databases may be linked and coordinated (Chen et al., 2023) so that they can all be updated at the same time and made available to everyone. When value is created and circulated in a distributed manner rather than centrally, the circular economy has the potential to profit from both collaboration and competition inside the loop (Narayan & Tidström, 2020). The blockchain technology's core features of decentralisation, distributiveness, and encrypt (Narayan & Tidström; 2020) can actually facilitate economy consequences via its features of smart contracts and tokenization (Narayan & Tidström, 2020). Supply chain stakeholders must have comprehensive and transparent

information and transactions on the blockchain in order to build trust between them (Veuger, 2018).

Cryptocurrency transaction can be made more efficient, secure and faster in times of crisis and catastrophe with the use of technology (He, 2022). Remittances may be sent automatically and pre-programmed by using a smart contract-enabled blockchain (Chuen & Teo, 2021). In times of crisis, technology may assist build trust and foster a greater sense of community by facilitating communication and tracking contributions. In addition, the transparency of logistics provided by blockchain is essential in preventing human rights violations, child labour, and corruption. More financial inclusion may be achieved via the use of blockchain technology, which supports the integration of the unbanked people and small-scale farmers and companies.

2.8.3 Challenges of Blockchain in Logistics

Rane and Thakker (2020) criticize that while incorporating blockchain and into supply chains is still a work in progress and even have the potential to revolutionise the green logistics, there are a number of hurdles that must be overcome.

When it comes to implementing blockchain, Hughes et al. (2019) mentioned that the two areas that have yet to be fully explored are organisational preparedness and regulatory compliance. Thus, it is necessary to include government agencies in the development of blockchain-based solutions in order to ensure compliance with local and national legislation (Chang et al., 2019). The importance of consumers' understanding and empowerment in the adoption of a new technology is critical, since they will have to adjust their buying and operational practises (Sylim et al., 2018). Currently, there is a lot of resistance among enterprises to exchange information on a worldwide platform. Issues like the lack of interoperability across various organisations are a stumbling block to expanding up (Sharma et al., 2018).

In terms of data collection and management, there is a common issue which blockchain implementation faced when attaining logistics sustainability. Qi (2020) summarized that Google processes data of 24 petabytes in 24 hours, while Facebook uploads exceed ten million images 60 minutes. This is a sign which data consumption in now era are continuously increasing. Likewise, in the logistics industry, a wealth of data is gathered and kept daily. As a result, the use of blockchain is in jeopardy (Tan et al, 2020). In accordance with the growing quantity of data gathered, a huge storage capacity is required by each blockchain node since data is continually stored every day (Krishnan et al., 2020). Large block size, slow response times, unnecessary storage wastage and high implementation fees as well are the concerns in blockchain implementation (Casino et al., 2019; Tan et al., 2020). To top it all off, the green development movement is being undermined by the high energy consumption. Real-time data collecting may lead to network congestion and a decrease in service quality. Casino et al. (2019) further comment that latency challenges also arisen as several minutes is required to analyse each block and perform the security check. In this case, blockchain's stability cannot be assured consequently.

In order to deploy blockchain technology for logistics sustainability, the logistics sector must overcome obstacles such as implementation cost and risk. Logistics companies are often burdened by high investment costs (Venkatesh et al, 2020). Device, training, operation, hardware, software, and maintenance expenditures are inevitable (Dutta et al., 2020). It's been a long time since most of the possible advantages were discussed. Instead of making a major investment in blockchain, companies may want to avoid blockchain implementation due to uncertainty and risk. A great effort that needs to exert before blockchain can greatly enhance the logistics sustainability is costly (Casino et al., 2019). Additionally, there is high in investments risk in which operations of logistics organisations are susceptible to disruption when there are technological issues.

2.9 Summary

Shortly, the researcher introduces the concept of blockchain, logistics, logistics sustainability including the challenges in logistics sustainability in terms of environmental, social, and economy. As far as we know, no previous research has investigated about the blockchain implementation that helps in logistic sustainability. Most of the studies in this related field are focusing on the advantages, challenges that linked the sustainable supply chain to blockchain technology. Thus, a new approach is necessary to address the lack of research regarding the implementation of blockchain that empowers the logistics sustainability instead of the supply chain sustainability that being widely study since past few decades.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, it aims to provide explanation regarding the methodology chosen to obtain data and the established research questions in this research. It also further discusses about the design philosophy, research design that mentioned about the qualitative methodology to be utilized for this research. In terms of data collection method, primary data obtained from respective respondents through interview session and archival documents published from official website of the organization are selected as secondary data to answer the research questions stated previously as well as the thought process behind these decisions. In terms of research sampling, self-selection technique will be discussed for this research. For the analysis of data collection, content analysis is chosen. Lastly, there is time horizon, ethics, as well as data reliability and validity that should also being emphasized when carrying out qualitative methodology research in this research.

3.2 Research Philosophy

To conduct research in a defined direction, a research philosophy is served as an overarching theory or set of beliefs that provide guidelines for the proper way for research to be carried out. It is founded on concepts about the nature of knowledge and world that acts as the framework regarding the appropriate procedures for data collection, analysis, and application for studying a particular phenomenon. According to Saunders et al. (2019), it is important to classify the research philosophy as it allows researchers to differentiate the truth concepts as well as the development of knowledge that related to their research. Positivism and interpretivism are the two dominant philosophies in the field of research. According to positivism, reality exists apart from human. Researchers can study reality in an objective manner, which one may make predictions after reviewing the foundation that has been observed and described in the past, as well as the interrelationships between them. For interpretivism, it claims that the nature of reality is mainly subjective due to the fact that it is sculpted from researchers' perceptions. Similarly, Saunders et al. (2019) proposed that interpretivism prioritizes the exploration of highly complicated social phenomena via acquiring an empathetic knowledge of how the researcher perceive the world relying on results obtained from a comparatively small sample size (Collis and Hussey, 2014). Thus, interpretivism philosophy is selected as the appropriate philosophy that suit with the phenomena regarding the blockchain technology that empowers the logistics sustainability.

In terms of interpretive philosophy, it consists of few frameworks such as postpositivism, social constructivism, pragmatism, and more. In this study, social constructive (Framework emphasizes on multi meanings, and understanding of world) is underpinned with the interpretivism philosophy. It allows researcher to gain information from open-ended questions that answered by participants who have diverse background and interpretation ways (Creswell, 2014). Aside from obtaining knowledge through theory, it is vital to collect insights and information from varied respondents about the blockchain implementation that enhance the logistics sustainability. As the highlighted in research title which it is a case study on DHL company, only DHL employees and blockchain experts who has connected with DHL

will be selected for interviews. Thus, the researcher will interpret the reality of the respondents without observing an objective reality. All data information that collected through interviews and documents from company will be analysis and compared among each other, so that a deep understanding on how blockchain implementation manage to enhance a sustainable logistics can be generated.

Not to forgot, there is also philosophy assumptions that researcher should examined after determined the philosophy framework. Ontological and epistemological is the two philosophy assumptions that implemented in this research. EasterbySmith et al. (2018) summarizes that ontological is referring to the reality's nature and characteristics that further influence researcher's assumptions whereas epistemology refers to the knowledge that researcher equipped and the ways that researcher acquire the knowledge from their assumptions of their own reality. As stated in the significance of study that this research is to identify the how does the implementation of blockchain empowers the logistics sustainability, it is a priority to be observant and grasp the concept of numerous realities and generate evidence from a variety of sources such as interviews with people who have witnessed these various realities first hand. It cannot be assumed that there is only one function of blockchain technology to help in logistics sustainability. It is depending on the observer's perspectives and how does the implementation of blockchain benefit the observers' when it comes to logistics sustainability. Thus, an interpretive framework that equipped with constructivism philosophy approach along with ontological and epistemological assumptions is applied in this study.

3.3 Research Design

Research design is defined as a blueprint created by the researcher that contains of the research methods and techniques when conducting the research (Abutabenjeh & Jaradat, 2018). It is known as the general plan regarding the method utilized by researcher to address the research questions, the specify data sources that researcher

obtained and analyzed the data, as well as the limitation in the research such as ethics, time constraint and data validity that occurred when conducting the research. Easterby-Smith et al. (2018) proposed that the research design to be carried out in either quantitative or qualitative manner is depending on the nature of research questions.

To examined how does the blockchain implementation enhance the logistics sustainability, qualitative research design is selected in this case. According to Easterby-Smith et al. (2018), the foundation of qualitative research is the collection of non-numerical data and an attempt to contextualize it in order to answer the research questions on the 'how' or 'why' of the study being conducted. Thus, the topic for qualitative study is often centred on an individual's perception of the reality, and further results in an investigation that is more exploratory in nature (Easterby-Smith et al., 2018).

In this study, the research objective is to grasp an insight on how the implemented blockchain fosters the logistics sustainability. The researcher will hence gather and analyze different point of perspective from diverse participants on their thinking for the logistics sustainability that being enhanced through the blockchain implementation. A quantitative approach could be challenging since the research's findings are depending on the participants' thought about what sort of influence blockchain technology may have in regard to logistics sustainability. It would be inaccurate if general response for the question is provided. Thus, this research will utilize an exploratory and qualitative technique in line with the constructional viewpoints in order to accomplish its research objectives. Saunders et al. (2019) proposed that, an exploratory approach is ideal since it allows for a deeper dive into the subject matter in the case of novel phenomena like blockchain. Additionally, a qualitative and exploratory method to the research was selected as the researcher aims to collect a smaller sample of data from a variety of viewpoints (Easterby-Smith et al., 2018).

3.4 Research Approach

According to Bell and Bryman (2015), the research approach can be carried out in terms of deductive, inductive, or abductive method to differentiate between theory and research. Saunders et al. (2019) summarize that deductive approach is known as the theory of verification, which a new theory is first constructed based on the evaluation of propositions that relevant to a previously conducted research. Hypothesis, observation, and conclusion are then further carried out after the establishment of new theory. The authors also mentioned that induction approach, the theory of generation and building first collect data through observations, identify the themes and pattern, establish tentative hypothesis and finally the development of new theory. For abductive approach, Saunders et al. (2019) proposed that it is the theory of modification. It is the combined approach of the two previous approaches where research is necessary to proceed the research back and forth between theory to data and data to theory approaches.

Abductive research approach is most appropriate in this research due the infancy development or likely to be non-existing theory regarding blockchain implementation that helps in logistic sustainability. Since there is only few available research in content of the blockchain implementation towards sustainable supply chain management, Saunders et al. (2019) ; Kovács and Spens (2005) stated that this study has to keep going back and forth between the conceptual theory and the data obtained from observations or interviews in order to reveal the gaps and broaden the research area. To conduct this study, abductive approach is ideal to produce testable conclusions which the conclusions of blockchain implementation enhances logistics sustainability could not just totally obtained from the theory, but it is needed to obtain insight from various respondents who have experienced or in touch with the blockchain technology. Based on Kovács and Spens (2005), there are several parallels between the abductive approach and case study, one of the research strategies that widely utilized in research.

3.5 Research Strategy

With research strategy, it is essential to guide reseacher's thinking and provide a defined direction to accomplish the study on time. Denzin and Lincoln (2018) highlighted that there is a connection between the research philosophy, research design, research approaches as well as research strategy. As mentioned previously that qualitative research design is utilized in this case, here are few qualitative strategies that widely implemented in conducting research such as archival and documentary research, case study, ethnography, action research, grounded theory and narrative inquiry.

According to Yin (2018), case study strategy allow researcher to have a deep understanding about the research topic as the examination of a specific contemporary phenomenon with a real-life context is carried out and leads to empirical descriptions and theory development. Similarly, case study strategy is often utilized to investigate meticulously one or a small number of cases within a defined period (Easterby-Smith et al., 2018). Bell and Bryman (2015) proposed that general conclusions will be drawn from specific contents, which researcher will keep in mind in which the participants are placed in and how it can influence their perception of the topic. The research will thus have a well-defined framework for analysing data and drawing logical conclusions from it (Easterby-Smith et al., 2018). In this study, it will be only single case study associated with archival or document research strategy along with the abductive approach as researcher aims to observe and analyze a phenomenon that few have considered before.

3.6 Data Collection Technique

In this research, a multi-method qualitative study is implemented which there is two types of data collection techniques being take in actions to conduct the research.

Below are the two data collection techniques such as interviews, and archival report and document.

3.6.1 Interviews

As one of the qualitative data collection strategies, interviews is defined as a conversation that carried out on purpose. During interview, the interviewer asks clear and straightforward questions towards the interviewee and pays close attention to the interviewee's response and feedback (Yin, 2018). Easterby-Smith et al. (2018) proposed that researchers and interviewees may explore new things from one another by reflecting on and exchanging knowledge throughout an interview. It is clearly mentioned that the objective of this research is to examine the blockchain implementation that enhance logistics sustainability. Thus, it is necessary to determine the scope of interviewee which are related to the topic of research as they equipped with more experiences in this particular area. The interviewee as shown in the research title 'Implementation of Blockchain Empowers Logistics Sustainability: A case study of DHL Company', the interviewee will be only selected among the employees or top management who works within DHL company as well as blockchain experts who have been connected with DHL Company or experiences in the blockchain operation in DHL Company.

There are few types of interview structures for research conducting which are structured, semi-structured, and unstructured (Ghauri et al., 2020). Structured interview is a usually closed-ended questions or known as multiple-choice questions that conducted through questionnaires. According to Easterby-Smith et al. (2018), it is often utilized in quantitative method research as the standardized questions and answers are provided by the researcher. The responses of feedback obtained from interviewees are fixed in a narrow view. For semi-structured interview, it is the combination of structured and unstructured interviews which research has a general thought about the questions to inquire, yet the questions not necessary to be in sequences. Unstructured interview is recognized as the most flexible type of interview that interview can ask questions spontaneously according to the previous responses answered by the interviewee. However, due to the new phenomenon in blockchain

technology, unstructured interview could be challenging as the research topic's background is not solid enough. Ghauri et al. (2020) critics that unstructured interview may contribute to low reliability of study as interviewee has complete freedom to discuss the topic where the questions asked are based on the interviewee's feedback. Thus, semi-structured is chosen in this study. This type of structure enables the establishment of a flexible yet conversational interview environment which research manage to explore the topic in deep accordance with the defined framework.

Before interview being carried out, every single interviewee will be provided with a synchronized guides regarding the topic and interview protocols. This step is vital to ensure the data reliability which influence the findings of study. Transparency and traceability concerns related to logistics sustainability will be examined through the semi-structured interviews with interviewees such as employees and top management in DHL company and blockchain experts who has extensive experiences in blockchain technology. To be more specific, the criteria of interviewee must be experienced in both blockchain technology and sustainable logistics. In the appendix 1, there are the questions determined to ask during the interviews.

3.6.1.1 Interview Protocol

High quality qualitative data can be obtained only with the use of a solid interview protocol (Yeong et al., 2018). Interviews conducted in a structured, coherent, and integrated direction via the beforehand delimitation of the subjects to be addressed, aids the interview process (Patton, 2015) Protocols for interviews is essential to promote the efficiency of the interview session as it assures necessary information is gathered in the specified timeframe. The researcher then able to obtain a deeper grasp of the experience of the respondents and discover essential factors pertinent to the subject matter owing to the rich qualitative data that has been gathered.

In interview protocol, it mainly consists of the routine elements related to interview session such as ethics during interview, professional interviewing skills, question formulation, and interview environment (Yeong et al, 2018). In order to conduct this qualitative research that equipped with semi-structured interview by

person, the interview protocol for this research is developed to collect interviewees' thoughts on blockchain implementation helps in logistics sustainability in terms of the advantages received, and challenges along with solution to address the particular challenges as well. By referring to Appendix 1, it is the interview protocol that developed to guarantee the interview session to carry out in a more smooth and effective manner.

3.6.2 Archival report and document

Being one of the qualitative data collection techniques, archival report and document is advantageous for researcher to access a larger scope of information by the utilization of Internet without limitations of geographical distance. Digital data, online archives as well as open data provided by governments or business are the secondary data sources that contributed to the research. Namely, the textual documents can be illustrated in few ways such as communication among individuals or within group through email or letters, booklet or documents published by the organization (reports, strategy statements, agendas and etc), media documents (online articles and data), government documents (publications, report, national statistics data sets) and more (Lee, 2012).

As the implementation of blockchain still in its infancy stage, there are few well-known logistics company have published article or documents that introduce to the public about the blockchain technology including its benefits, challenges, and drawbacks. Document allow researcher to explore more about what information is included and excluded in the organization, how and to whom the information was disseminated and even that facts that only scrutinized by partial people (Prior, 2007). In this study, it is the need to gather and analyze the archival report and document as blockchain implementation is still a new phenomenon towards community. However, archival report and document are not originally created for research purpose, Ward (2022) critics that researcher must be observant and sensitive to the original purpose

of the documents when obtaining and analyzing those data information. To address the concern, the combination of archival report and document with interviews is ideal in this research.

3.7 Research sampling

According to Easterby-Smith et al. (2018), research sampling is used to describe the process of empirical selection. The research sampling method utilized in this study is snowball sampling. Easterby-Smith et al. (2018) proposed that convenience sampling eases the selecting process which the scope of data or participants to be selected depends on the researcher's accessibility. Although convenience sampling is recognized as the most advantageous sampling strategy especially for exploratory research. Considering that blockchain is currently a relatively new phenomena in every industry including logistics industry, it is challenging in terms of the limited empirical population.

Self-selection sampling, a part of volunteer sampling is suitable in this research as the limited empirical population could distract the research sampling progress. Researcher will first reach and interview the management who works at any divisions of DHL company including the DHL IT Service, DHL Global Forwarding, DHL Express (M) Sdn Bhd and more. To connect with the potential respondents, researcher will make use of the automation tools such as LinkedIn, and email as well. Saunders et al. (2019) argued that self-sampling aids in verifying the desire or willingness of individuals to participate in the research. By requesting the interview session through LinkedIn, researcher first approaches to the individuals who fit the requirements as stated in Table 1. Researcher then able to collect and further analyse the data information that obtained from the ones who provide feedback and willing to have a interview session.

Interviewee's Criteria
• Works under DHL company or having great understanding about the innovative technologies in DHL company. • Have great understanding about blockchain implementation. • Manage to address the sustainable logistics practises in DHL. • Involved in logistics sector as well as logistics management. • Involved in blockchain development that in touch with external customers.

Table 3.1: Criteria of Interviewee

3.7.1 Sampling Size

It's been argued for a long time on how large a sample size should be sufficient to provide sufficient and accurate data collection in qualitative studies (Sebele-Mpofu, 2020). In order to facilitate the in-depth case-oriented analysis that is fundamental to qualitative research, researchers often choose very small sample sizes (Vaseilou et al., 2018). According to Lakens (2022), the aim of sampling is not always to choose a sample that is representative of the whole, but rather to select a sample with a large enough variety of topics to allow for effective saturation. To better justify the sample size in qualitative research, Fugard and Potts (2015) demonstrate how to take into account three factors. First, the number of codes that exist in the population (in this case, the number of reasons people implement blockchain in logistics), the probability a code can be observed in a single information source (e.g., the probability that someone who interviewed by researcher will mention each possible reason for having implementing blockchain technology for sustainable logistics), and the number of times researcher want to observe each code.

According to Malterud et al. (2016), sampling technique may help qualitative interview research by moving focus from participant count to the actual contribution of new information gained from the study. Knowledge power suggests that a smaller sample size is sufficient if it contains sufficient information about the population of interest. Denicolo et al. (2016) revealed that it's not about the researcher's assumptions

about how other people live their lives, yet it's about the everyday people and how they see and make sense of the world around them. Consequently, adaptability was crucial all through the study process, and findings were often based on very small samples of 3-5 participants (Ohman, 2005). Particularly, Creswell (2002) recommends include between three and five people in a case study. There is a past research related to blockchain carried out by Baharmand et al. (2021) proven the successful of research even the only small sample size for interview had been conducted as the researchers only manage to approach to a limited number of blockchain experts.

3.8 Data Analysis Method

To better comprehend a phenomenon, qualitative researchers use data analysis, which is described as the methodical search and arrangement of interview transcripts, observation notes, and other non-textual resources. A straightforward yet precise data that generated through appropriate data analysis method will then eases the data interpretation for researcher. In this case, content analysis is selected as this data analysis method able to evaluate pattern across multiple sources of communication or content. As stated previously, interviews along with archival report and documents are the sources of data collection in this research, content analysis is useful to analysis the information obtained. Researcher can first calculate the frequency of a particular concept or idea being mentioned during the interview as well as in the documents. For instance, researcher can identify the times being mentioned by the interviewees regarding blockchain's transparency that helps in logistics sustainability.

Not to forgot, coding and categorising data is also a part of content analysis. It is essential for researcher to start the data analysis process with such a precise question and purpose in mind, or the researcher will get disoriented in the haze of the process. In content analysis, transcription of interview conversation takes place after the data collection through interview session. From the transcription of interview, vast volumes of text are broken down into codes, which are then summed up into categories which

are blockchain, logistics sustainability, benefits, and challenges. Based on the frame of reference, each of these issues has notions that were judged significant. Coding, as defined by Bhattacherjee (2012), is the act of classifying enormous volumes of data into a set of codes in order to acquire the most useful information. Coding was used to organise data and identify patterns and relationships between the frame of reference and empirical facts (Bhattacherjee, 2012).

Furthermore, subtopics and codes for the interpreting step were assembled during the reassembling stage. Before translating process started, researcher has the initiatives to double-checked that all codes were relevant by referring to the proposed framework. Kovács & Spens (2005) stated that the empirical data were then studied via the proposed framework in order to extend the present theory and acquire fresh insight into the issue. During the study process, four obstacles emerged from empirical data that case firms confront while certifying environmental, economic and social standards, which are examined and linked to blockchain theory. We switched back and forth between phases as needed during the study (Yin, 2018).

3.9 Ethics

The standards of behaviour that govern researcher to act when conducting research is called research ethics. Easterby-Smith et al. (2018) stated there was a need to establish a consistent set of ethical norms for research to be carried out since there were two researchers participating in the study. In order to conform to research ethics and discourage plagiarism, significant attention has been paid to acknowledging work and citing sources.

In this qualitative research, ethics can be further illustrated through the interview process. Privacy is the priority when researcher has the intention to create an interview with ethical behaviour. Privacy can be illustrated in few manners such as the efforts of researcher to provide informed consent towards participants who taking part in interview, ensure data confidential as well as data maintenance, and

responsibility during data analysis, findings, and conclusion as well. Let's take responsibility during data analysis, findings as example. When analysing and reporting data, researcher has the obligation to ensure privacy, anonymity, and secrecy. Falsifying primary data or outcomes is unethical. Unexpected findings should be reported completely and truthfully. Secondary data sources such as documents should also be cited. Analyses and interpretations should be thoroughly verified and corrected to guarantee the correctness of the study report and any other conclusion in the scope of the research without first getting permission or breaching the consent supplied.

Additionally, research ethics is important to prove that participation is entirely voluntary, and there is a provision for dropping out at any time. It is impossible to dispute a person's right to refuse to take part in a research study. Participation does not have to be accompanied with fear of harassment. Attempting to broaden the scope of involvement beyond what is willingly offered is another thing that is not acceptable. Participants have the right to continue or to determine how they will take part in the data collection process. This includes the rights to not answer any question or set of questions, not provide any data that is requested, change the nature of their consent, withdraw from participation, and perhaps withdraw data that they have already given.

3.10 Data Validity and Reliability

In qualitative study, data validity means the adequacy of the tools employed, the precision of the results analysed as well as the generalisability of the research findings. Since semi-structured interviews are conducted in this research, it leads to a high validity level by the deliberate use of clarifying questions, probing meanings, and the exploration of feedback from numerous viewpoints. To ensure data validity, researcher must take initiatives in appropriateness of interviewer's demeanour, opening statements for interview sessions, questioning strategy, attentive listening skills, ability to sum up and evaluate understanding as well as capability to record the whole data in a precise manner.

In qualitative research, data reliability is referring to the ability to obtain a consistent finding through the data collection techniques and analytics procedure with none of the researcher's business. It is somehow a challenging aspect as there are few reliability threats cases such as participant error (factor affecting performance of participants), participant bias (factor that induces a false response by participants), researcher error (factor affecting researcher's interpretation), and researcher bias (factor that induced bias in researcher's recording). Although the above cases might be unavoidable, it is a must for researcher to provide a report with totally high transparency regarding the research process, method, so that other researchers manage to judge for themselves and able to replicate the study for further investigation.

3.11 Time Horizon

Time horizon, a fixed period of time that utilized to conduct the research. Generally, there is two types of time horizon research such as longitudinal and cross-sectional. Longitudinal study is mainly to investigate the changes and development of the particular topic which it is conducted by interviewing the same sample of people over time repeatedly due to its longitudinal nature. Cross-sectional study is the study of a particular topic or phenomenon at a fixed time period which a fresh new sample of people is studied when conducting the research and no repetition of study is allowed.

Instead of longitudinal, cross-sectional time horizon is fixed when conducting this research. A cross-sectional study is appropriate for the research subject of blockchain implementation toward logistics sustainability because the case study method that equipped with interviews requires only a short time period to enable researcher to explain the implementation of blockchain that empowers sustainable logistics.

No.	Activity	Week															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Registration and Selection for Supervisor																
2	Discussion and Finalization for Research Topic																
3	Drafting for Chapter 1																
4	Submission to supervisor																
5	Correction for Chapter 1																
6	Drafting for Chapter 2																
7	Corrections based on comments from supervisor																
8	Drafting for Chapter 3																
9	Submission to supervisor for the research proposal																
10	Correction and Submission of final draft for supervisor's view																
11	Proposal Presentation and Proposal Defence																

Table 3.2: *Gantt Chart for PSM 1*

No.	Activity	Week															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Data Collection and Data Analysis																
2	Drafting for Chapter 4																
3	Submission to supervisor																
4	Correction for Chapter 4																
5	Drafting for Chapter 5																
6	Submission to supervisor																
7	Corrections for Chapter 5																
8	Submission to supervisor for the final check of the research project																
9	Formatting and Correction for the research project after receiving comment from supervisor																
10	Final Year Project Presentation and Defence																

Table 3.3: *Gantt Chart for PSM 2*

3.12 Summary

This chapter consists of the methodology used in this research. This chapter reviewed on the research philosophy which constructivism framework that underpinned with interpretivism philosophy along with assumption of ontological and epistemological is utilized in this research. The chapter further explain about qualitative research design, abductive research approach as well as case study strategies that used to conduct this research. To have a defined direction when conducting research, data collection technique such as interviews, archival report and document are selected as the sources of information. Self-sampling strategy in this research can be illustrated through self-selection sampling. For data analysis method, content analysis is equipped for better analysis and arrangement of the interview transcripts and documents. Lastly but not least, the chapter also mentioned about the ethics, data validity and reliability, and time horizon as well that research should pay attention when conducting the research.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

In this chapter, it depicts the findings and discussion of the research on the implementation of blockchain that empowers logistics sustainability through a case study of the DHL Company. The data was mainly acquired through in-depth interviews with DHL employees as well as the Chief Executive Officer of the Canadian Blockchain Supply Chain Association, both of whom have extensive experiences in the blockchain field and sustainable logistics. Archival documents published by DHL through its official website functions as an alternate data source for the research collection. Before the results that obtained through interview will be portraying the three research objectives that were highlighted in Chapter One, the justification of the selection of case study is provided in section 4.1. Additionally, the framework proposed in Chapter Two will be further discussed in this chapter. All in all, along with the archival documents, data collected via qualitative method which several interview sessions were carried out with DHL employees and blockchain expert who fulfil the requirements of this research are interpreted.

4.2 Case Study Background

The case study was carried out utilizing qualitative method and archival documents. In-depth interviews were conducted using qualitative method with 4 interviewees, three of whom are employed in DHL and one of whom is a blockchain expert with 25-years of experiences and knowledge about blockchain and sustainable logistics. Of all the interviewees, the job titles for the three DHL employees are junior associate, associate project analyst, and project manager, while the other interviewee is the chief executive officer (CEO) of Canadian Blockchain Supply Chain Association (CBSCA). In addition, archival documents pertaining to blockchain technology and sustainable logistics can be accessed on DHL's official website, and DHL's LinkedIn page as well. Blockchain experts from DHL's Blockchain of Excellence have been sharing their thoughts on LinkedIn to encourage the community to comprehend and invest in blockchain technology. Thus, DHL was chosen as the case study for this research.

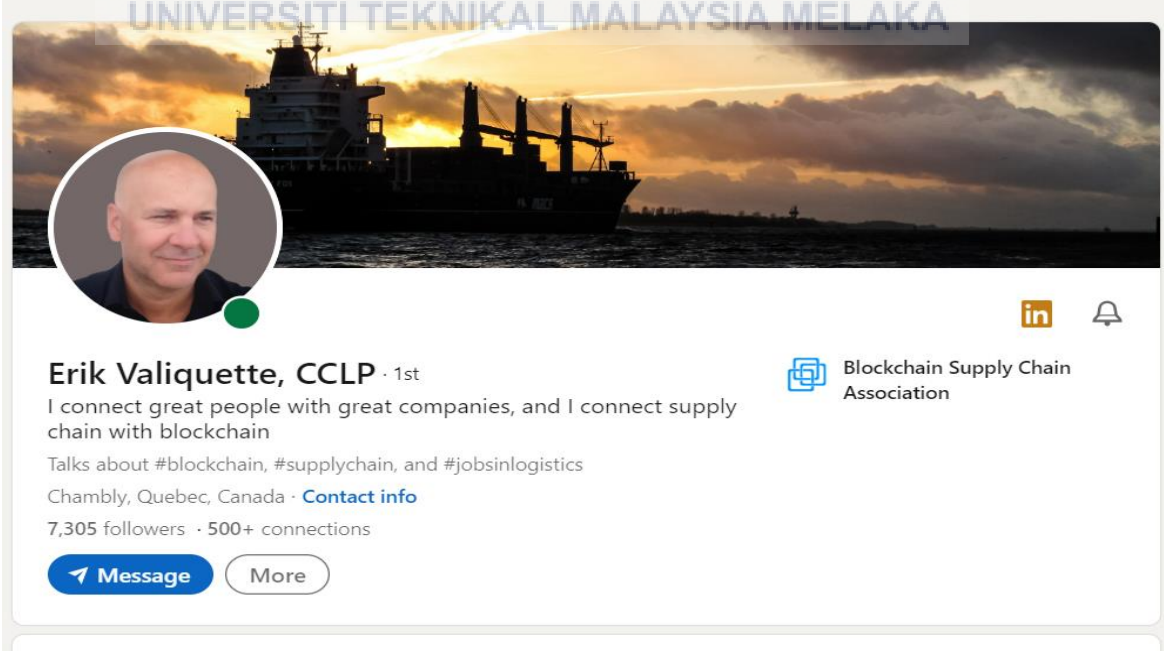
4.2.1 Respondent details

The respondents that being selected for interview session were equipped with the knowledge of blockchain application and sustainable logistics. Respondents' details are shown in Table 4.1.

Respondent	Designation	Interview Method
Junior Associate	DHL	Google Meet
Associate Project Analyst	DHL IT Services	Google Meet
Project Manager	DHL Express (M) Sdn Bhd	Google Meet
Chief Executive Officer	Canadian Blockchain Supply Chain Association (CBSCA)	Webex

Table 4.1: Summarized by the researcher (2022)

Figure 4.1: *Online Interview with the Interviewee*



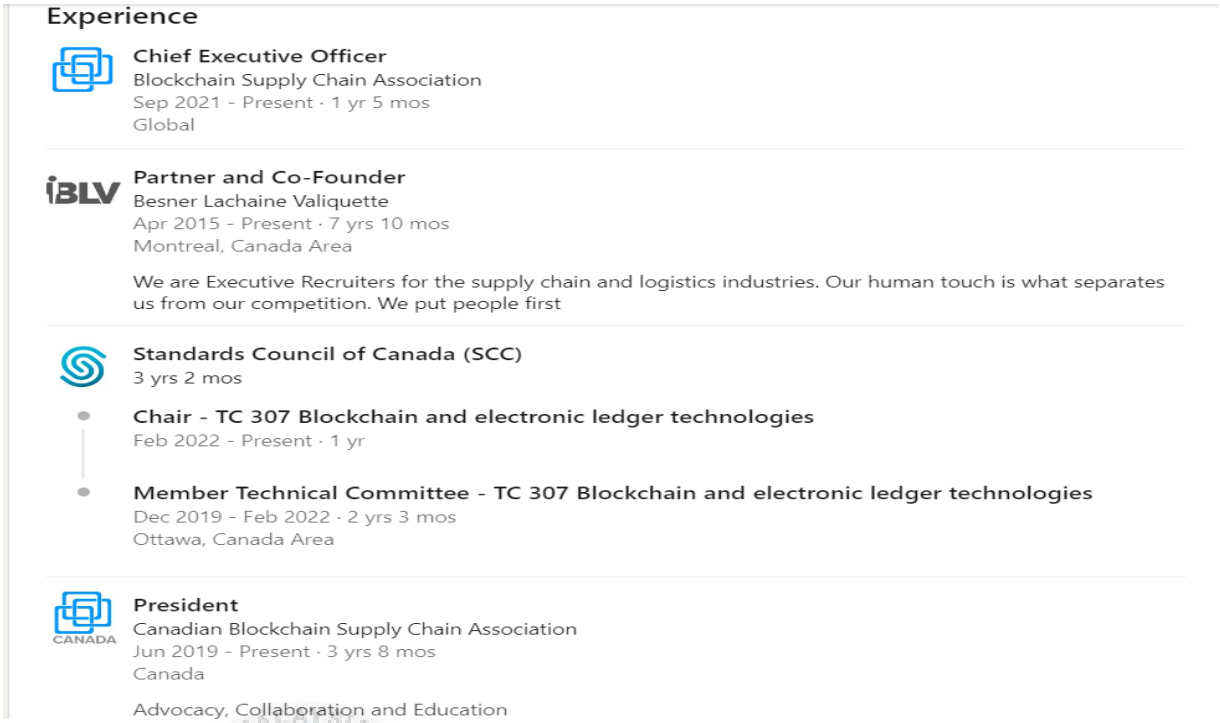


Figure 4.2: *The Profile of The Chief Executive Officer of Canadian Blockchain Supply Chain Association (CBSCA)*

4.3 Propose blockchain implementation to enhance the sustainability of logistics operation in DHL

The initial objective of this research is to propose the blockchain implementation to enhance the sustainability of logistics operation particularly in DHL, a logistics service provider company. In this section, it first discussed about the general explanation about the functions, and current issues of blockchain, as well as sustainability in logistics that understand by the logistics experts including DHL employees and the CEO of the CBSCA. This section also further explored about the implementation of blockchain that applied in DHL company and how does the blockchain linked to the logistics sustainability.

4.3.1 Blockchain

In logistics field, it is typical for a network or numerous logistics partners that operate for the same goal to be connected to one other when performing satisfied supply chain and logistics delivery for their end customers. When it comes to the distribution of logistics, collaboration is always present. Collaboration with partners was carried out manually and offline, which paperwork or physical documentation are required for transferring goods, logging each transaction, bookkeeping, and more. Consequently, the complexity due to the involvement of multiple partners within the collaboration has resulted to the issue of redundancy and mistake. The issue can only be solved when the entire network of logistics partners working together with the same or real-time data sharing to create transparency. Thus, to tackle the issues mentioned, blockchain technology have been implemented in DHL company as they realize the importance of blockchain technology that cater their logistics digitalization.

"So, for today we can see most collaboration is connected manually and offline. So, next we use paperwork to transfer shipments, to record, bookkeeping this or that. That is often leads to redundancy and mistake. Only is possible, if all parties work together by sharing the same data as well to create transparency. Therefore, we find blockchain technology or blockchain initiative to tackle is problem. So, as time goes by, now we can directly have our business with our customers either business or private artists without any vision from other 3rd parties. So, blockchain technology make our operation efficient and safer without any mistake."

(Junior Associate, DHL)

From a bigger picture of logistics industry, the network of logistics industry is incredibly huge in this globalized era. Goods and shipments are transporting from one place to one place without limitation of the geographical distance. According to the chief executive officer (CEO) of the CBSCA, hundreds of components that originate from different regions of the world, all of which are transported using carbon-based shipping methods before being assembled, transported as a finished good across the

globe into large warehouses, and then shipped again by truck before possibly reaching the consumer. The emission of carbon is often the environment issue that concerned by the community especially the logistics service provider companies when transporting shipments all around the world. Hence, there is no better technology than blockchain for calculating the environmental effect and quantifying the carbon consumption of all these trade partners. With blockchain, it eases the business companies as well as their partners to keep tabs on data shared.

"These are hundreds of different parts that come from all over the world shipped using carbon to ship those then assembled then transported as a finished good across the world into big warehouses then shipped again by truck then finally maybe getting to the consumer. So, the environmental impact and measuring the carbon use of all these trading partners is well where blockchain can play an important part because there's no tool that makes it easier than blockchain. Blockchain makes it a bit easier to track information across several business partners."

(Chief Executive Officer, Canadian Blockchain Supply Chain Association)

4.3.2 Logistics Sustainability

Logistics sustainability has been the topic of discussion at DHL as well as the entire logistics field in recent years. Nonetheless, there is an issue which the older generation doesn't know about sustainability. They are clueless and not paying attention to sustainability topics including logistics sustainability. People in the pre-industrial age had no notion on the measurement for sustainability. Consumers in today's worldwide economy are getting observant and more aware of climate change and other environmental issues that occurred during the logistics process or shipments. They are becoming more concerned with sustainability-related issues such as logistics sustainability, as they realized that sustainability guarantees a brighter and cleaner future for the community as well as the upcoming generation. Consumers nowadays are concerned about how the logistics services affecting the sustainability pillars such

as environment pillar. Thus, logistics sustainability is ultimately tied to the visibility, awareness, and comprehension of individual impacts to the environment.

"The industry has not been talking about sustainability for a very long. We as an industry, we are starting to talk about it because the consumers are more educated and want to know more about the impact on the environment of logistics process of our products in general right? So, it's about visibility and it's about understanding our individual impacts."

(Chief Executive Officer, Canadian Blockchain Supply Chain Association)

In the perspective of logistics service provider, logistics sustainability is evaluated through the efficiency of the logistics service in maintaining the sustainability pillars such as environmental, economic, social or governance. With an eye on maintaining a healthier environment, economic situation, as well as a social community, DHL has done a significant effort to provide its customers a satisfying logistics service performance. Besides lean logistics that most logistics service providers are familiar with, there is a green program, 'GoGreen 2050' that been implemented in DHL to achieve the goal of sustainability. By 2050, the goal of the 'GoGreen 2050' initiative is to minimize the carbon emission to net zero emission through their logistics service.

"In DHL, we have the lean logistics. We have green logistics portfolio known as 'GoGreen' mission 2050, it is part of own CSR. We aim to generating values for business and society with this GoGreen program. So, for the mission 2050, DHL wanted to reduce logistics related emission to zero carbon by 2050. That is the main goals."

(Junior Associate, DHL)

During the interview with DHL project manager, he explained the goal and initiatives achieved through the 'GoGreen 2050' program in a deeper way. For

instance, by 2025, DHL hopes to have boosted carbon efficiency by 50% compared to 2007 levels, plan to enhance its first and last mile services that eliminates noise and air pollution. At the same time, this green portfolio also aims to facilitate the quality of its delivery performance and customer satisfaction by running 70% of its pickup and delivery services using clean solutions. On a business level, DHL's goal is become unrivalled in the green logistics industry. Despite the fact that the 'GoGreen 2050' program still has about three years left to run, it has already accomplished a great deal, including the optimization of transportation routing using electric vehicles, the installation of an environmentally friendly climate control system, and the installation of smart lighting in our logistics centres. The same example was provided by the associate project analyst. *"To make up this project to a success path, the innovation team in America have been making a great effort, so they invest for zero emission technologies and fuels like the electric vehicles, biogas, and the so call Bio-LNG and more."* This underlined that electric vehicles and biogas (Bio-LNG) are few examples of zero emission technologies and fuels that invented to make success of the 'GoGreen 2050' program. Hence, "GoGreen 2050" initiative is contributing to maintain a superior logistics industry or performance, allowing DHL to realise one of its purposes of bringing people together and enhancing their quality of life.

"For example, one of our goals for this GoGreen program is to improve carbon efficiency by 50% over 2007 levels by 2025, we want to increase first and last mile services which helps in reducing the noise and air pollutants as well as to enhance the quality of our delivery performance and customer satisfaction, we aim to operate 70% of our own pickup and delivery services with clean solutions. Economically, we wish to lead in the market of green logistics. Although there is about 3 years to go since now, but GoGreen program has a lot of achievement like optimized transportation routing electric vehicles, eco-friendly climate control system and intelligent lighting in our logistics centers."

(Project Manager, DHL)

4.3.3 Blockchain application in DHL

Being one of the top leaders in logistics service providers industry, DHL has illustrated their efforts in implementing blockchain technology for a better, innovative management and delivery performance. According to the interviewees, all the information is summarized as below.

Data Transparency and Traceability

When it comes to logistics, CBSCA argued that blockchain is a layer of technology or a shared ledger that having TCP or IP as the protocol. In a logistics process, the shared ledger encompasses the sharing of documents such as purchase order, sales order, waybill, customs, inventory, and payment (CBSCA, 2019). By utilizing blockchain that consists of a series of informational blocks that are linked to one another by the technology, as well as by the consensus, the transaction can be recorded in a tamper-proof manner. If ones have a timestamp, and there is an audit trail between all of the blocks, it is providing the data transparency and auditability for every participant in the blockchain system. Therefore, the information that is shared has the transparency that is provided by the blockchain mechanism, which is the chain of blocks, and the participants tend to have the auditability that they require so that they are able to track any changes that are made to the information as it moves through a supply chain or a logistics process. This demonstrates the flexibility of blockchain technology, since it allows for the instantaneous exchange of any kind of data at any point in the logistics and supply chain as well.

"Like I mentioned earlier, it's a chain of blocks of information all attached to one another by again the technology by the consensus. So, you have timestamp, you have an audit trail between all the blocks, and that again can share you use the right word transparency and auditability. So, by sharing information, it has the transparency by the blockchain mechanism the chain of blocks, we have the

auditability because we have a trace of the changes to the information as it progresses through a logistics process or a supply chain."

(Chief Executive Officer, Canadian Blockchain Supply Chain Association)

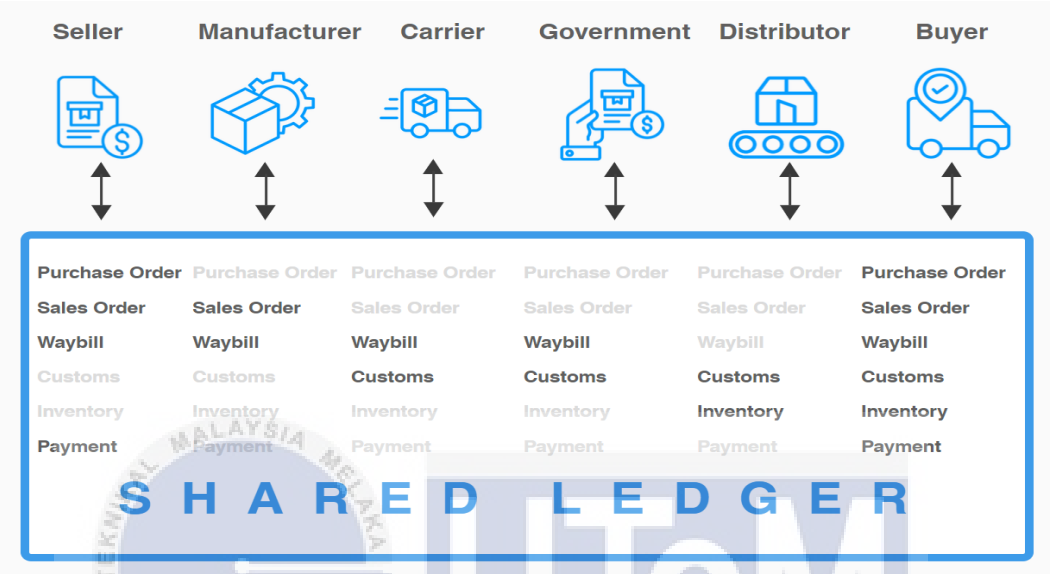


Figure 4.3: *The documents involved in the logistics process. Sources: BSCA (2019).*

On the other hand, the Logistics Trend Radar published by DHL has recognized blockchain technology as the digital backbone that contributing to transparency and resilience, customers experience, automation and efficiency. According to Junior Associate who worked in DHL, blockchain technology is being utilized for data transparency and traceability. In terms of transparency, blockchain is implemented in DHL to aid in the flow of information which contributes to a better planning and managing of the supply chain, especially towards the manufacturing as well as the distribution departments. Aside from that, blockchain makes the cargo more efficient, which is important considering that DHL's goal is to deliver the right items to the right location at the right time. The entire process become more efficient as a result of digitalization, which is in keeping with DHL's slogan, "excellence and simply delivered." In terms of traceability, DHL uses blockchain technology to analysis the commodities' origin and movements. It is used to continuously tracking the materials at every moment of the value chain. Also, there are the systems, NPTS and SHERLOC

that being developed by using the blockchain in DHL that aims for a better tracking ability that allows DHL to do business with others even private artists with existence of 3rd parties. Thus, blockchain that developed by DHL is believed to be serve as a digitising token for clients to use while tracking their shipments.

"One of it is transparency, where the flow of information to support the supply chain planning and controlling. For instance, the production and distribution. Besides, it eases the efficiency of the shipment where DHL's mission is getting the right goods to the right place at the right time. So, through digitization, it may make it more efficient, and it goes to DHL's motto which is excellence and simply delivered. Other than transparency, it will be traceability. So, where DHL by using blockchain, it can reconstruct the origin and the movements of goods by keep on track of the materials at every stage in that value chain. We created some system that we applied in blockchain such as network proactive tracking system known as NPTS and another is shipment explorer indicators (SHERLOC). This element, DHL created, and it will be now as a digitization token for the customers to track the shipment."

(Junior Associate, DHL)

Project manager furthers elaborate that the high transparency in blockchain is boosting for a better logistics service performance. Companies nowadays facing the problem of limited product visibility particularly during the shipment of products. Along with the logged records, Blockchain is believed to offer the visibility as a trusted, immutable ledger that allow stakeholders to ensure the attributes of product such as the products' origin (The Logistics Trend Radar DHL, 2022). The feature of blockchain provide a straightforward view for the stakeholders to trace the information of the goods to be delivered, such as the origin of the goods, the materials of goods, the real time location of goods that already out for delivered, and more. In DHL, there is also confidential information such as the details of shipments like airways bills, tariff, decode term as well as the personal information of staffs and customers. By having, blockchain, it gives a high traceability for every stakeholder from the process of raw material procurement till the shipments to end customer.

"We use blockchain for data transparency in our logistics operation. We use the technology to record the confidential information such as shipments details and also customers' personal information. So, we have been using blockchain to offer stakeholders a clear view for the products information, trace on the origin of the products, and get some the real-time details of the shipments. Blockchain also increases data transparency and our logistics overall performance."

(Project Manager, DHL)

DHL sees that a blockchain-supported degree of transparency allows supply chain firms to verify supplier and distributor compliance with the hundreds of international trade rules and regulations (The Logistics Trend Radar DHL, 2022). Being a worldwide logistics service provider companies that doing business with hundreds partners from all over the world, blockchain is believed to increase trust amongst supply chain participants by serving as an immutable record of all transactional activity. By utilizing the blockchain technology that provide data transparency and traceability, it ensures each and every record or transaction is accurate, free from ambiguity, and derived from a source that cannot be contested. Every partner involved in the blockchain system now has managed access to a shared dataset, which together forms a single source of truth, as opposed to the previous situation, in which several parties were responsible for keeping up with the replication of their own datasets. Everyone who is dealing with this knowledge will now have absolute assurance as a result of this.

"It guarantees every single record or transaction are exact, alter clear, and from an irrefutable source. Rather than numerous parties keeping up with their own dataset duplication, every partner now gets controlled admittance to a common dataset that making a solitary wellspring of truth. This means a certainty is given to everybody who is working with this information."

(Associate Project Analyst, DHL)

Smart Contract

Smart Contract in blockchain is an algorithm that facilitates an automated procedure that contributes to an overall increase in the effectiveness of the supply chain. The digital papers and up-to-date information on shipments that are shared among users of the blockchain system are the essential component that will ensure the success of smart contracts. This indicates that it has the potential to minimise the amount of human interaction and dependence on third parties that is required to verify that the requirements of a contract have been satisfied. The interviewee furthers mentioned that blockchain has the ability to monitor who owns a title or a piece of merchandise. Therefore, smart contracts have the potential to assist in the process of transferring ownership of merchandise or titles. Consequently, this process is analogous to passing on some form of digital key from the previous owner to the current owner.

"So, the smart contract in blockchain is an automated process that helps in increasing the efficiency of the entire supply chain. The digitized documents and real-time shipment information which are shared within the blockchain system is the key to the success of smart contract. This means that it can reduce human intervention and reliance on third parties to verify that the terms of a contract have been met. So, like I mentioned before, blockchain can track the ownership of the title or goods, so smart contract can also help in transferring the ownership of the goods or titles. So, it is like transferring a kind of digital key from the existing owner to the new owner."

(Associate Project Analyst, DHL)

'Through process of blockchain, it helps to provide repetition of transaction as well as the process error, human error by verifying each transaction. Human error, like I say blockchain is also known as smart contract. This can foster the automation processes and reduce the potential human errors. It can further make it faster for many processes.'. In the highlight of smart contract by Junior Assistance, it can be understood that in addition to act as an automated process that reduce in human error,

smart contract also permits DHL staffs the ability to form a business relationship with other businesses or even with complete strangers. In The Logistics Trend Radar DHL (2022), blockchain-based smart contract enables companies to optimize business operation management by reducing the likelihood delays, shorten critical-path timeframe while raising transparency to an automated system in logistics network. When using this smart contract, there is no need to be concerned about any potential security issues. Because the programme is responsible for carrying out the whole procedure, even the developer who was responsible for writing the code, even he is unable to make any changes to it. Consequently, all of this brings us to the issue of safety when using this blockchain technology.

"Also, it provides the flexibility to make a business connection with other companies by using smart contract. Another good thing about blockchain is also the data security. Due to its nature, no one can easily change the data information easily without consent or authorization. So, this ensures that the security level of how we store confidential data."

(Project Manager, DHL)

Cryptocurrency Payments

Cryptocurrency payments, one of the functions that blockchain being implementation in DHL. Blockchain is playing the roles of payment which the digitalized technology is used to make money transfer to suppliers. When transferring money to suppliers, or making any payment towards business partners, efficiency is important to ensure the high effectiveness of the transaction. To have such effectiveness when using this digitalized system as well as documentation, DHL building team has exerted their efforts. According to Project Manager, there is a Bitcoin Wallet invested by DHL. *"At the same time, we also developed a Bitcoin wallet, called "YellowWallet" which only supports Bitcoin Lightning Network transactions and Bitcoin Core. So, this cryptocurrency payment is still under internal testing, and it is not publicly acknowledged yet."* This underlines that there is a developed Bitcoin

Wallet, YellowWallet which is a cryptocurrency payment method that only for the use of Bitcoin Core and Bitcoin Lightning Network transactions in DHL. Yet, this wallet is still under the internal testing of DHL employees and haven launched towards the public.

"*Finally, we have the payment part. So, where the transfer money to suppliers requires efficiency through blockchain and this is very digitalized when we have this kind of digitalized documentation which is conducted by DHL building team."*

(Junior Associate, DHL)

As compared to the payment method that the community are familiar with, such as credit cards, blockchain that being implemented for the use of cryptocurrency payments is more reliable and trustworthy. *"It is like an alternative digital payment method which is actually more reliable as compared to things like credit cards that we are using."* by Associate Project Analyst. Every transaction is being safely recorded and the transaction can only be approved if the conditions or the criteria of payments are met. This thereby illustrating the effectiveness and security level of blockchain while making any cryptocurrency payments. Similar to the PayPal and credit cards, the cryptocurrencies values such as Bitcoin and Ethereum are becoming more trustable and slowly replaced as the alternate payment manner. Thus, companies in the logistics and supply chain should think about taking bitcoin as a payment option as consumer demand for the digital currency looks to be on the rise and laws are expected to follow (The Logistics Trend Radar DHL, 2022).

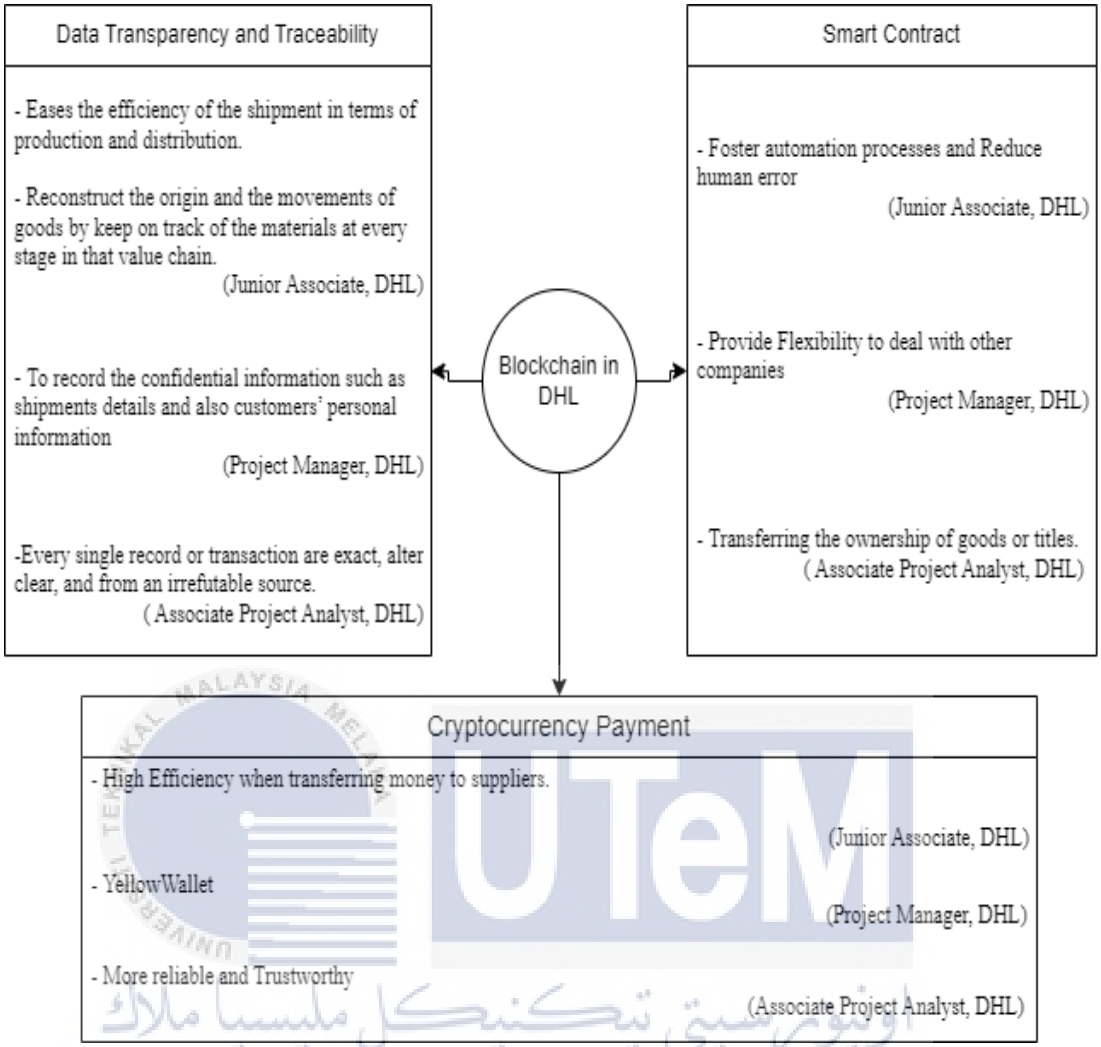


Figure 4.4: *Propose blockchain implementation to enhance the sustainability of logistics operation in DHL*

4.4 Examine if DHL, the logistics service provider company is aware of and understand the benefits that come with the implementation of blockchain in conjunction with the goals of contributing to logistics sustainability

In this section, it discusses about the advantages that reaped by DHL, a logistics service provider company when implementing blockchain technology in conjunction

to achieve logistics sustainability. The most benefit advantages that linked to sustainability pillar will also be further discussed along with the ways that taken by DHL in ensuring the continuous advantages to be reaped for the company as well as the employees itself.

4.4.1 Advantages of Blockchain linked to logistics sustainability

Increased Data Transparency and Traceability

Blockchain in Logistics (2018) by DHL revealed that blockchain is widely implemented in many projects to increase the transparency of supply chain and track the authenticity of goods. The similar perspective was provided by the DHL project manager. *"I think the advantage is like just now I mentioned, because with the blockchain, it has enhanced data transparency. People, we in company or anyone can access the database and its complete history."* This highlights that blockchain has contributed to the increased data transparency and traceability within the entire supply chain. As a logistics service provider, DHL inevitably connected with huge number of businesses network to achieve a single business goal. It is complicated if ones need to wait for other businesses' permissions to access their confidential data without the use of blockchain. By using blockchain, it allows any participants within the blockchain system to access the entire database freely, having accessibility for the entire, complete transaction history, which also means for the peer-to-peer transaction and interactions.

The implementation of blockchain technology is said to be improving the visibility and traceability of its supply chain due to its end-to-end transparency. Blockchain is believed to offering a single source of the truth by merging the data from all of the stakeholders, from its suppliers and carriers all the way up to its consumers. As a global top logistics service provider company, DHL has to deal with customers, suppliers, or business partners from all over the world. Hence, by using blockchain technology, all the data are converted or stored into a single, or one language that enables all of the stakeholders to understand the entire database. Blockchain

technology has the potential to improve DHL performance via the monitoring of the performance history of its carriers and suppliers, both of which have the ability to offer reliable information on the performance in the past.

"Blockchain implementation can enhance our supply chain transparency and traceability which means that it can provide end-to-end transparency. It is like blockchain provide single source of the truth by integrating the data from all the stakeholders such as suppliers, carriers until our customers into a single, or one language that all the stakeholders can understand. Blockchain can raise our performance by monitoring our performance history of carriers and suppliers which can further provide trustworthy information of the past performance."

(Junior Associate, DHL)

According to the associate project analyst of DHL, blockchain technology increase the possibility for data to be stored in permanently and the participants able to exchange or share their data freely. The digitalized technology provides participants in the supply chain with more extensive track-and-trace capabilities than ever before. The increase in data transparency and traceability is illustrated as the information in real time provided by blockchain further results in an improvement in efficiency. There is no longer a waiting period of one day or either longer waiting time as there was in the past. DHL and Accenture are working together to develop blockchain technology, all of the parties involved in the distribution of pharmaceuticals, including the suppliers, the warehouses, the deliverymen, and the customers, will be able to track real-time information and have proof that the products they are shipping are legitimate.

"Blockchain allows data to be permanent and easily shared, giving supply chain players more comprehensive track-and-trace capabilities than ever before. It increases the efficiencies by providing the real-time information. So, there is no such one day waiting time or longer waiting time like before. Like I say, the collaboration of DHL and Accenture, with blockchain, all the stakeholders like suppliers,

warehouses, deliveryman as well as the customers, they are able to track the real-time information to have the proof of legitimacy for products in pharmaceutical shipments."

(Associate Project Analyst, DHL)

Increase in Operation Efficiency

Accordance to the statement of the project manager, blockchain is believed to be bringing a better efficiency of operation for the stakeholders involved in the logistics industry, either DHL or other business partners. *"Also, another advantage is that with the blockchain, it increases our performance efficiency because it has a very clear view about our courier and deliveryman's performance."* With existence of blockchain, it allows stakeholders to experience the high efficiency in logistics performance or operations through the transparency provided by blockchain. The stakeholders are confidence and feel secure with the high efficiency of DHL's operation as the entire logistics process from the step of raw material procurement until the delivery of goods to the end customers are visible at all times. Thus, in the interviewee's personal opinion, blockchain that helps in enhancing the logistics efficiency are therefore increasing the DHL's reputation as every record or transaction can be traced easily and immediately.

By enhanced the operation efficiency, blockchain also helping the logistics providers including DHL company to boost its confidence and financial returns. It is hence believed that blockchain technology offering the stakeholders a variety of position features such as data transparency and traceability, smart contract, cryptocurrency payments, which are all related to secure transaction and data storing. As a result, the stakeholders are satisfied, confidence, trust and loyal towards DHL, which further enhance DHL's confidence as DHL are always providing high quality, high efficiency logistics service and thereby manage to continuously obtain high revenue in return.

"So, my personal experience with the blockchain implementation in logistics industry, it will help us as the logistics providers to boost our confidence and profitable

growth which generate positive impact to all of our stakeholders. So, this is the most important thing."

(Junior Associate, DHL)

In terms of environmental pillar, blockchain also contributes to the reduction of carbon emissions. In DHL which achieving net-zero emissions is one of the goals from its 'GoGreen 2050' program, blockchain is being implemented to assist in resolving the issues related to operational efficiency. Blockchain allows for the creation of a decentralised network is capable of more efficient energy production, storage, and distribution. As a result, technological progress is being made, and connected gadgets are becoming "smarter" in their ability to monitor and communicate data. By utilising this blockchain, those stakeholders will be able to follow the live data of the products, and the carrier or deliveryman will be able to arrange the quickest shipping routes to limit the amount of extra CO2 emission.

"So, by utilizing blockchain technology, stakeholders have the abilities to monitor the real-time data like the products' shipments and this enables carrier or deliveryman to optimize their transportation routes for maximum efficiency while we also cutting back harmful CO2 emission. So, this is an innovative approach, I believe that it is a sustainable on a global scale."

(Project Manager, DHL)

In the past, DHL had to rely only on paper documentation, which was a significant challenge for the company as well as their employees. By having rely on the paperwork, employees are facing the issues of paper wastage, damaged in paper that leads to low efficiency or accuracy of performance tracking, as well as time wastage due to the reorganisation of the paperwork itself. By using blockchain technology, which is digitized, it will be possible to significantly cut down on unnecessary waste while simultaneously boosting both efficiency and production.

"Because before this, we have to just using paperwork and we have a lot of problem in that. We have paper waste, and then we have time in waste because of the restructure of the paperwork itself, damaged paperwork so we can't track it clearly. So, through blockchain and digitalization, it will reduce a lot of waste and increase a lot of efficiency and productivity."

(Junior Associate, DHL)

Saving in Terms of Time and Cost

In traditional supply chain and logistics process, paper-based work is mainly taking place for the shipment documentations such as the airways bill, tariff and more. The sharing and transferring of documentation are time-consuming and may leads to the situation of human error, the needs of requiring third-party for verification of transaction and more. The interviewee mentioned that to reduce the transit time of document which means for a better efficiency of transaction, blockchain is playing the role to streamline the process. Every transaction or process are done through online and digitalized technology which no papers are needed which savings in time and cost for DHL logistics operation.

"So, unlike those traditional processes that involve a lot of paper-based work which are time-consuming, at the same time prone to human error, and often require third-party intervention, our company is using blockchain to streamline these processes, so that transaction can be completed faster and more efficiently."

(Associate Project Analyst, DHL)

The CEO of CBSCA also stand with the point that blockchain technology is giving the advantage in the sense of cutting down on time spent on mundane tasks by a substantial amount. Blockchain is helping the logistics company like DHL to save time and money in the logistics process by switching to digital information. In a logistical sense, if DHL operator from Canada wish to make shipments by sea

transportation to Malaysia, the operator must complete the necessary paperwork before loading the consignment onto the ship and sending it across the ocean. The bill of lading and other primary papers must be first sent to receiver by international DHL mail to allow the receiver to accept delivery of the merchandise. Consequently, there may be holdups if DHL misplaces the envelope. Even if the new, latest shipments documentation is immediately sent to the receiver, it's possible that there will be some holding up. So, it can be said that using paper documents is not only inefficient, but also costly and time-consuming.

"Three, it saves an incredible amount of time. So, in a logistics process, if I'm shipping something to you in Malaysia by boats, right? Again, I have to do my documentation, put the shipment on the vessel, it crosses the ocean. I actually have to send you a physical copy of the bill of lading, the principal documents in a DHL envelope overseas. So, you can receive those goods, right? So, if DHL loses the envelope, then there might be delays. If I provide you the wrong information in my original set of documents, I have to create a new one and send it to you again. So, that might create delays, right? So, relying on physical paperwork is very expensive, it's very time consuming and it's prone to delays. And using digital information instead, is another advantage where we can save some time, same sort of costs in the logistics process."

(Chief Executive Officer, Blockchain Supply Chain Association)

Economic pillar which is a part of logistics sustainability has also been emphasized in DHL while aiming for a sustainable logistics. The interviewee gave his opinion that blockchain is contributing to the economic sustainability as this decentralized technology helps in eliminating human error, shipment delays, issues related to paper wastage that eventually linked to time wastage as well. The interviewee further stated that in the perspective of both economic and environmental, the reduce in using paper has much contribute to money saving and environmental pollution. Also, sometimes any delays or mistraced of the data due to the ineffective paper usage might lead to the situation which DHL need to pay for the compensation to their customers, which is also a factor that related to the economic pillar.

"We can reduce a lot of cost because any human error, any delays, any problem in paperwork such as damaged of paperwork without blockchain, it might cost a lot for the company. It might cause a loss because we have to pay for the compensation for our customers. For economic plus environment, we can reduce paper, we don't have to buy the paper."

(Junior Associate, DHL)

Smart contract in blockchain has contributed to the economic sustainability pillar as well. In smart contract, all transaction is recorded on the basis of computer code making the entire information and its execution to be visible to every node. Stakeholders are managed to monitor, record, and verify the current state of the contract via the user interface. As a consequence, blockchain helps toward reduced delay or mistake in the operation of a supply chain, decreasing human error and, thereby, avoiding needless expenditures that related to the economic pillar.

"Smart contract is based on computer code, which minimizes the ambiguity of language and is presented through a tight logical structure. The entire content and its execution are transparent to all nodes, which can observe, record, and verify the contract status through the user interface. So, this contributes towards lesser delay or mistake in a supply chain process, thereby reducing human error which then avoid from unnecessary expenses."

(Associate Project Analyst, DHL)

High security for data protection

As a global logistics service provider company, DHL contains a lot of confidential data such as the shipments details, employees and customers' personal data. To guarantees the privacy and security of these data, blockchain is implemented in DHL to monitor the sharing of the data. It is not easy, or it is impossible for anyone to change the embedded data in blockchain system. To access that confidential

information which stored in blockchain technology, only the relevant participant with their secret code and employee's id can access that information. This ensures the encrypted data can be only accessed by particular participants and every record for accessing that embedded information can be tracked easily just with a click of mouse. The interviewee claimed that blockchain implementation guarantees the sharing of data in a safe manner. In DHL, every piece of data, particularly information pertaining to customers and employees, such as their picture identification or cargo details, is considered sensitive and essential. The manner in which crucial pieces of data are seen may be drastically altered by blockchain technology, as it generates records that cannot be altered and are encrypted from end-to-end. Blockchain technology contributes to the reduction of fraudulent and unlawful behaviour. Therefore, it is believed that the issues over privacy may also be handled on the blockchain by obliterating personal data and limiting access. Since data is not kept on a single server but rather distributed over the whole computer network, it is more difficult for malicious users to access the information without the secret code to entering the data system.

"And the third advantage is that I would say, blockchain technology ensures secure data exchange. So, in DHL, every data especially those customers and employee information like their photo id, shipment information, those are sensitive and critical. Blockchain can dramatically change the way when viewing critical information. So, by creating records that cannot be tampered with and are end-to-end encrypted, blockchain helps to prevent fraud and unauthorized activity. So, privacy concerns can also be addressed on the blockchain, including by ancientizing personal data and restricting access. From this, we cannot have any third parties to intervene our data. We can gain all the digitalized documents in a same characteristic achieved by the cryptographic. By this, blockchain can provide the exchange data and document."

(Associate Project Analyst, DHL)

In conjunction of providing transparency for stakeholders, blockchain that build up using cryptography principle contributes towards the data security. While using the blockchain technology, all the participant able to share or view the data

instantaneously. Everyone can access the real-time information including any actions or decision that made by one of the participants. This means that blockchain acts as a platform that allowing every participant to have a real-time information which establishing the trust among the participants. When there is someone making any decision at the moment, everyone in the can view the decision and provide any suggestion or just agree with the decision made. Thus, it is building the trust among the participants.

"It uses cryptography, so it is secure, right? There's a consensus algorithm. Always a difficult word even for me. And since we're all in, we're all sharing this ledger at the same time it builds trust because if I update something you see it instantaneously, right? You see it, so you would hopefully trust that I'm doing the right thing and if we're 50 people more than 50 have to agree to this information. So, it is a trust mechanism."

(Chief Executive Officer, Blockchain Supply Chain Association)

In the progress of delivering shipments, everyone involved in the shipping from the operators in warehouses, operators who pack customers' order, courier man or deliveryman who deliver the goods, they are the ones who engaged throughout the shipments. There might be the risk in miscommunication, misunderstanding or other unexpected situation that leads to delay in shipments. There might be also the attitude of staff who involved in the shipment to do something negatively towards the shipments such as stealing small portion of customers' order, and more. With the blockchain technology, it lessens the likelihood of theft, data theft, and forged data. In blockchain, it is impossible for anybody to erase any data, including the airways bill number and papers pertaining to the shipments, such as incoterms, tariffs, information, and many others.

"What I can understand is that through the shipments, they touch every process. With the blockchain technology, they can reduce any theft, data theft, data forge.

Meaning that someone cannot remove any kind of data such as the airways bill number, documents about the shipments like the incoterms, tariffs, details and more."

(Junior Associate, DHL)

Moreover, blockchain is linked to social pillar through the verification of the identifications or even the originality of the goods. In DHL, the company has collaborated with Accenture to fight for the counterfeit pharmaceutical goods. Product verification is made possible by blockchain's capacity to track and display data transparently. Therefore, it provides reassurance to the final consumer at the time of sale that the medical goods that they have purchased are authentic and in excellent condition. In a social perspective, blockchain is playing the role of verification either the performance or the personal data of ones, or the originality of the goods, which then provide consumers a sense of secure while making order or shipments with DHL.

"So, for social pillar, it is like blockchain helps in verifying the identification of the users or parties and it helps users to have better control on their data instead of worrying the leak of their confidential information. For example, our company has collaborated with Accenture to fight for the counterfeit pharmaceutical goods. The data transparency and traceability of blockchain allows product verification. So, it ensures the end customer at the point of purchase that their medicines are genuine and in perfect condition."

(Associate Project Analyst, DHL)

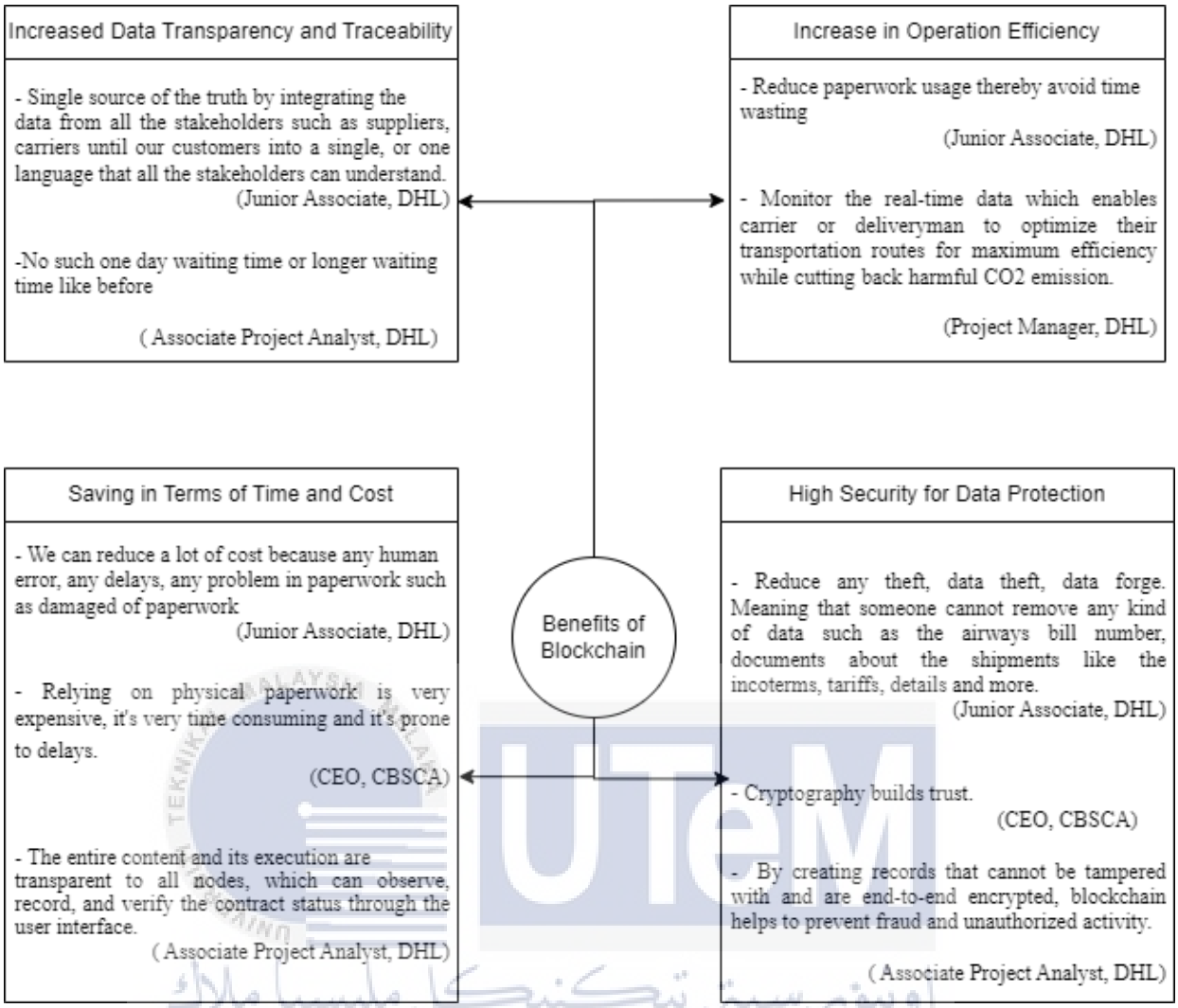


Figure 4.5 : *Examine if DHL, the logistics service provider company is aware of and understand the benefits that come with the implementation of blockchain in conjunction with the goals of contributing to logistics sustainability*

4.4.2 The most benefits pillar

Among the three sustainability pillars, economic pillar is believed to be the most positively impacted pillar through the blockchain implementation. The personal stand of the interviewee is that economic is the primary concern first comes before the environmental pillar. Others might think that reducing paper wastage, reducing paper printing are contributing to the environmental pillar the most, but the reduction in paper usages are eventually benefits towards economic pillar. It is common for

businesses to aim for the goal of cost reduction while gaining more revenue in return. This same goes for DHL, a global logistics service providers which is also a profitable company. Although all the sustainability pillars are linked to each other, but economic pillar is the utmost pillar, then followed by the environmental pillar and social pillar.

"We more focus on economic actually. Although we do touch about environmental like I mentioned like we reduce paper waste. We use blockchain to reduce printed paperwork. We are more to economic because we are profitable company, we want to reduce any cost and increase our profit. Through blockchain implementation, it is a huge impact in the economic pillar itself. But, in public we will support for the environmentally pillar; yet in reality we are more to economic pillar."

(Junior Associate, DHL)

The project manager of DHL also stands with the point that economic pillar is the things that comes first before other two sustainability pillars. The implementation of blockchain has greatly enhance the logistics performance, efficiency, as well as productivity. For example, blockchain is being utilized to reduce the carbon dioxide emission from the cargo shipments, reduce the paper usage which thereby reducing the human error. If there is any mistake or unexpected situation occurred such as delay or damaged paper, it may lead to compensation for its customers or its business partners. Hence, everything is connected to monetary matters. Money is required to make the corrections if anything works in the wrong or ineffective direction.

"I think the economic pillar should be the most important for company. It can help with the company or the society. Through the blockchain, we can reduce human mistake in operation, because everything is gone thru the blockchain right? It has also increased a better logistics performance, it also helps the global warming, it reduces reduce the emission of CO2 and also the paper usage. So, I believe that by implementing this blockchain, it is good in our company, our customers, and our logistic partners."

(Project Manager, DHL)

Economic sustainability pillar is further said to be the most important pillar while implementing blockchain technology. The interviewee indicates that with this digitalized technology, blockchain helps in increasing the investment capital for more cutting-edge technologies such as IoT and blockchain. By utilizing this advanced technology, it helped to optimize and automate the entire process of data transferring. "*So, by optimizing and automating some of their data processes, they can save money. By going digital, you can save money, then you can save time, and you can save money and you can save penalties maybe from customs by being digital instead of paper."* by CEO, CBSCA. Thus, this indicates that blockchain provides the stakeholders with the real-time information such as the delivery progress manage to save money from the reduction in paper usage as well as the human error. For example, operators who schedule for the shipments route able to fix the shortest delivery route more accurately. From this, blockchain is believed to be reduce in paper wastage, resources wastage, reduce in carbon emission which all will reduce in environmentally pollutants. When there are less environmentally issues existing, the money used for tackle environmental issues can be saved and therefore there is more money for investment in innovative technologies.

"When there is less wastage, less carbon emission, there will be less pollution towards the environment and hence less money used to invest for environmentally issues. The saved down cost can be used to invest for more innovative technology for further performance enhancement just like blockchain, IoT or even more. So, we can say that economic pillar is the one that is playing the most important role compared the other pillars."

(Associate Project Analyst, DHL)

4.4.3 Ways to ensure continuous advantages

The interviewees claimed that knowledge and awareness regarding blockchain and logistics sustainability to ensure the continuous advantages to be obtained from the blockchain implementation. By having knowledge regarding what exact

blockchain is, how does blockchain function, the advantages, challenges, and solution related to blockchain, it boosts the understanding and willingness of individuals, particularly the companies that provide logistical service to participate in the blockchain technology. When one's level of knowledge about blockchain is increased and have better understanding on the topic, his or she will invest and innovate for a better and more efficient blockchain technology. In the headquarter of DHL that located at Bonn, Germany, there is a blockchain centre of Excellence (BoE) formed that mainly to innovate the weakness of existing blockchain technology. The team of business and technology experts has created a blockchain solution, Baseline Eco-system System Service (BLESS). This solution is developed to enable interoperability with a variety of other blockchain protocol through its innovative architecture.

"I think that knowledge is the way to ensure the advantages to be continuously benefit me or the company. Because you know, knowledge increase the understanding as well as the willingness of people especially the logistics service company to involved in this blockchain implementation. When you equipped with the knowledge regarding blockchain, then you will know the good of blockchain, how to invest or utilize it wisely, and always innovate it, think of the ways to enhance it. Just like DHL, there is a Baseline Eco-system System Service (BLESS) that invented by the DHL's blockchain center of Excellence, it is a centre at the DHL's headquarter, Germany there. So, the BLESS is the solution that the DHL blockchain experts created to allow for interoperability with various Blockchain protocols through it's innovative design."

(Project Manager, DHL)

4.5 Investigate the challenges faced and efforts made by DHL to tackle the issues and challenges encountered when seeking to adopt blockchain in its system in conjunction to enhance its logistics sustainability

4.5.1 Challenges faced when implementing Blockchain

Lack of Knowledge and Awareness

When it comes to the realm of digitalization, the majority of people are knowledgeable and informed. Nevertheless, people don't really get to blockchain which means the majority of people lack a grasp of this digitalized technology. The same perspective is obtained by the associate project analyst. *"People or the generation nowadays are lacking curiosity. They might know what is blockchain, but they don't really know about how exact it works or what exactly it is, or how does the blockchain benefits their business. Instead of taking the risk, they would just remain the same, remain the current technologies that they are using now."* This implies that today's people, or more specifically the younger generation are lack of curiosity. They may be familiar with the term "blockchain," but they have no idea how the technology works, what it really is, or how it might help their company. As a result, they would simply keep doing what they have always done and stick with the technology that they are using at the moment. The lack of knowledge also connected to a significant limitation which limited quantity of experienced labourers to develop, build, and run this blockchain-based logistics system. According to the project manager: "*A lot of people don't what is it even people who working in logistics, unless they are working in IT."* This comes to the point that not many people know how to develop this blockchain, they just heard about it and don't know about what the true thing of blockchain is unless they haven been working on the information technology department, particularly related to the blockchain technology.

"First of all, knowledge and awareness. When it comes to digitization area, most of us know and aware, but we don't really get to it, most of us are lack of

understanding about blockchain. Also, there is potential limited availability of skilled workforce to design, implement, and operate this blockchain into logistics. Not many people know how to build this blockchain, they just heard about it, and they don't know about what the real thing of blockchain is."

(Junior Associate, DHL)

Based on the 'Blockchain in Logistics: DHL' (2018), the use of blockchain now resides at the infancy phase of the software maturity lifecycle and has yet to be implemented on a large scale. The CEO of CBSCA has illustrated the same opinion as the DHL's archival documents. Although cryptography as the principle of blockchain has been proven for years, but it is still in an early development stage to implement in the business field. Cryptography in blockchain has successfully proven to be addressing the issues of unauthorized access that lead to data privacy, sensitive data concern in smart packaging along with the real-time tracking (The Logistics Trend Radar, 2022). Thus, most of the businesses including some logistics service providers are just started noticed and discovered blockchain. However, the lack of understanding among the businesses are bring the challenges when implementing blockchain technology.

"Blockchain is still at very early stages in development within an enterprise setting. The actual technology is a bit proven for 10 years, 20 years, 30 years, right? Cryptography is a proven technology. But from a business perspective, we are only now starting to use it. So, understanding the technology is challenge number one."

(Chief Executive Officer, Blockchain Supply Chain Association)

Lack of resources or technical limitations

Blockchain is an innovative, digitalized technology that is inevitably required advanced technology as well as sufficient technical support or resources to ensures the effectiveness of blockchain technology. Although blockchain technology has been

able to accomplish a variety of goals, regardless of whether the chain in question is public or private, yet one of the most significant challenges that blockchain technology is now facing is figuring out how to bring DHL's offline assets online, or more specifically, how to map the actual assets that exist outside of the chain onto the chain. The Logistics Trend Radar (2022) has included that the technical limitations like the scalability and power consumption are the challenges that pulling community's attention on how to succeed in practicing sustainability and large scale-deployment. Thus, blockchain is said to be the basis for the digital economy of the future.

"*Because blockchain technology has achieved certain results, whether it is a public chain or a private chain. But, how to make our offline assets on the chain is an important challenge faced by blockchain technology, that is, how to map the real assets under the chain to the chain. This is also actually the foundation of the future digital economy."*

(Associate Project Analyst, DHL)

As a CEO of CBSCA who connecting people with blockchain in supply chain, the interviewee mentioned that the limited knowledge, limited resources, or limited financial assistance are often the challenges for small companies to start investing blockchain technology in their businesses. Unlike those big companies which have experienced programmers who able to program a blockchain solution, small companies are facing the issues for lacking experienced programmers who can smoothly run the blockchain technology.

"*Big companies have programmers that can program a blockchain solutions, but if you're a smaller company, you don't have the understanding, and you don't have the resources or the money to start programming a blockchain solution."*

(Chief Executive Officer, Blockchain Supply Chain Association)

"The primary reason for this is that we do not really have a large number of people who are familiar with developing this blockchain technology. This is due to the fact that it requires a large number of specialists, including those with backgrounds in computer sciences, statisticians, accounting, and other fields. The difficulty arises from the fact that we do not now possess it, and we are working to develop someone who will be able to reificate this thing. Because despite the fact that it is still quite lengthy, very few individuals choose to do it. The majority of people are familiar with basic coding concepts, but the development of this sort of technology is quite difficult, and thus, few people are interested in pursuing it.

"The main reason for that is we don't really have a lot of people who know about creating this blockchain technology, because it requires a lot of experts, not just for computer sciences background, statisticians, accounting, and more. The challenge is that we are lacking that and we trying to create someone who be able to reificate this thing. Because even though is still long, but not many people go for it. Most people just know how to do coding stuff, but to create this kind of technology is quite complicated, and not many people want to to go for it."

(Junior Associate, DHL)

High Investment Cost

Another challenge when implementing blockchain technology is the high investment cost. According to the interviewee, there is a number of efforts that one need to pay out before launching the blockchain technology in its business. For example, ones need to hire blockchain experts who able to program the blockchain system efficiently, need to invest in building up or utilizing the existing blockchain software system such as Ethereum, Hyperledger and more. Also, the maintenance cost for blockchain technology is not an easy thing. Ethereum is an example of public blockchain platform that functions similar to the smart contract, mainly used for making the transactions with the aids of consensus algorithm. For Hyperledger, it is a private blockchain platform that focuses on collaboration which various blockchain

framework are used to support global enterprise solution. Every value of technology or system will depreciate along with the years of using, the same for blockchain. As the time past, maintenance is necessary to ensure the efficiency of the blockchain so that when there are any bugs detected, the company can take necessary actions immediately.

"So, to develop or to utilize the blockchain technology, you need a blockchain expertise of course, also like you need some experts who really know about like Ethereum and Hyperledger, things like that. These are all blockchain terms. Ethereum is just like smart contract, while Hyperledger is for the purpose of collaboration. We also have maintenance cost in blockchain. The cost is quite expensive since not many people know that."

(Project Manager, DHL)

When bring up the topic of investments or risk management, most of the companies are more preferring to play their businesses in safe and continue doing whatever it is that they are doing at the moment. They do not want to make any investments in blockchain technology because of the current economic climate, which is marked by instability, inflation, and other factors. The interviewee's personal standpoint is that the financial load is the primary challenge among others as a huge amount of investment cost is unavoidable if the company wish to start constructing blockchain. Implementing blockchain is not a simple thing to accomplish, if ones wish to launch the blockchain technology, there is many things to spend for such as do a lot of study and a lot of "try an error. So, everything eventually involved money, which is said to be a financial challenge, high investment cost.

"When we talk about investment or risk management, most likely they choose to be safe, to do whatever they do right now. They don't want to invest in blockchain because right now we heard about our instability of economic, inflation and more. I can say that financial burden is the main cause because if you want to start making blockchain, you have to invest a lot of things, because blockchain is not an easy thing

to do, you have to do a lot of research and a lot of 'try an error' to implement this blockchain."

(Junior Associate, DHL)

Lack of Regulation and Governance

Although blockchain is counted as a digitalized technology that being invented since many years ago, but blockchain itself is still a 'fresh' innovative technology for community all over the world due to the lack of knowledge and awareness regarding blockchain. Not to mentioned Japan, China which are few examples of countries that widely utilize blockchain, United States as one of the countries that leading blockchain technology in global level is also lack of straightforward legal framework that acts to govern blockchain transaction. This situation is also applied in Malaysia. In Malaysia, seldom business transactions are done through the blockchain technology. For illustration, many knows about Bitcoin, which is one examples of blockchain. Yet, bitcoin is so far not under any governance of any countries except South country located at South America. This indicates that the lack of governance has restricted permissible range of blockchain from the point of view of the realm. Therefore, it is quite challenging to function as the reference for running and administering the blockchain technology.

"*Blockchain is already years to behind, but not many people, especially our government, any country, is not just Malaysia but in United States also they have lack of clear legal framework to govern this blockchain transaction. What we know right now is about bitcoin. Bitcoin is one big example of blockchain, but it is not under any control by any government in our world, except for south country in South America. In any blockchain transaction, it has limited acceptable from the universe perspective. So, it is really hard to act as the reference for operating and governing the blockchain solution."*

(Junior Associate, DHL)

Consequently, the lack of laws and governance that acts as a legal blockchain framework has increase the worries among the businessmen to implement blockchain in their businesses. In 'The Logistics Trend Radar" (2022), the unregulated cryptocurrencies have caused the increase in potential for fraud and low levels of trust which are the barrier to the acceptability of cryptocurrencies as a method of payment and as assets. For companies, implementing blockchain that lack of legal compliance and governance means they are taking the risk either in management or in financial. There aren't any guarantees or protection for the companies who utilizing blockchain in their businesses. They thus lack of confidence and feeling unprotect while using blockchain. According to the project manager, anonymity can say to be the factor linked to the lack of governance and laws. Anonymity is somehow giving the disadvantage when illegal activities such money laundering and asset theft were carried out though the blockchain features. Thus, rather than placing themselves in the risk of financial and management, they could play in the old, traditional yet secure manner of management.

"I think the downside of the anonymity is the difficulties to track the criminals by using the technology for illegal purposes. They can use like blockchain to carry out illegal activities such as money laundering, asset theft, stuff like that. The relevant identity information of criminals cannot be obtained through the address alone, so it results in criminals being undetectable at large, causing regulatory difficulties. Another thing is that this technology is still very new, so it lacks the laws and governance about blockchain makes many businessmen, investors to scare to invest into blockchain technology. "

(Project Manager, DHL)

4.5.2 Most burden challenge

Among the challenges that mentioned previously such as the lack of knowledge and awareness regarding blockchain, the high investment cost of blockchain, the lack of technical skills and resources, and the lack of laws and governance, researcher had further asked for the opinion of which challenge found the most burden and what kinds of burden that the challenge belongs to. Based on the findings obtained through the interview process, it comes out with the point that knowledge and the lack of knowledge and awareness regarding blockchain is the most burden challenge among others. It is linked to the economic sustainability pillar which means it is exactly a financial burden.

When there is insufficient blockchain related understandings, knowledge, and awareness, it means everything need to start form the bottom. According to associate project analyst, ones need to first equip himself with necessary, sufficient blockchain related information, hire expertise, invest in multiple research projects and developing few blockchain software to implement or launch the blockchain technology effectively. "*Like I said, the lack of knowledge and awareness requires high investment cost to build the software, hire expertise, invest for multiple research projects and more."* It is insufficient or ineffective if ones just search on the Internet or through reading books, because everyone can obtain the general information from the Internet easily. So, when everyone is accessing the similar information regarding blockchain, the outcome of the learning is similar as well. In addition, the information sourced from the Internet doesn't means everything, it might be some mistakes shared by the uploader or the information is not applicable for all solutions. The CEO of CBSCA mentioned that everyone can use EDI, API, or even Excel spreadsheets for their operation when they are lack of knowledge on blockchain. When they are fulfil with he blockchain-related knowledge, they are getting better to know about which solution suit them the best based on the solution faced.

"*When you hear blockchain, what do most people think about? Bitcoin, right? Cryptocurrencies. But that's not the case. So, understanding how the technology works, understanding that for some solutions, it's the right solution but not for every solution.*

You can still use EDI, you can still use API, you can still use Excel spreadsheets for certain solutions. So, understanding the technology, I think is the biggest barrier that we have right now."

(Chief Executive Officer, Blockchain Supply Chain Association)

So, one of the best ways to enhance the knowledge and understanding is through the hirings, communication or interview with experts who really have extensive experience in the blockchain field. The same statement was stated by the project manager: *"Yes, of course, there will be costly because the market is still new and there are not many experts in this field."* Due to the relatively new development on Blockchain which means the lack of blockchain experts and market adoption, it can be said that everything involved money. Without sufficient money, everything will be hard to achieve, and this is connected to the economic or financial pillar. From the perspective of the Junior Associate, knowledge and awareness is ranked as the second challenge after the financial risk. The top management in DHL belongs to the categories of baby boomers who willing to take risk in making investments, but it is a problem when not everyone of the top management understand about blockchain technology. The ones who understand about blockchain are mostly the ones who worked under the data management, and the other like deliveryman who focusing on shipping the goods on time doesn't know about blockchain. Thus, it is a situation that leads to the lack of knowledge and awareness among the DHL company.

"The second challenge for DHL is most likely is the knowledge and awareness. DHL mostly are not the young generation here. Even the top management are baby boomers. But they still taking risk for that. So, not all employees in DHL can understand blockchain. Only the ones who work with data management like me, I work for 2 years, and I understand about it, blockchain. But, for the deliveryman, I don't think they know about that. Only who works with data know about it, whoever didn't work with data don't care about it."

(Junior Associate, DHL)

4.5.3 Solutions taken to overcome the challenges

In order to tackle the challenges mentioned above, there are some solutions taken by DHL to have a better application of blockchain while aiming for logistics sustainability. This section will further elaborate on the solution that applicable and effective the most among others.

Collaboration

In DHL, collaboration means to develop its cooperation with data professionals and large firms that have created and extensively deployed blockchain technology. By having collaboration, the company is potential to improve the effectiveness and productivity of the supply chain and logistics, as well as bring blockchain to the attention of a greater number of people and help them have a better understanding of how blockchain governance works. In this particular instance, DHL has been working along with a number of other large multinational corporations, including BMW, Accenture, CISCO, and a few more. DHL and Accenture are collaborating on the development of a blockchain-based serialisation project that will provide track-and-trace capabilities, with a specific focus on the pharmaceutical business. Therefore, in this instance, it is as if the serialisation process is the "naming" or the act of bestowing upon each pharmaceutical product its very own one-of-a-kind identity, such as the place of origin of the product, the raw materials used in the production of the product, the date of expiration, the batch number, and a variety of other details. Therefore, the serialisation process makes it possible for or assists all of the relevant parties in carrying out the product verification. Customers at the end of the supply chain will be protected from damage and guaranteed their right to get authentic pharmaceutical items thanks to this initiative.

"Strengthen cooperation with data experts or big companies that developed and widely used blockchain technology is the key point for collaboration. In this case, DHL has been collaborating with few big mnc company such as BMW, Accenture,

CISCO and more. DHL works with Accenture to create a blockchain-based serialization project that offers track-and-trace features particularly for the pharmaceutical industry. So, in this case, it is like the serialization process is the 'naming' or giving each pharmaceutical products with their own unique identity such as the origin of the product, the raw materials used to make up the products, the expiration date, the batch number and more."

(Associate Project Analyst, DHL)

From a perspective of blockchain expert, collaboration helps in fasten the progress of achieving a goal. In logistics field, the term 'cooperation' which is the combination of collaboration and competition, is one of the methods that brings multiple businesses with different functionalities to works together. Even the businesses might be each other's competitors, but when both the businesses are working for the common goal, it is known as a healthy competition that boost for a better performance and more efficient service for the end consumers. When there is a common goal to work on, everyone will be motivated to put in all their efforts for a benefit of all.

"And of course, continuing to work together on different problems even from a technology perspective or a business perspective is very important. I mean if we're working together towards common goals, instead of always competing against each other. Then we can make progress faster, right? A lot of people used to use the word coo-petition, collaboration competition but in a competitive environment which is business, right? We're here to compete after all but we need to collaborate towards a common goal to move those goals forward."

(Chief Executive Officer, Blockchain Supply Chain Association)

Education

With the progress of the times, society pays more and more attention to education, and education is very important for a country. Education, the sources of knowledge. Education protects both a person's economy and his ability to live his own life. It allows to set a standard of living. The quality of education is directly related to the future development of the country, is an indispensable condition for the prosperity of a country, and strengthening school education, social education, and family education is indispensable for a person's future development. In this case, when education for blockchain has been greatly provided for community, it is believed that it will enhance the understanding of blockchain among community. The community will start to realize the functionalities, advantages of blockchain and invest it.

"So, I think by having a strong foundation, the knowledge and awareness regarding blockchain will definitely bring those organization especially logistics service providers companies to a new digitized world. As they manage to discover the real blockchain, identify and realize the value of new operating models, I can say that they will definitely invest blockchain into their business."

(Associate Project Analyst, DHL)

Education doesn't mean to be the initiative offered by the government such as blockchain related courses in public universities or private universities. There is blockchain supply chain association built up for the purposes of providing more information, offering more studies about blockchain. The interviewee claimed that BSCA has promoted several education services such as courses, webinars, workshops, and webpage that shared their current news or information to the public easily. BSCA has provided the viewers or whoever interested in blockchain technology to get more deeper into the digitalized technology not from the coding perspective but from the business perspective.

"So, from an education standpoint, again you know this is what we do at the association. We do a lot of education, we do webinars, and workshops. We've built a course for logistics professionals to understand the business implication of blockchain technology. So, learning about the technology, learning it from a business perspective and not a coding perspective is one of the steps that we take."

(Chief Executive Officer, Blockchain Supply Chain Association)

Standards

When dealing with the lack of laws and governance, setting standard is the solution used to tackle the challenge. Standard is a standardized framework that acts as a guideline for every business to follow so that everything is legal and recognized by the government and community. For example, Food and Drug Administration (FDA) is applied in USA, the International Standards Organization (ISO) that being widely used all over the world. So, by having a standard that agree and recognized by the entire countries or even entire world, give confidence to consumers about the legality and quality. In the case of blockchain which lack of laws and governance, standards should be set up and follow by the community. There is also the issue of various countries using various standards and some might even not use any standard. So, by having a clear standard to follow, everyone able to work in the same and legal manner which everything is done based on the standards provided.

"In the USA, it might be FDA, Food and Drug Administration, people who regulate but it can also be other policy makers such as ISO, the international standards organization. So, they set business standards so impacting those business standards can be a good resource and then having a standard framework for the way that we do business which is not something that exists globally right now. Different countries use different standards, or some countries don't even use any standards. So, from a standards perspective, standards are there to help businesses do business together in the same way. So, if there's a standard for something, you follow it, I follow it. Then, we know what we're talking about."

(Chief Executive Officer, Blockchain Supply Chain Association)

4.5.4 Most applicable solution taken

Among the solutions mentioned in previous section, collaboration is found out as the most applicable solution for the major challenges faced when implementing blockchain. The junior associate stated that: *"Collaboration is the best way I can said. Collaboration with other companies as well. There is a risk for their sustainability. When we collaborate, everyone wants to have the same share for it."*. Collaboration is not just limited between the departments of a company but also with other businesses as well. The intention behind the formation of a collaboration is to achieve a win-win situation for all the involved parties. Therefore, collaboration makes it easier to achieve success since it allows the experts of both parties to more effectively leverage their respective competitive advantages while reducing the costs required for a long-term partnership.

"Collaboration is created on the basis on hoping to gain a mutual benefit for both the parties. So, with collaboration, it eases the success process when the experts of both collaborated parties effectively utilize their competitive advantages while minimize the cost needed for a long-term collaboration."

(Associate Project Analyst, DHL)

Collaboration is said to be helping ones to pick up new knowledges and skills in areas that his is not common with. It enables ones to gain new experience and furthers develop his own cutting-edge technological solutions at a reduced cost. Additionally, collaboration over a long period of time is beneficial to the reputation of the company which when its business partner or other firms have agreed to extend the cooperation, it indicates that they have faith in the partners and are looking forward to collaborating for the foreseeable future. This will lead to a rise in the company's reputation, which, in turn, will likely lead to an increase in consumer confidence and loyalty.

"Yeah, of course. So, I think learning is just one of the benefits. Because it can help to enhance the business relationship and it allows our company to learn from each other. Also, it can increase our company's reputation and our customer confidence."

(Project Manager, DHL)

However, their long-term viability is jeopardised. When companies are collaborated and work together on anything, everyone wants to get an equal part of the credit for it. Hence, to maintain a high efficiency of the solution, it is important to be someone who respects other parties and considers the overall benefits, rather than only concentrating on own advantages. It is necessary to have a conversation first to reach an agreement that is acceptable to everyone. Always keep in mind that the most important thing that contributes to the success of a good partnership is having goals and objectives that are well-organized and easy to understand.

"And for your second questions which is how to remain high effectiveness, well, I think, be someone who respect other parties and look at overall benefits instead of just focusing on our own benefits. Make decision under discussion of all in order to reach a consensus. Always remember that a well-organized and straightforward goal and objective is definitely the utmost factor that brings to a successful collaboration."

(Application Specialist, DHL)

4.6 Summary

In this chapter, it analysed and discussed about the data information gathered from the interview sessions with 4 interviewees. Through the interview session which known as the primary data source, the blockchain and logistics sustainability topics

has been widely discussed. The findings from the interview session were regarding the blockchain implementation in DHL logistics operation to enhance the logistics sustainability, the understanding of DHL about the advantages that come with the implementation of blockchain in conjunction for achieving logistics sustainability, and the challenges as well as solution taken when adopting blockchain for better logistics sustainability.

In short, all the research objectives are conducted through interview method. For research objective 1, interview method is used to propose blockchain implementation to enhance the sustainability of logistics operation. For research objective 2, interview method is applied to the interviewees to examine if DHL, the logistics service provider company is aware of and understand the benefits that come with the implementation of blockchain in conjunction with the goals of contributing to logistics sustainability. It same goes for the last research objective. For research objective 3, interview method is utilized to investigate the challenges faced and efforts made by DHL to tackle the issues and challenges encountered when seeking to adopt blockchain in its system in conjunction to enhance its logistics sustainability.

In the next chapter, Chapter 5, it will further outline the conclusion of the research, where the findings obtained through the interview sessions will be summarized.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The last chapter of this research, chapter 5 discusses about the findings, research evaluation and conclusion drawn from the entire research process. Besides contribution towards knowledge, industry field, and policies field, limitations and suggestions for the future research on the implementation of blockchain empowers logistics sustainability are included in this chapter as well. In a deeper view, the results of each research objectives will be further examined in light of Chapter 4's findings. To begin, the research objectives that mentioned in Chapter 1 includes to propose blockchain implementation to enhance the sustainability of DHL's logistics operation, to examine if DHL, the logistics service provider company is aware of and understand the benefits that come with the implementation of blockchain in conjunction with the goals of contributing to logistics sustainability as well as to investigate the challenges faced and efforts made by DHL to tackle the issues and challenges encountered when seeking to adopt blockchain in its system in conjunction to enhance its logistics sustainability.

The findings of this research are discussed according to the relevant research objectives. The intention of this research is to explore and present the major findings as far as the objectives that are concerned. As such, the discussions and findings are

explained and elaborated in three parts. The first part, section 5.2.1, which is the first research objective, examined how does blockchain being implemented to DHL, the logistics service provider company's logistics operation to ensures logistics sustainability. The second part, section 5.2.2 discusses the second research objective, the key advantages in terms of logistics sustainability towards DHL, the logistics service provider company as a result of the blockchain implementation, and lastly, the section 5.2.3 discusses about the challenges faced by DHL when implementing blockchain for logistics sustainability and solutions taken to address the issues and challenges arise.

The respondents are abbreviated as Junior Assistance (R1), Associate Project Analyst (R2), Project Manager (R3), and Chief Executive Officer (R4). In this chapter, the analysis obtained from the findings through the interview sessions are thus discussed and concluded in sequences along with the research objectives.

5.2 Discussion

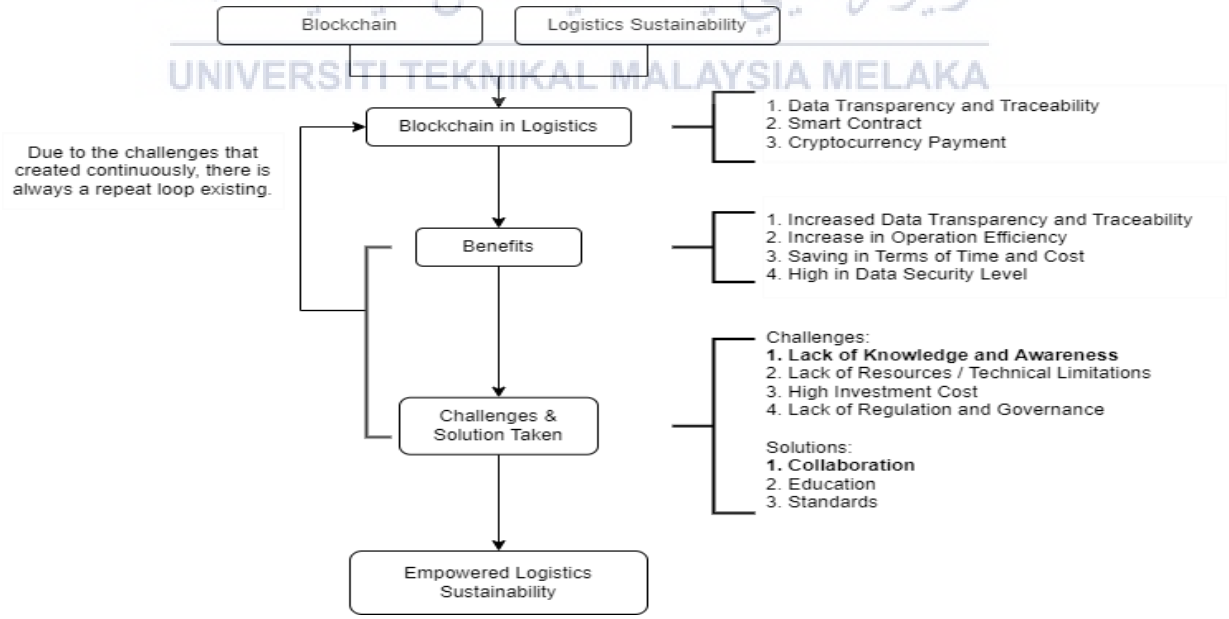


Figure 5.1: *Proposed framework for Implementation of Blockchain Empowers Logistics Sustainability*

Above are the findings obtained from the interview sessions based on the data analysis mentioned in Chapter 4. The findings illustrated in the proposed framework shown above are discussed in a deeper view as below.

5.2.1 Research Question Q1: How does blockchain being implemented to DHL, the logistics service provider company's logistics operation to ensure logistics sustainability?

Aligning with the first research objective which is to propose the blockchain implementation to empower logistics sustainability, the first research question of this research is how does blockchain being implemented to the logistics service provider company's logistics operation to ensures logistics sustainability.

Data Transparency and Traceability

According to Hellani et al. (2021), blockchain offers a level of transparency that enables every participant to access the full visibility in terms of the data information, services, and goods being introduced and exchanged. In the perspective of a logistics service provider, blockchain technology is utilized to secure the integrity and transparency of data storage, thereby mitigating the danger of tampering and security breacher with codes (Ho et al., 2021). In DHL, blockchain is widely implemented for the use of data transparency and traceability which the efficient flow of information is essential to have a well-organized planning of the supply chain and logistics management (R1). Based on his experiences in the field of blockchain, transparency is created on the basis of information sharing among the business parties. By using this decentralized technology, blockchain helps in providing data transparency that allowing the right goods to be delivered to the right place at the right time.

Tian et al. (2020) stated that transparency is critical not just for the government agencies, but also for the consumers as well. In order to make more effective policies,

government agencies need access to data on the operational state of logistics companies. For customers, blockchain give customers the accessibility to have a quick yet clear glance about the shipments details such as airway bill, tariff, decode term, and goods' details such as the goods' origin, materials that made up it, expiration date and more (R3).

In the light of the above explanation about transparency, it can be said that traceability comes along with the transparency realization (Hellani et al., 2021). The authors further claimed that data traceability enables businesses to equip with the capability to evaluate their supply chain efficiency, compliance with legal standards, and verifications of sustainability commitments. R1 claimed that data traceability playing role of digital token for both operators and customers that contributes to goods' movements which blockchain allow operators to reconstruct the goods' origin and customers able to keep track with shipments.

It can be said that data transparency and traceability in blockchain technology acts as a trust mechanism (Centobelli et al., 2022). Blockchain systems combine a decentralised database with a cryptographically secured chain of transaction blocks that are linked in chronological order (Kattwinkel & Rademacher, 2020). Due to this design, false or misleading information is less likely to exist, and agents' actions may be regulated autonomously, without the need for centralised authority. According to R2, blockchain build up the trust among the company and its stakeholders as the technology ensures each transaction are genuine, unaltered, and is immutable. Instead of having several parties maintain their own copies of a dataset, they may now share one and provide their partners restricted access to it. The entire transactions and records are sensed and noted down accurately which provide the stakeholders the real information (R4).

Smart Contract

In fact, smart contract and smart properties can be created and managed by blockchain technology (Ullah & Al-Turjman, 2021). According to R1 and R2, smart contract is a mechanism that innovates the previously manual process to become fully

automated, which improves the supply chain efficiency. The concept of a "smart contract" refers to the codification of a legally binding agreement into computer code that can then be independently validated by a group of individuals (Kasatkina, 2021). Smart contract is utilized as the algorithm that minimizes human intervention and reliance on third party involvement to verify the conditions of contract to be met (R2). Also, smart contract offers the flexibility of the companies to collaborate or making transaction with others including strangers (R3). He further explained that the flexibility comes from the power of blockchain in terms of the high security. The entire process occurring in smart contract can't be tampered even the developer himself.

Also, smart contract is used for the transfer of products' ownership (R2). Research conducted by Omar and Basir (2018) illustrated that smart contract in blockchain has the capabilities to perform the transfer of ownership that done by the device identity owner that a secure, yet rapid transferring process is carried out from one to another. In simple words, smart contract in blockchain can be used for the purpose of asset management. For illustration, non-fungible assets such as the title of vehicle or house can be managed by using smart contract (Serrano, 2022). In other hand, smart contract is used in verification of products and users. To verify the information regarding the transaction as well as to locate the person in charge for making the transaction, smart contract along with the blockchain log is querying to ease the process of accountability proof (Wang et al., 2019). In DHL, smart contract is used to verify the identity of users or parties (R2). When there is a malicious user invades the system, the regulator has the ultimate power to remove the person from the permission list (Wang et al., 2019).

Cryptocurrency Payment

Foo et al. (2022) claims that blockchain contributes towards an economic sustainability as the cryptocurrency payment aids in facilitating the financial transactions and supply chain finance. They stand with the point that cryptocurrency payment is recognized as a payment method that allow supply chain partners to make instant transfer with low transaction fees or even without any fees for products and services. There are no such intermediaries cost as well when using cryptocurrency

payment as there is no involvement of any third parties or bank (R3). Instead of using current payment method like credit cards, cryptocurrency payment is an alternative digital payment method that is more reliable and secure to use (R1, R2).

Due to the development of Bitcoin along with cryptocurrency, blockchain is widely implemented in the financial field (Dutta et al., 2020). The rise of cryptocurrencies has also had an impact on society and people's lives. In the future, all types of virtual cryptocurrencies may be used to fund local and worldwide transactions, resulting in a completely new financial system from the existing exchange rate-based financial systems. YellowWallet, a Bitcoin Wallet that developed by the DHL team that supports both Bitcoin Core and Bitcoin Lightning Network transaction (R3). However, this wallet is still not being launched to the public yet and it is still in the progress for future preparation.

5.2.2 Research Question Q2: What are the key advantages in terms of logistic sustainability towards DHL, the logistics service provider company as a result of the blockchain implementation?

The key advantages in terms of logistics sustainability that reaped by logistics service provider company through blockchain implementation includes the increased data transparency and traceability, the higher operational efficiency, high data security level, time saving and cost saving.

Increased Data Transparency and Traceability

Owing to the decentralized and digitized features of blockchain, this technology is believed to be enhancing the data transparency and traceability, thereby manage to organize the bookkeeping efficient (Tijan et al., 2019). According to R1, blockchain that equipped with the end-to-end transparency is implemented in its logistic operation mainly to improve the visibility and traceability of its entire supply chain. Many people think that by combining data from all relevant parties from

producers and shippers to end users, blockchain may provide an unalterable reality (R1). By utilizing blockchain technology, it enhances the transparency, visibility and give high synchronization of information tracking in all kinds of business (Chang et al., 2019; Dasaklis et al., 2022). For example, blockchain offers consumers a clear view of products' pricing information from raw materials procurement to suppliers till the necessary fees used to reach the final destination (Yoo and Won, 2018). Thus, it results in dissemination of honest information by all the stakeholders, thereby proving the characteristics of blockchain as a trustworthy mechanism.

Based on the research of Jain et al. (2020), blockchain that enhanced the data transparency is proven to aids in terms of social sustainability. In a general perspective, data transparency is greatly enhanced and assist logistics professionals such as carriers, shippers, and brokers in detecting and preventing fraud and theft (R1). The decentralized blockchain giving full data transparency allows everyone to freely access the entire database including the complete history (R2). In a deeper view, blockchain is found to be a single, verifiable source of information by translating all the information we get from suppliers, transporters, and consumers into a common language (R1). By keeping tracking on the performance done by both the carriers and suppliers in the past, blockchain technology that offers trustworthy information is promised to help a company to boost its consumers' confidence in any financial transaction as well as monitoring title ownership (R1).

Increase in Operation Efficiency

According to Dutta et al. (2020), to attain sustainable reverse logistics and circular economy objectives, blockchain technology is utilized to empower "product return management in reverse SCs" as well as the reduction in resources wastage through effective tracing of materials. The authors discussed that by effectively tracing the materials, this in turn drives operational efficiency and promotes cleaner production that takes into account reuse, refurbishment, and remanufacturing. R1 stated that this digitalized technology has been leading for less wastage, boosting for a higher efficiency and productivity particularly on the track and trace ability about the shipments' movement.

Blockchain that increases operation efficiency is more connected to the environmental pillar of sustainability. Shipping companies, carriers, and couriers may all benefit from using blockchain technology because of the environmental, financial, and economic advantages it offers in terms of the sustainability. Reducing or eliminating fraud or errors, boosting inventory management, decreasing courier costs, lessening long waits brought on by paperwork, speeding up the identifications of problems which all are related to the efforts in eliminating considerable resource waste (Tijan et al., 2019). As stated by R1 that blockchain had minimizes the paper usage for the shipment documentation, he further elaborated that blockchain reduce the possibility of having damaged paper that will affect the low efficiency and accuracy of performance tracking or productivity.

When talking about operation efficiency that connected with blockchain, blockchain that provide real-time visibility of information for the entire participants in blockchain has definitely contributes to the environmental concern (Bao et al., 2020). R3 claimed that by implementing blockchain to monitor or sharing the live data of the goods, it allows the carrier or deliveryman to schedule the shortest shipment routes thereby reducing the excess emission of CO_2.

Saving in Terms of Time and Cost

Chang et al. (2019) suggests that the usage of smart contract contributes to a reduction in time and cost. Tijan et al. (2019) revealed that blockchain technology has eases the paperwork process which the entire transaction, process or shipping documents is shared through the blockchain ledger or smart contract is replacing the traditional paper. R2 argued that paper-based work is mostly performed in conventional supply chain and logistics processes for shipping documentations such as airline bills, tariffs, and more. The sharing and transferring documents take time and may result in human mistake, the requirement for third-party verification of transactions, and other issues (R2, R4). According to the R2 and R4, blockchain is being used to simplify the process in order to minimise document transit time, which equals improved transaction efficiency. Every transaction or procedure is completed

online and digitally, so no paper is required, saving time and money for the logistics operations (R1).

In addition to allowing for the integration and networking of merchant ships, Komathy (2018) demonstrates that blockchain technology also ensures minimal latency in real-time money transfers, the openness of transactions from faraway places, heightened vigilance with regards to data protection of privacy, transaction verification, and theft monitoring. It is time consuming, labour intensive, as well as cost consuming from a human standpoint especially when there is the loss of information (R4). R1 and R4 explained that when there is the loss of shipment documentation, it might lead to a situation to shipment delay, and further need to pay for the compensation to their customers due to the expected situation.

Also, when using blockchain technology that replace the paperwork for the use of sticker labelling, it means to reduce the consumption in terms of cost and time (Tan and Ngan, 2020). According to R1, the stickers use for labelling, for instance, aren't exactly inexpensive since the special sort of water-proof paper and adhesive is required to guarantee the documents to reach the end customer under the good condition. With the blockchain technology that everything is carried out through online, the company do not have to pay for the expensive water-proof stickers anymore, therefore everything is much more affordable (R2). Also, the reduction in use for water-proof stickers minimizes the risk of mislabelling the cargo, containers, and documents which thus guarantees for the secure and rapid transfer of the original shipments documents virtually through blockchain (R2).

High Security for Data Protection

In recent years, blockchain technology has emerged as a potentially game-changing approach to addressing security and privacy concerns in edge computing networks and enabling the next generation of EoT (Edge of Things) devices (Zhou et al., 2020; Gadekallu et al., 2022). Information on customers and employees, such as their photo id and shipping histories, is very crucial and sensitive to a company's operation (R1). As blockchain technology has the potential to revolutionise how

crucial data is viewed, it is believed that it aids in preventing fraud and unlawful behaviour by producing immutable records that are encrypted from beginning to finish (R1). Therefore, the blockchain may also be used to solve privacy issues, for as by permanently erasing sensitive information and limiting who can access it (R4). This means that no other parties can access the records.

To ensure the high secure level, smart contract in blockchain is take as the example (Chen et al., 2020). With the use of cryptography, the business operators can recover all of the digitised documents with the same quality. As a result, blockchain technology may now be used to record and verify transactions (R1). When adopting blockchain technology, all participants may instantly access or exchange data. Any choice or action taken by any participant is visible in real time and may be reviewed by all (R4). Therefore, blockchain functions as a platform that facilitates the sharing of accurate, up-to-date information among all parties involved, therefore fostering an atmosphere of mutual trust (R4). R4 further elaborated that everyone in the room can see who is making a choice at any given time, offering input or just nodding in agreement. As a result, confidence in one another grows.

5.2.3 Research Question Q3: What are the challenges faced by DHL when implementing blockchain for logistics sustainability and solutions taken to address the issues and challenges that arise?

5.2.3.1 Challenges when implementing blockchain for logistics sustainability

Lack of Knowledge and Awareness

Lack of understanding, knowledge, and awareness of the blockchain related information such as the applications, benefits, and technicalities as well is one of the challenges when adopting blockchain in a supply chain system (Dutta et al., 2020). According to R1 and R2, the young generation especially the baby boomers are lacking curiosity. They are uninterested to widen their knowledge regarding the blockchain's

application, benefits, challenges and solutions (Aich et al., 2019). As the adoption of blockchain in logistics field is still in its infancy level, many businesses including logistics service provider companies choose to remain its current technology instead of the digitalized technology (R2). The challenge somehow due to the shortage of qualified blockchain experts to develop, implement, and run blockchain logistics (R1, R3). Lack of awareness and basic misconceptions about the trade-offs of blockchains is a core issue with the industry as it exists now (Heim, 2022). Not to mention the scarcity of experts, it is also difficult to determine whether or not blockchains are really effective for the many different applications being suggested for them as the requirements are not defined properly (Shahzad et al., 2021).

Furthermore, the lack of knowledge is recognized as the challenge that most burden for most of the business (Karuppiah et al., 2021). The same opinion provided by R2, R3 and R4. When there is a severe lack of blockchain-related awareness, education, and comprehension, it implies that everything must begin from square one and is cost-consuming (R1, R2, R3). By searching the Internet or reading books is inadequate or inefficient since anybody may readily access the general knowledge from these sources. Also, information received from the Internet does not signify everything, as the uploader may have made some errors, or the material may not be comprehensive enough for those who want to undertake in-depth investigation (R3). Based on the research of Post et al. (2018), due to the lack of people equipped with adequate blockchain related knowledge, the lack of education is the most burden challenge among other challenges.

Lack of Resources and Technical Limitations

Baharmand et al. (2021) acknowledged that the lack of resources, technical skills and training are one of the main barriers for blockchain application. R4 claims that smaller businesses have trouble when implementing blockchain solutions because they are lacking the necessary resources, such as in-house programmers. Berg and Myllymma (2021) mentioned the insufficiency in IT infrastructure is one of the technological obstacles. It poses companies to make substantial expenditures in IT infrastructure to support blockchain technology (Sharma et al., 2020). A precise

quantity of software and hardware expenditures is difficult to anticipate because of the wide variety of business requirements and sizes (Venkatesh et al., 2020). R1 argued that the difficulty arises from the fact that a lot of individuals only excel in coding but creating an effective blockchain is rather complex and risky, thereby no one is willing to take the risk. In terms of technical limitations, it is another issue regarding the connection between offline assets to digital ledger (R2). Chen et al., (2021) acknowledged that blockchain failed to carry out the transfer of ownership for the offline assets.

High Investment Cost

Wong et al. (2019) proven that the complexity, unpredictability, privacy, and security worries, as well as a general lack of understanding contribute to the perception that using blockchain technology is highly risky. Many businesses are wary of investing in blockchain technology at the moment due to widespread concerns about the instable global economy and rising inflation (R1). R1 share his experience that the cost to get started with blockchain development is huge in the sense that creating a blockchain isn't a simple task, it requires extensive planning, investigation, and trial-and-error implementation.

Investment for blockchain is not limited in terms of blockchain software which company pay in huge to develop a private blockchain, but it also involved the training provided by the company to enhance the related skills for its employee (Zhou et al., 2020). R3 suggested that hiring blockchain experts, build up blockchain software such as Ethereum, Hyperledger, and maintenance cost are all inevitable to have an efficient blockchain technology. In short, significant investment cost will be required to implement blockchain due to its profound nature of the technical shift, thereby making businesses decide to not invest in expensive, cutting-edge technology that's still in its experimental stages (Öztürk, et al., 2020).

Lack of Regulation and Governance

Research by Duan et al. (2020) regarding AI aligning with cutting edge technologies such as blockchain is found to be having a big barrier in terms of regulation and the role of government is crucial, especially on how government can provide adequate policy, laws, and legal framework to guide and prevent abuse of blockchain technology. When it comes to expanding blockchain's reach and coverage, the least investigated topics are organisational preparedness and legislation (Hughes et al., 2019). According to R1, blockchain technology is already years behind where it needs to be in terms of widespread adoption, and there is a lack of a clear legal framework to oversee blockchain transactions in both Malaysia and the United States. He further explained that while governments in certain places may attempt to regulate virtual currencies like Bitcoin, the technology behind blockchains like Ethereum is not regulated anywhere outside of the South American region.

Furthermore, it is an issue of unsynchronized regulation and governance that used as the guidelines of blockchain implementation (R4). Dutta et al. (2020) suggested that it is a regulation related challenge which government should provide a synchronized regulation particularly regarding the laws of cryptocurrency, data warehousing, scalability, and more. By having regulation and governance, Berg and Myllymaa (2021) is believed that blockchain able to increase the supply chain transparency and encourage more individuals or businesses to implement blockchain.

5.2.3.2 Solutions taken to overcome the challenges faced for blockchain Implementation

Collaboration

According to Rejeb et al. (2021), collaboration plays the role of integrating variety skills and scientific idea which then further acts an efficient pathway for developing the nations to get access to scientific information and technology. Large

corporation have initiate collaboration that aids the entire process of the supply chain along with the development in automation under the hybrid structure (Kelechi et al., 2020). For example, GUTIERREZ (2020) acknowledged that the collaboration between Walmart and IBM has bring the succeed in launching a pilot project when aiming to achieve the traceability of mangoes from the farm to fork. DHL has been collaborating with some International companies such as BMW, Accenture, CISCO and more to empower the implementation of blockchain (R1, R2, R3). Also, Hackius and Petersen (2020) mentioned that collaboration is practiced among few companies or even institutions by transforming the job scope of IT solutions provider experts as a platform software provider to the infrastructural basis providers.

Blockchain is created on the basic of shared ecosystem that must be available to any organisation, even companies that compete with each other (Hackius & Petersen, 2020). It is recognized as an approach to gather blockchain experts who aiming for a common goal to work along under the healthy competitive environment that further benefits in fasten the process achievement (R4). Research conducted by Naef et al. (2022) concluded that the collaboration of companies with cutting-edge technologies not only manage to produce a worthwhile application, but it also aggregates the market and industry power which means to increase the usage of blockchain among community. In addition, collaboration allows for long-term relationship with business partners as well as customers and gain new knowledge with low cost (R4). Besides saving investment cost, Latif and Latif (2021) stated that collaboration has greatly increased the adequacy of raw material in the long run, enhancing the development of product through the innovation in technology and process.

Education

Saif et al. (2022) clarified that many companies are failed to offer appropriate orientation and workshop for their employees caused the lack of understanding about the blockchain technology and hence leads to the issue of lack of trust among stakeholders such as IT technicians, policymakers, businessmen, and more. Chang et al. (2020) acknowledged that to enlarge the knowledge of employees regarding blockchain, it is essential to provide experiential learning or problem-based learning

for them in order to achieve the benefits in long-term goals. R2 stand the same point which the community will develop in blockchain technology once they have the strong foundation on the knowledge on blockchain as they truly realize the functionality of blockchain that will aids their business.

Hackius and Petersen (2020) stated that to encourage community to implement blockchain technology in their business, there is the need to have good understanding on blockchain which is kind of relatively new business model in innovating their products or services. Based on R4, the Blockchain Supply Chain Association (BSCA) has offered all kinds of method to improve the understanding and knowledge of community regarding blockchain from a business perspective. Besides providing the education service for those needed through courses, webinars and workshop (R4), BSCA also provide the consultations about the advocacy, collaboration, assisting in building consensus and standards, and more (BSCA, 2022). Through BSCA official website, the committees of BSCA often provide the opportunity for everyone who wish to get in deeper into blockchain to connect with them in order to share, learn, and grow together.

Standards

Berg and Myllymaa (2021) acknowledged that standardization has contributed to the sharing and enlargement of the knowledge and idea about blockchain technology. Research conducted by Hackius and Petersen (2020) proven that to tackle the issue of lack in laws and governance, it is necessary to either join an existing Blockchain consortium or start one in order to standardise the sector and bring it under one umbrella. By joining a dominant consortium, there is the potential to be the driving force behind a shared Blockchain platform, to set standards for certain procedures, and to bring in new members as a result. The participation in a consortium is seen as the first step toward using Blockchain technology in SC&L, according to the specialists (Wang et al., 2019). According to ‘Blockchain Technology’ (2018) published on DHL website, there is the first blockchain consortia being establish in logistics field, which is the Blockchain in Transport Alliance. R4 has suggested to have the standard set-up to tackle the challenge regarding the lack of laws and governance for blockchain

implementation. Naef et al. (2022) discussed that by reaching a standard, blockchain technology is becoming more attractive and there will be more people interested to implement tis digitalized technology. The authors further elaborated that by having the standard established, it eases the management team acts as the force responsible for coordinating among the many stakeholders involved. It does this by enabling communication with and between members, generating consensus, and pushing the development of the application in a way that is focused on its goals.

5.3 Contributions

5.3.1 Knowledge of contribution

This research has first contributed to the aspects of knowledge. This research contributes conceptually by enriching literature regarding how the implementation of blockchain empowers the logistics sustainability with the case study on DHL. There is few research in the past that emphasized on the blockchain application that helps in supply chain sustainability (Saberi et al., 2019, Kouhizadeh et al., 2021). However, most of the research were carried out theoretically, and there is the need for conceptual framework as research that conducted conceptually is said to be all-inclusive, aiming to address all the sections mentioned in the research process (Kivunja, 2018). In addition, there is less or no single research existing regarding the implementation of blockchain empowers logistics sustainability. There is only blockchain helps in reverse logistics (Kazancoglu & Ozbiltekin-Pala, 2022), blockchain technology helps in sustainable education (Savelyeca & Park, 2022), blockchain-based framework for green logistics in supply chains (Tan et al., 2020) existing in the current researches. Thus, this study has greatly contributed to the knowledge for researcher as well as reader on the blockchain implementation that empowers logistics sustainability, specifically on the perspective of logistics service provider, DHL. DHL is well-known as a logistics service provider company that has led in the logistics industry for many

years and illustrated their extensive reputation and efforts in providing satisfying customer service while striving in the sustainability.

From the research findings, researcher has obtained the results that blockchain technology is being implemented in DHL for the use of data transparency and traceability, smart contract, and cryptocurrency payments. Through the interview session, researcher able to gain much deeper insight and experience from the employees on the efforts that they paid off for a better implementation of blockchain such as NPTS, and SHERLOC which are seldom known by the public or through the Internet.

At the same time, researcher able to differentiate the advantages that connected with each sustainability pillars such as environment, economic, and social. For example, high data protection as well as increase in data transparency and traceability are related to social pillar, increase in operation efficiency as well as saving time and cost are linked with both economic and environmental pillars, but economic sustainability is always the prior when implementing blockchain for a business.

Furthermore, the challenges and solutions taken by DHL are further contributed for the knowledge. Among the challenges, knowledge and awareness are recognized as the most burden challenge that comes along with financial burden. To tackle the challenges as mentioned, the most applicable and effective solution is collaboration, which DHL has been carried out joint with few big multinational companies such as Accenture, BMW, CISCO to enhance the blockchain implemented project.

In short, this research has contributed to the knowledge for either the researcher or the reader as everyone manage to gain the real information that is relatively new to the study field. Most of the research in the past only discussed about the application, challenges, and potential of blockchain that related to sustainability in the industry of healthcare (Vishwakarma et al., 2022), food (Friedman & Ormiston., 2022), agricultural (Mukherjee et al., 2022), education (Savelyena & Park, 2022) and even the textile and clothing (Nazam et al., 2022). At the meantime, there is no research conducted regarding the blockchain technology being implemented specifically based on only DHL. Thus, by conducting this research, it has offered the opportunity to

enhance the knowledge of researcher and readers on the blockchain technology that implemented in DHL for the aims for logistics sustainability.

5.3.2 Industry of contribution

From another perspective, this study has making contribution for the logistics industry particularly for the logistics service providers (LSPs) industry. As stated previously that the field of blockchain technology research is still in its infancy and is mostly focused on the information and communication technology, healthcare, food, agriculture and other industries, the results of previous studies may not be applicable to a wider population. There is a lack of knowledge of blockchain technology disruption in transport and logistics, according to the research on logistics that has been published (Noor, 2022). To be more specific, there is a lack of information about how businesses interact with LSPs that have adopted blockchain or how LSPs implement blockchain technology (Orji et al., 2020; Noor, 2022). It is said that previous research has not yet shed light on the criteria that drive third-party logistics companies to implement blockchain technology (Batta et al., 2020). In this case, researcher had approached to many DHL employees for the interview request. However, many of them seem to be lack of knowledge on the blockchain technology and couldn't accept for the interview including the top management.

By conducting this research, it had enhanced the knowledge and awareness of among the LSP industries to start carry out necessary research on the blockchain technology. Some interviewees had undergone for blockchain related research before having the interview session. Thus, this has greatly increased their attention, and knowledge on the blockchain. When there is more attention and researches done by the scholars, it is contributing to the high usability of blockchain among LSP industries. DHL, one of the leaders among LSP company that illustrated the applications and benefits of blockchain is believed to be showing the good example on how the blockchain helps in logistics businesses, and hence boost the confidence and willingness of others LSP companies to start involved in Blockchain technology as well.

5.3.3 Policies of Contribution

Research by Kafi et al. (2022) clarified that the transportation-related operations and activities grew from year to year, with a compound annual growth rate (CAGR) of 3% from 2013 to 2018. It is the goal of government's National Logistics Trade Facilitation (NLTF) 2015–2020 and National Transport Policy (NTP) 2019–2030 initiatives aim to make the logistics industry in Malaysia more international within the context of regional trade integration and boost its contribution to GDP by 8.9% by 2020 and beyond (MIDA, 2021).

From this study, by understanding the blockchain's application, benefits, challenges and solution can be taken to overcome the potential solution, it is believed to influence the implementation of blockchain technology among Malaysian especially those LSP companies, as well as the Malaysia government. Malaysia government can know better on the functionality and demand of blockchain that further empowering the logistics industry through this research. According to Fernando and Saravannan (2021), Malaysia government has been exerting efforts in establishing necessary policies regarding blockchain technology while aiming to open up the digitalized technology accessibility for the company. Thus, this research is offering government a straighforward sight to put efforts in creating the policy and giving sustain supports by intervening in the logistics business affairs especially in the development of blockchain technology areas. For instance, there are few research discusses about the blockchain transaction policy (BTP) for a better blockchain adoption (Miraz et al., 2020), cryptocurrency and digital asset policies for more sustainable business management (Sukumaran et al., 2022), and more.

Thus, it is believed by having this research, policy makers and regulators manage to obtain more information on cryptocurrency investments before they can come to sound choices about how to proceed. This is vital because governments need to carefully act in this field by avoiding both over-regulation and under-regulation, both of which would inhibit the growth of digitalization. This is because both would hamper the development of digitalization. As a result, gaining an understanding of how retail investors evaluate the risks and potential rewards of investing in cryptocurrencies is essential. This is because such knowledge would enable one to gain a better

understanding of how the general public views this newly developing form of investment.

5.4 Limitations of Research

While this research may provide some groundwork for future research, it does have a number of inevitable limitations. Challenges with the study's methodology and accessibility to relevant materials are the sources of the problem. The following discussion eluidates these constraints and the measures taken to mitigate their potential effect on the study's findings and conclusions.

There are certain limitations placed on this research due to the novelty of the subject matter being investigated. Blockchain has been widely discussed or linked to the supply chain sustainability, but it is seldom being connected in a more specific way which is the linkage with logistics sustainability. Thus, there are eventually lack of the research done by the researcher in the previous years. As stated, that this research is specifically focused on the DHL Company, there is a problem which not many of them know about blockchain including the top management themselves. This limitation is linked to the lack of knowledge and awareness which mentioned in the research. Besides, the published year of 2018 for the related documentation is also one of the limitations faced when conducting this research. Owing to the resource's availability, several interviews session are carried out with interviewees who fulfilled the requirements of the research.

In terms of methodology, these findings of this research are obtained through the semi-structure interview as well as the archival documents of DHL. Nevertheless, the data was collected inefficiently. For instance, due to the hectic schedules or unexpected meetings after working hours, the respondents had delayed for the interviewee sessions several times. Moreover, the interview sessions are all carried out through online platform such as Webex, and Google Meet. Thus, there are the issues of unstable internet connection that leads to the interruption during the sessions. Let's

take the interviewee who located at United States, there is the unstable internet connection due to the different Wi-Fi network, which Malaysia is using the 4G and U.S is using the 5G. Another case is regarding the interviewee who located at Canada. Since there is the difference of 13-hours in time zone, which Canada is using the Eastern Standard Time (EST) while Malaysia is using the Malaysia Time (MYT). It is the issue which the interview session then needs to arrange based on the agreement of two.

5.5 Further Research

Since blockchain is still a relatively new technology, its implications are not well understood. Also, the absence of standardisation of blockchain language makes it more difficult for various parties to communicate with one another. In this research, it shows that blockchain's publicity machine can work both for and against the technology. It would be helpful for both academics and professionals if the language around blockchain were standardised, and if more attention were paid to the industrial applications of blockchain technology. More empirical research on the impact of certain blockchain characteristics on logistics sustainability is required. All in all, the research notes that many businesses are lack of the blockchain-related knowledge and hence afraid to invest in blockchain technology since they don't know what it would cost. Therefore, further study such as investigate the total cost of integrating blockchain technology throughout the whole logistics process or more should be carried out. This would provide potential businesses with crucial guidelines.

5.6 Conclusion

In conclusion, this research has greatly enhanced the understandings on the blockchain technology regarding its application, benefits, challenges as well as the solution to be taken for a better blockchain implementation. The research objectives are all clearly stated and accomplished under this study. Besides having deep insights on the blockchain application such as data transparency and traceability, smart contract, and cryptocurrency payments in general, this study has provided more specific sharing such as the BLESS, NPTS and SHERLOC software for better running of blockchain technology in DHL, there is also the YellowWallet that developed by DHL acts a platform for cryptocurrency payment that ease customers for a secure payment.

In addition, this study further had focused on the advantages received through the implementation of blockchain that linked with the three sustainability pillars. Instead of environment pillar that being most discussed in few past researches, both economic and social pillars are included in this research as well. It is found out that economic pillar is known as the most beneficial pillar among others as blockchain is proven to enhance the operation efficiency, and saving in terms of time and cost. With the smart contract and cryptocurrency payments features in blockchain, it helps in term of the social pillar which are the users, products as well as transaction verifications. The use of blockchain that empowers logistics sustainability can be further illustrated through the enhanced data transparency and traceability. Blockchain enables stakeholders to track and authenticate the goods that being transported from the moment of procurement of raw material to manufacturers to warehouses until the end customers, thereby giving trustworthy information of the shipment. Reduced in paperwork as documentation for shipping are all carried out through digital platform has encourage for high traceability and data security. This indicates that others than contributing to environment sustainability, blockchain has also aids for lesser human fraud and error that might lead to shipment delays, avoid from compensation due to any unexpected situation occurred.

Lastly, the research has concluded for the challenges and solutions regarding blockchain technology. Aside from the high investment cost, lack of technical skills and resources, lack of regulation and governance, the lack of understanding and

awareness related to blockchain technology is recognized as the largest and most burden challenge that bring along the financial burden. The lack of knowledge required investment cost including the cost for hiring blockchain experts, invest for blockchain cloud or software, necessity to conduct related research and so on before blockchain adoption. Thus, it can be said everything involved money. In the light of research's findings, there are few solutions such as collaboration, education, and standard being suggested to tackle the challenges as mentioned. Among the potential solutions, most of the respondents agreed that collaboration is the best approach for the better blockchain implementation. Collaboration has been widely practiced in DHL with other MNC as well. Accenture for example, has collaborate with DHL to create a blockchain based serialization project aiming to trace the pharmaceutical throughout the supply chain and logistics.

There were some research limitations during the data collection progress with the interviewees. The first limitation is the lack of knowledge within the company's employees, which mostly of its employees have no idea on the blockchain technology. This hence making the situation which there is lack of interviewees that fulfil the requirements for the interview session. At the meantime, there are interviewees who located at overseas such as Canada and America, which means there is difference in time zone. Researcher had to communicate with the interviewee and schedule meeting based on the time zone which suitable for both interviewer and interviewee.

In the research, it also mentioned about the future study that others can get involved for a better understanding as well as implementation of blockchain among businesses, particularly LSPs. To encourage more individuals or businesses to invest in blockchain, there is the necessity to pay attention on the research about the total cost of integrating blockchain technology throughout the whole logistics process and more. By having such research in the future, it is believed that more businesses including individuals will take the risk to adopt blockchain technology, a digitalized technology that enhance the business operation as well as logistics sustainability.

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APPENDIX 1: INTERVIEW PROTOCOL

1. In-depth Interviews (IDIs) Information Profile

INFORMATION PROFILE

In-depth Interviews

Introduction

I, Miss Tong Zhe Wei, am conducting a bachelor's degree research study to examine the Implementation of Blockchain Empowers Logistics Sustainability: A Case Study of DHL Company. I am interested in exploring the application of blockchain that contribute to the sustainability of logistics through qualitative research paradigm via a case study approach. This study endeavours to explore the blockchain implementation that helps to enhance logistics sustainability of DHL logistics activities, the benefits that DHL received through the blockchain implementation in conjunction aiming for sustainable logistics, and the challenges as well as solution of DHL put in efforts when implementing blockchain to enhance the logistics sustainability.

What is the purpose of this study?

I would like to enlarge my horizon of knowledge regarding the implementation of blockchain in empowering the logistics sustainability in a different context of blockchain-related experiences from diverse people, while identifying its advantages, challenges and application of solutions aimed at achieving high levels of logistics sustainability.

What will happen if you participate in this research interview?

I would like to ask you some open-ended questions about your perspective on the blockchain implementation that enhance logistics sustainability, the benefits received by both the company and customers through the blockchain implementation, and the challenges followed by the solutions taken by DHL before, during or after implementing blockchain into its logistics activities.

I will take notes of the discussion and a recording will also be made using a digital voice recorder. After asking these questions today, I will not ask you to do anything further. All information gathered will be treated as **confidential** by the researcher purely for *academic purposes*, and records of the interviews will be kept securely in locked filing cabinets and offices. No personal identification information such as names will be used in any reports arising out of this research.

How long is the duration of this research interview?

The interview will last about less than 60 minutes.

Can I ceased being part of the research interview?

You can opt to stop participating at any time. Just inform the researcher right away if you wish to stop the interview.

What risks can I expect from being in the research interview?

Participation in any research study may involve personal views and opinions. Information you provide about your experiences and opinions will be recorded, but your name will not be used in any reports of the information provided. No quotes or other results arising from your participation in this study will be included in any reports, even anonymously, without your agreement. The information obtained from these interviews will only be used by the researcher for academic purposes. We will do our best to make sure that the personal information gathered for this in-depth interview is kept confidential.

Are there benefits to taking part in the study?

There will be no direct benefit to you from participating in this study. However, the information that you provide will help researchers and policymakers particularly in the logistics industry to understand how best to utilize blockchain implementation in achieving the high level of logistics sustainability and how blockchain further benefits DHL in terms of the sustainable logistics practices.

What other choices do I have if I do not take part in this study?

You are free to choose not to participate in the study. If you decide not to take part in this study, I respectfully accept your decision without prejudice.

What are the costs of taking part in this study?

There are no costs to you for taking part in this study.

What are my rights if I take part in this interview?

Taking part in this study is your choice. You may choose either to take part or not to take part in this interview. If you decide to take part in this study, you may change your mind at any time. No matter what decision you take, there will be no penalty to you in any way.

Who can answer my questions about the study?

I will personally be delighted to answer all your inquiries, concerns, and questions. You may contact me at tzuweyy99@gmail.com for any other further inquiries.

Giving consent to participate in the study

You may keep this information sheet if you wish. Participation in this interview is **voluntary**. You have the right to decline to participate in the study, or to withdraw from it at any point without penalty. If you do not wish to participate in the study, you should inform the researcher now. If you do wish to participate in this interview, you should tell the researcher now, or at the time of the interview if this is to take place in the future. If you do not agree to quotes or other results arising from your participation in the study being included, even anonymously, in any reports about the study, please tell the researcher now.

2. Personal Interview Consent Form

CONSENT FORM

Study Title: "**Implementation of Blockchain Empowers Logistics Sustainability: A Case Study of DHL Company"**

Researcher: Miss Tong Zhe Wei (B061910223), UTeM, Malaysia

- The study has been explained to me in a language that I comprehend. All the questions I had about the study have been answered. I understand what will happen during the interview and what is expected of me.
- I have been informed that it is my right to refuse to take part in the interview today and that if I choose to refuse, I do not have to give a reason, and that it will not prejudice the care that I can expect to receive now, or in the future.
- I have been informed that anything I say during the interview today will remain completely confidential: my name will not be used nor any other information that could be used to identify me.
- It has been explained that sometimes the researchers find it helpful to use my own words when writing up the findings of this research. I understand that any use of my words would be completely anonymous (without my name). I have been told that I can decide whether I permit my words to be used in this way.

Circle response:

I agree to take part in the study:	Yes	No
I agree that my own words may be used anonymously in the report	Yes	No

Signature of participant:

NAME (in capital letters)	**SIGNATURE**	**DATE OF SIGNATURE** (in DD/MM/YYYY)

Signature of Researcher documenting consent:

I have discussed the study with the respondent named above, in a language he/she can comprehend.

I believe he/she has understood my explanation and agrees to take part in the interview.

NAME (in capital letters)	**SIGNATURE**	**DATE OF SIGNATURE** (in DD/MM/YYYY)

3. Participant/Informant Interview Questions (Face to Face Interview)

Interview Questions

Interview Focus: Implementation of Blockchain Empowers Logistics Sustainability: A Case Study of DHL Company

Participant ID NO |__|__|__|__| Gender Male / Female Researcher Initials |__|__|__|

Case location |__|__| Date |__|__/__|__/__|__|

Introduction

I am _____ from _____

- ✓ General purpose of the study
- ✓ Aims of the interview and expected duration
- ✓ Who is involved in the process (other participants)
- ✓ Why the participant's cooperation is important
- ✓ What will happen with the collected information and how the participant/target group will benefit
- ✓ Any questions?
- ✓ Consent

Background Info [demographic & blockchain implementation history]

Can I ask some details about you and your job?

Job Title _____

Highest Educational attained _____

Logistics Industry Connection: _____

Are you involved in any forms of blockchain implementation endeavours? ____Yes ____ No

Kindly specify: _____

Age bracket? _____ Under 30yrs _____ 30-40yrs ____ Over 40yrs

Now I am going to ask you some questions about your knowledge and experience on blockchain and logistics sustainability, current issues or situation on logistics sustainability, blockchain application in logistics sustainability, advantages reaped by both the company and customer through blockchain, and challenges followed up by solution taken to address the challenges when implementing blockchain in your company.

*****Explanation on blockchain technology and logistics sustainability: Blockchain technology is a technical solution for storing, verifying, transferring and exchanging network data through its own distributed nodes without relying on third parties. In the field of logistics, blockchain can reduce logistics costs, trace the production and delivery of goods and improve the efficiency of supply chain management. It is considered to be a promising application of sustainable supply chain nowadays. Yet, the rising in logistics complexity contributes to the priority of logistics service providers to emphasizes on sustainable logistics instead of sustainable supply chain. Logistics sustainability refers to the ability of practices and procedures to address environmental concerns while preserving performance efficiency in logistics activities (Kumar, 2022). To measure the logistics sustainability, it can be evaluated from 3 pillars which are environmental, economic, and social. It is believed that a high logistics sustainability able to benefits the development of logistics service providers in terms of the balanced growth of the 3 pillars mentioned. Thus, blockchain is defined as the solution to the trust problem in large logistics, and can facilitate the realisation of scale, low cost and promote zero carbon footprint as well which further described as the one of the best technologies to enhance logistics sustainability.***

Domain	**Topic and Probes**
Knowledge on blockchain technology and logistics sustainability?	**What do you know and understand about blockchain technology and logistics sustainability in your capacity?** **Probes:** What do you understand by blockchain technology? What do you understand by sustainable logistics? How does this apply and relate in your context? Can you cite examples on any level of blockchain technology in logistics activities?
Current Issues or situation on logistics sustainability?	**What are current issues and situation related to logistics sustainability?** **Probes:** What is the importance and priority of these issues or situations? What is your experience in facing or dealing with these issues? Do you think these issues can be grouped into broad categories? Why do you perceive these issues are relevant? How can these issues be resolved?

Blockchain application in logistics sustainability	**Can you briefly explain the blockchain technology implemented in your logistics operation?** **Prompt:** Where did you gather this information from? Do you trust the source of information and why/why not? What is the source of your blockchain application information that brings up sustainable logistics – personal experience, observation from real example, community, social media platform, employee, colleagues, blockchain expertise or a combination? **Does the application of blockchain actually helps in logistics sustainability? Can you provide few examples, please?** **Prompt:** What is your thinking regarding the blockchain application towards logistics sustainability? How does it relate to what you know, experience, and observe now? **Based on your personal and communal experience, do you think "blockchain implementation enhance logistics sustainability" exist within your context?** **Prompt:** Touch on the earlier explanation of what constitutes blockchain application on logistics sustainability.
Advantages obtained from Blockchain Implementation	**What is your personal experience or opinion in the context of advantages developed from the blockchain implementation?** **Prompt:** How do the implementation of blockchain contribute to the enhancement of logistics sustainability? Is blockchain technology helps in the three pillars of sustainability? **What is your perspective on the sustainability pillar gained the most benefits through the blockchain implementation?** **Prompt:** Which pillar occupied the larger percentage of advantages through the blockchain implementation? Do all the pillars has connection to each other? **How do you think the advantages can be continuously benefit to you as well as the company logistics operation and customers?** **Prompt:** Can you give illustration on how to ensure the advantages mentioned can keep on benefits towards you, company, and customers? Is there any ways to guarantee the continuous advantages provided from blockchain implementation?

Challenges faced when implementing Blockchain for logistics sustainability	**In your point of view, is there any challenges faced when implementing blockchain technology while aiming for reaching logistics sustainability?** **Prompt:** When implementing blockchain into their daily operation activities, does the challenges such as lack of knowledge, issues on data collection and management, high in implementation cost and risk existing? **What is the challenge that brings the most burden towards you as well as the company? What kinds of burden is affecting you, company as well as customers?** **Prompt:** How does the challenge put employee, company as well as customers in a worried situation? Is the challenge appears in terms of environmental, economic, or social that related to the logistics sustainability?
Solution taken to address the Challenges related to Blockchain Implementation	**What are your perspectives on solutions that taken to overcome the challenges mentioned previously? Do the solutions effective and further helps in enhancing the logistics sustainability?** **Prompt:** What solutions have been taken to tackle the challenges mentioned? How does the solution be carried out? Does it involve a lot of expenses and workload towards DHL employees and top management? Does it really advantageous in terms of logistics sustainability? **Which solution is the most effective and applicable to majority challenges? How to keep yourselves or the company to remain the high effectiveness when applying this particular solution?** **Prompt:** Why is the solution chosen to be the best and widely implemented when there is any challenge existing? What is the method that makes you high in confidence about the effectiveness of solution?

Closing

Is there anything else you think is important in understanding the implementation of blockchain that empowers the logistics sustainability?

- ✓ Summarise – I will summarize some key points from our interview;
- ✓ Thank you for your kind participation
- ✓ I'll be happy to provide any extra and relevant information and contact you.

APPENDIX 2 : INTERVIEW TRANSCRIPTION

Interviewer: Hi, good evening.

Interviewee: Hi, once again. Good evening. Thank you, good morning. Now I see you and I can hear you. Alright, I can see you, you can see me?

Interviewer: Yes, I can see you.

Interviewee: Okay, that's perfect. So, how is everything so far? How was your doing?

Interviewer: So far so good, I think.

Interviewee: So, are you now staying at campus?

Interviewer: No, I stay at my house. My house is near to the University.

Interviewee: Oh, so you don't stay at hostel. Then, you can save a lot of money. Oh, you are from Melaka.

Interviewee: You are a junior, senior? What are you studying?

Interviewer: I am a final year student.

Interviewee: Final year, okay. So, this is for your FYP.

Interviewee: Alright, so yeah. I believe this might be the interview session, but I prefer more to have a talk. So, you can just ask anything because I already spend this time only for you. So, here is getting to have weekend, so I have a lot of time, so please feel free to ask anything and you can move forward.

Interviewee: Thank you very much. So, now I will start my interview session now.

Interviewee: So, now you are staying with your family?

Interviewer: Yes. I stay with my family.

Interviewee: Alright, sure. No problem.

Interviewer: Because there is some delay due to the unstable Internet, so there might be crash during the talk. I here first say sorry.

Interviewee: Oh, never mind. It's fine. Because right here I hear you everything is fine. I am not sure, but here we are using 5G, so there is nothing to do with here the internet connection. But that's fine. I can understand that. Because I am actually from Malaysia, I live here for awhile, for working here. So, yeah. A lot of things are different in United States and Malaysia. So, alright. Let's begin.

Interviewer: Okay, so before everything starts. Let me introduce myself. My name is Tong Zhe Wei, you can call me Tong. I am a final year student at UTeM who conducting research entitled 'The Implementation of Blockchain Empowers Logistics Sustainability: A case study of DHL Company.' So, I would like to ask for your permission for allowing me to do for the voice recording so that I can do for my transcription later on. Is it okay?

Interviewee: Sure.

Interviewer: So, every data and recording that I get from you will kept for the purpose of academic and it won't expose to the public.

Interviewee: Yeah, sure. I will provide you everything based on my experience working at DHL. But please be noticed that I am not longer working with DHL.

Interviewer: Sure, okay, so I will start our interview now, okay?

Interviewee: Good.

Interviewer: So, what do you understand about blockchain in your capacity? Like the current issues or situation related to it.

Interviewee: Well, as working in logistics background. So, a logistics is a, I can say for logistics is a process which involves multiple parties so that requires to join execution for every process. So, for today we can see most collaboration is connected manually and offline. So, next we use paperwork to transfer shipments, to record, bookkeeping this or that. That is often leads to redundancy and mistake. Only is possible, if all parties work together by sharing the same data as well to create transparency. So, therefore, we find blockchain technology or blockchain initiative to tackle is problem. So, from my previous company, DHL. I worked there for 3 years. we created some system that we applied in blockchain such as network proactive tracking system known as NPTS and another is shipment explorer indicators (SHERLOC). So, we use blockchain mainly for this. So, we build up this blockchain technology system to help cater our digitalization in logistics. So, as time goes by, now we can directly have our business with our customers either business or private artists without any vision from other 3rd parties. So, blockchain technology make

our operation efficient and safer without any mistake. That's what I explained about blockchain technology.

Interviewer: Okay, so can I proceed to the second question? So, what do you understand about logistics sustainability? Like the current issues and situation also?

Interviewee: Well, I did work about the sustainability, and we do have the 3 pillars in sustainability. In DHL, we have the lean logistics. We have green logistics portfolio known as 'GoGreen' mission 2050, it is part of own CSR. We aim to generating values for business and society with this GoGreen program. So, for the mission 2050, DHL wanted to reduce logistics related emission to zero carbon by 2050. That is the main goals. So, in fact issues that we have lately is to convert everything into digitalization. So, there is why we come towards this seat. Cause everything comes with sustainability. So, blockchain could impacted with our logistics sustainability through digitization.

Interviewer: There are 3 pillars for the sustainability, right? The economic, environmental, and social right? So, is blockchain really helps for these 3 pillars?

Interviewee: Yeah, blockchain does involves all of them.

Interviewer: So, proceed to next question. Can you briefly explain how does the blockchain technology implemented in logistics operation. Because the first question is like generally, and this question is like more specific, no need too details but roughly.

Interviewee: Alright, is a good question. So, from what we understand in this globalization era, with the advancement in the fourth industry revolution, DHL do not take this opportunity as granted. What DHL did is, they implemented this technology, blockchain technology to

help in deification and traceability of shipments in addition to fulfil our customers enhancements. So, what did DHL success in Blockchain is when DHL and Accenture, is a company in Ireland. They worked in database management perhaps. DHL and this Accenture company, they created a blockchain-based serialization prototyped with nodes in six geographics to track from the stakes across the supply chain. So, this is the success from DHL. With this the legend tracking vaccines can be shared with all the stakeholders including manufactures, warehouses, distributors, pharmacists, hospitals, and doctors as well. This is how we managed.

Interviewer: So, how does the blockchain actually helps in logistics sustainability? Can you give some examples?

Interviewee: Well, I can say that there are four factors. Four factors where this blockchain technology affects DHL sustainability supply chain. One of it is transparency, where the flow of information to support the supply chain planning and controlling. For instance, the production and distribution. Besides, it eases the efficiency of the shipment where DHL's mission is getting the right goods to the right place at the right time. So, through digitization, it may make it more efficient, and it goes to DHL's motto which is excellence and simply delivered. Other than transparency, it will be traceability. So, where DHL by using blockchain, it can reconstruct the origin and the movements of goods by keep on track of the materials at every stage in that value chain. This element, DHL created, and it will be now as a digitization token for the customers to track the shipment. I am sorry, there is not four, but there should be three. Finally, we have the payment part. So, where the transfer money to suppliers requires efficiency through blockchain and this is very digitalized when we have this kind of digitalized documentation which is conducted by DHL building team. Yeah, so there is three instead of four.

Interviewer: Based on your personal experience, do your think blockchain implementation enhance logistics sustainability exists with your content?

Interviewee: Uhmmm, I totally agree with this statement because as blockchain implementation, it will reduce a lot of waste and increase a lot of efficiency as well as productivity, especially for track and trace of the movement of shipments. Because before this, we have to just using paperwork and we have a lot of problem in that. We have paper waste, and then we have time in waste because of the restructure of the paperwork itself, damaged paperwork so we can't track it clearly. So, through blockchain and digitalization, it will reduce a lot of waste and increase a lot of efficiency and productivity. I am totally agreeing with the statement.

Interviewer: Next, what is your personal experience in the context of the advantages developed from this blockchain technology?

Interviewee: So, my personal experience with the blockchain implementation in logistics industry, it will help us as the logistics providers to boost our confidence and profitable growth which generate positive impact to all of our stakeholders. So, this is the most important thing.

Interviewer: Is blockchain really helps in the 3 pillars? Can you give some examples?

Interviewee: Well, most likely like I said, it affects 3 pillars. But most likely more to economic pillar because it benefits it the most from blockchain implementation.

Interviewer: Do the pillars actually connect? Like although economic is the most important.

Interviewee: Yeah, it is all connected as well. Like, I can say the most weightage for this is economic pillar. Because the others two not really much impacted, but it does have impacted, but is not much as economic pillar. Because when work in logistics field, we involve a lot of money.

Interviewer: Yeah, because through Internet, most of the academic research only focus on the environmentally pillars, so I am curious that is DHL only focus on environmental or it also focus on the economic.

Interviewee: We more focus on economic actually. Although we do touch about environmental like I mentioned like we reduce paper waste. We use blockchain to reduce printed paperwork. We are more to economic because we are profitable company, we want to reduce any cost and increase our profit. Through blockchain implementation, it is a huge impact in the economic pillar itself. But, in public we will support for the environmentally pillar; yet in reality we are more to economic pillar.

Interviewer: Okay. So, how do you think that the advantages can continuously benefits you as well as your company and the employees?

Interviewee: Well, actually blockchain implementation can enhance our supply chain transparency and traceability which means that it can provide end-to-end transparency. It is like blockchain provide single source of the truth by integrating the data from all the stakeholders such as suppliers, carriers until our customers into a single, or one language that all the stakeholders can understand. Blockchain can raise our performance by monitoring our performance history of carriers and suppliers which can further provide trustworthy information of the past performance. From this, we can analyse, compare, and contrast the best supplier or carrier that we use for the overall system as well as the purpose. It can also increase the real time visibility obtained

from blockchain because it is based on transparency which provide real-time information on the events and the status of various transport modes either air, ocean or maybe land shipments. Another thing is through blockchain, it can ensure the security as well as authenticity of the entire supply chain. From this, we cannot have any third parties to intervene our data. We can gain all the digitalized documents in a same characteristic achieved by the cryptographic. By this, blockchain can provide the exchange data and document. Another thing good about blockchain technology, we can detect any kinds of forge in every transaction, because every transaction is visible for all participants. You cannot forge for the data we have; you cannot remove. If someone remove the data from our blockchain, we can detect it very easily. Another point is from blockchain technology, we can also prevent theft. Blockchain contains a lot of confidential information like photo id requirements for pickup or delivery. For instance, when carrier providers want to pickups shipments, they have to give their employee id for security reason. We do have container cases, as well as serial number for the cases. The data that we collected, the photo, certification, as well as the documents, resits, we put it digitized and into the blockchain. So, we can prevent theft from that. Another thing is that we can improve our operation efficiencies. We can improve our compliance like blockchain can combine these electronic login devices which can send data about our drivers' behaviours to the blockchain platform in real time. We are not like in the old days need to wait for one day to update any shipments, because everything is in paper. But, nowadays, by using blockchain and digitalization, we can know on time live shipments. When u want to track shipment or the thing is in transit from where to where, the location, GPS and so on. So, from the operation efficiencies, we can reduce the transaction costs. Through process of blockchain, it helps to provide repetition of transaction as well as the process error, human error by verifying each transaction. Human error, like I say blockchain is also known

as smart contract. This can foster the automation processes and reduce the potential human errors. It can further make it faster for many processes.

Interviewer: So, are there any ways to guarantee the continuous benefits?

Interviewee: Yeah, sure. First of all, knowledge and awareness. When it comes to digitization area, most of us know and aware, but we don't really get to it, most of us are lack of understanding about blockchain. Also, there is potential limited availability of skilled workforce to design, implement, and operate this blockchain into logistics. Not many people know how to build this blockchain, they just heard about it, and they about what is the real thing of blockchain. Another factor is that the lack of trust among companies. Blockchain is actually not really new, it is kind of more than 10 years. But, nowadays people more to start to talk about it. So, it might have a lack of trust in the companies who are nervous about sharing data on an open platform to blockchain. Because this affects the trust and when we say about data sharing, most people won't like to share personal data, shipments data towards public. They are not like to share their information about their goods if they want to transfer it from end-to-end. Another thing is the interroll probability. I think this is the first time you heard about it. Interroll probability means integration issues due to a variety of individual solutions that used from each country involved in the non-existence of standard one blockchain solution. This is the term that we use in blockchain industry. Another factor is the regulation and governance. So, blockchain is already years to behind, but not many people, especially our government, any country, is not just Malaysia but in United States also they have lack of clear legal framework to govern this blockchain transaction. What we know right now is about bitcoin. Bitcoin is one big example of blockchain, but it is not under any control by any government in our world, except for south country in South America. I believe that

they approved this bitcoin currency in that daily transaction but not in other countries. Same goes to Malaysia, same goes to United States. In any blockchain transaction, it has limited acceptable from the universe perspective. So, it is really hard to act as the reference for operating and governing the blockchain solution. So, is way to go I guess to fight for blockchain initiative. Most likely the companies will do it by their own and not doing it holistically, so it is really hard because in the first point I gave you, knowledge and awareness. Because people about blockchain but they don't really understand about blockchain.

Interviewer: So, for you, there is the lack of the ways to guarantee the advantages.

Interviewee: Yes. Most generation like we are governing by the x-generation and baby bloomers, and they don't really like changes. So, I believe another 5 years, blockchain can be more successful.

Interviewer: So, are there any challenges faced when implementing blockchain while aiming for reaching logistics sustainability?

Interviewee: Well, I can say most companies more to financial burden. Blockchain is a new thing, even though is already long time ago, but for many companies in logistics especially from my perspective, is the financial burden. When we talk about investment or risk management, most likely they choose to be safe, to do whatever they do right now. They don't want to invest in blockchain because right now we heard about our instability of economic, inflation and more. I can say that financial burden is the main cause because if you want to start making blockchain, you have to invest a lot of things, because blockchain is not an easy thing to do, you have to do a lot of research and a lot of 'try an error' to implement this blockchain. It is say to be complicated at the beginning, but when any company invested for this, it is really worth it because is for the long-term

exist, this is called sustainability. But, from my perspective, many companies will not do it because of the financial burden.

Interviewer: So, are there any more challenges besides financial burden?

Interviewee: Well, like I say earlier. Back to the basic, when people don't really want to know about this, they think that this thing is quite complicated. They don't want to make them trouble especially in logistics. In logistics, our mindset, they will talk about reduce cost, high impact meaning that reduce cost, increase efficiency, and productivity. When we talk to any logisticians or logistics company, they might consider about this. So, this is a good advantage for invest in blockchain technology because of the knowledge and awareness as well as financial burden is less rather than other small companies like JnT. I believe that they would have blockchain technology, but they just doing in the old ways.

Interviewer: Following up next, what is your perspective on the solution taken to overcome the challenges mentioned previously?

Interviewee: When we talk about to invest or taking risk, many people afraid to make changes especially global level, unless they are big companies like DHL, Expediators, or FedEx something like that. My personal view will be when there is a high risk, there will be a high return. People will take it safe especially nowadays as we are having a bad economic situation right now. So, people will play safe risks.

Interviewer: So, means that they won't take any solution?

Interviewee: My solution is if you take the risk, invest in blockchain technology, you will be sustain in the future for a long-term, in the short-term it might be risky, but if you have better understanding to blockchain

technology, the advantages for it. Then, you will be success in the future.

Interviewer: So, what you mean is like to be brave to take the risk isn't?

Interviewee: Yeah, that is what I mean! Because blockchain for me is very safe. It is not like a normal thing or normal tracking stuff, blockchain is a different thing.

Interviewer: As what you said, we need to be brave to take the risk. Are there any ways to encourage people to be brave enough to take these challenges?

Interviewee: Through knowledge and awareness. We have to make people understand what is real of Blockchain. Pull and enhance about blockchain. Like I said, people just know about it, but they didn't really know. They know the term but didn't understand. When we talk about Bitcoin, not many people invest in Bitcoin right? Like, I know Bitcoin, but I don't believe it is safe. Same towards this case when we try to talk about blockchain in logistics, they don't want to take risk because they think only think about loses and not about sustainability in future.

Interviewer: So, that's the end of my question. Do you can anything maybe some extra information to add on like to boost for this?

Interviewee: Well, I would like to say to all the stakeholders or companies or personally, if you want to go for blockchain or think about sustainability in your business or in supply chain and logistics industry, you have to do these 3 steps means 3R which are reset, reform, and regain. If you think that something is not going right in your life or in your business, take a break for awhile, reset, then reform is like you restrategized for your life, and for your business.

Once you know that you tend that, you go for it means regain. Always do reflection on our performance versus our waste management because we want to eliminate as much of our chorus, any waste that we have through our operation level. So, like in logistics, we usually have waste of time, waste of energy, and waste of resources like paper. When we have the digitization as well as blockchain, we can eliminate all these 3 wastes. We don't use any manual paperwork, we only key in the data online. So, reduce cost, reduce effort, reduce time. Final solution that makes change for a better rule. I always implement six-sigma rule, this is a continuously improvement process. It will cost for certain company if they want to implement this six-sigma rule process, it will high in investment, but put that risk to pay on, why not? Because if you invest something for it, good things in the future, is really good for it, really use for it. For 6- sigma rule, the main objective is to eliminate any kinds of cost and improve efficiency throughout the supply chain.

Interviewer: For you, is the blockchain really good and should be implement by everyone?

Interviewee: Yeah, everyone! Not only for logistics, but for everyone. We talk this earlier about blockchain is the secure way and it reduces a lot of cost. It can reduce forge and a lot of good things that I mentioned earlier. The only bad thing that we have for blockchain is just the investment cost to start investing blockchain process.

Interviewer: Back to the topic about the challenges, is there any challenges regarding the lack of technology for blockchain to be implemented?

Interviewee: Yes. The main reason for that is we don't really have a lot of people who know about creating this blockchain technology, because it requires a lot of experts, not just for computer sciences background, statisticians, accounting, and more. The challenge is that we are

lacking that and we trying to create someone who be able to reificate this thing. Because even though is still long, but not many people go for it. Most people just know how to do coding stuff, but to create this kind of technology is quite complicated, and not many people want to to go for it. That is the main challenge. If we have a lot of people who able to create this kind of technology, it is a gain for that. Because we don't have any kinds of blockchain courses or degree, it is just a basic of programming or coding. But blockchain requires a lot of things, it is complex, and a lot of algorithms, cryptographic, everything is including that. It is a complex technology, but it is great to have it! So, there is the challenge that we are lack for expert of that.

Interviewer: So, for DHL, does the company take any action such as collaboration with other companies or like hires more experts?

Interviewee: Yeah, like I mentioned that DHL collaborate with Accenture which is a company which focus more on data management. So, DHL and Accenture created this blockchain technology. DHL have their innovation office. Although they are built at first, eventually they collaborate with Accenture to create a better technology for that.

Interviewer: Are there any examples which DHL able to collaborate with their customer through this blockchain? For example, last time I did some research from the YouTube, there is a video shows that DHL collaborate with BMW through this blockchain. Can I know like how they actually work, and the advantages?

Interviewee: Okay, so from blockchain, we can create language for all participants. Let give you an example like Accenture. Accenture helps DHL to make blockchain which help for pharmaceutical products. Any medical and pharmaceutical products that shipped through DHL can be tracked with all stakeholders regarding to

medical health. For BMW, it is the same thing. But, that one for automotive. What we have in our blockchain, is we have the special codes, we called it as aerial number or house view number. From that number, is like a tracking number, but is a special number that we can shared within the stakeholders, not for outsiders or third parties. If other third parties got this code and try to look for it, they won't have the visibility. The visibility is only for these stakeholders. So, in the case of BMW, only the BMW and DHL stakeholders are visible for the special codes. DHL as the logistics supplier, and BMW is the supplier, customers. Supplier for the raw materials is BMW, they shipped the raw material through DHL from the BMW factories. So, these all stakeholders can track the shipments, they can find anything related to the shipment, documentation, photo id, shipments status, tariffs, and decode term, HTS (Harmonized tariff system) for custom purposes. So, everything from A to Z was included in this blockchain technology. The language is through every member. DHL and Accenture are only for pharmaceutical. For BMW case, it is for automotive, for BMW supply chain. It is specialized.

Interviewer: Okay. So, all in all, you think that blockchain is really helped in the logistics sustainability, right?

Interviewee: Yes, that's right!

Interviewer: Before we end our interview session, can you make a brief summary about the blockchain empowers the logistics sustainability? Like regarding to the DHL company.

Interviewee: Alright, blockchain technology is something that created to make our data secure, more likely to have high security level for any data sharing within our stakeholders in any kind of business. This is the main intention of blockchain. When we started this blockchain, we

found out that it is not just about safety and security, but it is more to reduce waste and increase efficiency as well as productivity. Everything is digitalized. Through blockchain, we didn't have any paperwork. We go everything online and we have big data. So, from that, it will create sustainable stuff of any businesses especially in logistics, because we cut off paper waste, cut off time, cut off any human error through blockchain. So, this is the simple explanation for blockchain and sustainability. But the biggest challenge for blockchain technology is the investment cost in blockchain technology. It is hard to start or build up this technology because when you want to go for it, you need to invest, especially financial and sources like experts, who can build this technology, and knowledge and awareness for this. These are the 3 big challenges that we have. Like I say, if we know that is a high risk, there will be a high return, it is a long-term thing, long-term profit and long-term sustainability stuff for blockchain which have to be positively implemented by any other businesses.

Interviewer: As what you said that financial risk is the most burden risk, so is there any way to overcome it?

Interviewee: Well, it depends on the kind of businesses. If big companies, there might be not a big problem for them. But for small companies, yes, it is the problem. Because have to invest, the money is not just to build the blockchain. Bringing the blockchain technology, we have to like the server, we have to create some software or even coding. It is not for free, everything counts. Hired people which have expert in this kind of technology because it is quite rare. It is not a normal basic like accounting, or bookkeeping stuff. It is a different thing; it is really cost a lot initially to start the blockchain technology. But, to maintain blockchain technology is another cost. But the most cost that we use is to start, to invest, to regain this blockchain technology, because a lot of things you have to pay for. Also, you need to have

the server because blockchain have the cloud system, but cloud system has to save in the manual server like a server right. We distort all the data inside. There is no such thing of cloud server. It might have the main server, so it also cost a lot for that.

Interviewer: So, for those small companies, is there any way to help them out from this financial burden? Maybe collaboration with low cost or get some financial assistance from government?

Interviewee: There are a lot of ways, just like you mentioned. Collaboration is the best way I can said. Collaboration with other companies as well. There is a risk for their sustainability. When we collaborate, everyone wants to have the same share for it. Another thing is that asking for government financial assistance, it actually helps. If that small company smart, they have those experts can deal this technology, this will reduce the initial cost a lot.

Interviewer: For example, the big company such as DHL, what is their burden instead of the financial burden? As they are a big company, they are not worrying for their financial problem.

Interviewee: The second challenge for DHL is most likely is the knowledge and awareness. DHL mostly are not the young generation here. Even the top management are baby boomers. But they still taking risk for that. So, not all employees in DHL can understand blockchain. Only the ones who work with data management like me, I work for 2 years, and I understand about it, blockchain. But, for the deliveryman, I don't think they know about that. Only who works with data know about it, whoever didn't work with data don't care about it.

Interviewer: Do you have more ideas about the sustainability with blockchain? More elaboration on economic or environmentally.

Okay, like economic thing. We can reduce a lot of cost because any human error, any delays, any problem in paperwork such as damaged of paperwork without blockchain, it might cost a lot for the company. It might cause a loss because we have to pay for the compensation for our customers. For economic plus environment, we can reduce paper, we don't have to buy the paper. For example, we do use sticker for labelling, and yet the sticker is not cheap as it is a must to use water-proof kind of documents and stickers. But, since we have the blockchain technology and digitalization, everything is cheaper because we don't have to pay for that. So, environmental, they practice paperless. We more use to have online data.

Interviewer: What about the social pillar?

Interviewee: What I can understand is that through the shipments, they touch every process. With the blockchain technology, they can reduce any theft, data theft, data forge. Meaning that someone cannot remove any kind of data such as the airways bill number. For instance, we have origin team and destination team. Origin team send 10 documents about the shipments like the incoterms, tariffs, details and more. Suddenly there is one employee from the branches or from the origin division wants to remove one of the documents. From this, the blockchain technology can detect clearly who remove that document. Everything is encrypted. This means that blockchain can detect any forge, reduce theft of data, and increases the security level. So, it is like more to the social pillar. Does it make sense?

Interviewer: I think it is.

Interviewee: I guess it is. It is more to the ethical values for that. So, blockchain technology can make things traceable, make things transparent without any hidden things inside it so it is more towards social.

That's why blockchain technology has all of the sustainability pillars, but the main thing is more towards economic, because it can reduce a lot of costs.

Interviewer: I think this is such as a good example. Yeah, I think should be enough for my research project.

Interviewee: That's cool. It is great to hear that!

Interviewer: So, afterwards I am not going to asking you any questions.

Interviewee: No worries, cause I actually very happy to help you as a student as I was like you before.

Interviewer: Great to hear that! I really appreciate a lot for your help. It really helps me a lot for this research.

Interviewee: Yeah, I appreciate that you find me. Feel free to ask me anything if you wish. You can contact me through any mediums you prefer. No worries for that cause I am happy to help you for the research.

Interviewer: Sure! Thank you Mr. Aiman. I really appreciate it. I think we come to the end for this interview session. Once thank you very much!

Interviewee: Sure, wish you have a nice day, nice weekend!

Interviewer: Same to you, wish you have a nice day and nice week ahead you. Take care for working at overseas.

Interviewee: Alright, thank you so much! Is really a pleasure to meet you, Tong! All the best for your studies, goodbye!

Interviewer: Thank you! Goodbye!

INTERVIEW TRANSCRIPTION

Interviewer: Hi, Mr. Erik.

Interviewee: Hi, Tong. Nice to meet you.

Interviewer: Nice to meet you too, Mr. Erik. Thank you a lot for willing to have a talk with me for my help of research.

Interviewee: Ehem, thank you very much for choosing a fantastic subject.

Interviewer: Yes, of course. Because in Malaysia that is less of the knowledge about blockchain. So, that's why I wish to choose this to help maybe the people around me to get more know about this blockchain so that's why the reason.

Interviewee: Absolutely.

Interviewer: Okay so before everything starts, I would like to inform you that there's some changes for my topic which the last part for my topic is about a perspective from logistics service provider. So, I have changed it into more specifically like a case study of DHL company, but you can just provide me any information that you wish.

Interviewee: Okay, not a problem and I know a bit about the DHL blockchain solution that already exists. We are actually speaking with some people from DHL in the new year. So, if all goes well maybe I can introduce you to some blockchain people at DHL.

Interviewer: That's great for me, I think. It's great to hear that. Okay. So, before everything starts, let me first introduce myself. My name is Tong Zhe Wei, you can call me Tong. So, I am a final year student who undergoing my final project research about 'The Implementation of Blockchain empowers logistics sustainability: A case study of DHL Company'. So, before everything starts, I would like to ask for a permission for allowing me for this voice recording so that I can do for my transcription later on. Every data and information that I obtained from you will be keep confidentially for the academic purposes unless it is under your permission for like maybe to share to other people, the community. Is it okay for you?

Interviewee: Oh yes, I agreed to being recorded and yes, I agree to you sharing information.

Interviewer: Sure, thank you a lot. So, is there anything you wish to ask for me before the interview section begin?

Interviewee: No, I don't think so. I know that you had sent me your questions, so I have those questions remain the same or are they changing a bit?

Interviewer: It is remaining the same.

Interviewee: Remain the same, okay. To be very honest I didn't look at them I knew that we would be speaking so I wanted to keep them fresh.

Interviewer: Sure, no problem for that. Okay, shall we begin now?

Interviewee: We shall.

Interviewer: Okay, so, first what do you know and understand about logistic sustainability? Is there any current issues or situation related to it?

Interviewee: Absolutely. So, my background comes from the logistics world. I have about 30 years of experience with logistics. My background is with freight forwarding and customs brokerage in all modes of transportation right. So, I've done ocean freight, I've done air freight, I've done tracking, I've done rail throughout my career and from a sustainability perspective all this is very new to the industry. The industry has not been talking about sustainability for a very long. We as an industry, we are starting to talk about it because the consumers are more educated and want to know more about the impact on the environment of logistics process of our products in general right? So, it's about visibility and it's about understanding our individual impacts and that again is not something that the logistics world has been talking for a very long time. So, now the industry is at a place where they need to understand their impacts and that's what the industry is doing now. As they're starting to measure, right? In the past, they haven't measured their impact, or they, you know recently they've started, but in the you know more distant past, we were not measuring our environmental impact so we didn't know how sustainable or not sustainable the industry was, right?

Interviewer: Yes, so is that like what I get from internet is about logistics sustainability, it links to three pillars which are the economic environmental and also the social. Because I've been searching that most of the articles, the research is about environmental, is it exactly logistic is link to the environmental pillar or maybe more to the economic pillar?

Interviewee: Well. It's a bit of both right. Because when you take into account the meaning of the ESG. It's environmental, social, and governance, right? Good rules, so governance is about having good rules but where the consumers and where most people think when they think

of ESG is the environmental part, that portion right? Because we've been talking about climate change a lot more lately. In social circles, the united nation has put forward a list of sustainability goals for 2030, so people are aligning with those goals but a good portion of those goals are environmental, So, air quality, water quality, reduction of carbon to power or you know our energy resources. So, the environmental portion of the ESG, the e-portion of the ESG seems to be more important and I think that's where the industry, the logistics industry can have a bigger impact. As we know large ships use a lot of diesel right to power themselves, airplanes, they use a lot of carbon-based fuel right? And we have a lot of boats, and we have a lot of planes, and we have a lot of trucks in the world. So, that's where the industry can have the biggest impact. Then, we move on to social impacts where you're giving, you're training everybody with respect and you're equal in the economic development of certain industries like the logistics right?

Interviewer: Okay, so as what you speak just now, so you as a logistic expert, what can you generally tell us what is about blockchain and maybe some issues for that?

Interviewee: Yes, from a blockchain perspective, blockchain is just a technology. It's a technology that lends itself well to auditability, right? So, each block of information can contain that. I mean, I'm sure that you know the principles of blockchain right? So, I want to explain that to you but it's a great tool that we haven't used in the past to measure across different trading partners. So, in a logistics process we're in a supply chain process, you have many partners involved right? From a manufacturer and that manufacturer might not be the complete manufacturer. It can be tier one, tier two, tier three manufacturers assembling different parts from all over the world, being shipped from all over the world to you know a location where it's assembled like our computers, like our phones, right? These are hundreds of

different parts that come from all over the world shipped using carbon to ship those then assembled then transported as a finished good across the world into big warehouses then shipped again by truck then finally maybe getting to the consumer. So, the environmental impact and measuring the carbon use of all these trading partners is well where blockchain can play an important part because there's no tool that makes it easier than blockchain. There are other tools that can be used. You can use Excel spreadsheets if you want to but it's going to be very complicated right? Blockchain makes it a bit easier to track information across several business partners.

Interviewer: Okay, so from what you say is like generally. Can you maybe provide some information about how like does this DHL company that's actually implementing this blockchain for the use of this logistic operation?

Interviewee: Specific to DHL, I don't know yet. I haven't had the conversation with them yet. So, I will ask that, and you can hopefully ask that as well. But, if I look at my experience with the industry even someone like DHL will use multiple trading partners right? So, DHL, what we know is the yellow trucks right? That are everywhere and they are Global. That is only one small portion of the overall DHL business. They are also a logistics provider that uses, outsourced companies or steamship lines or different airlines, it's not just DHL airplanes they might be using Qantas Airlines or Malaysian Airlines or American Airlines right? To move their cargo globally as a logistics solution provider and tying all these different parties together from again a different trucking company to different warehouses to different modes of transportation to maybe customs to delivery to warehouse at the end at the retail side might involve a you know sometimes dozen of different modes and outsource companies. So, tying these together in a better way being able to

capture different information is probably something that DHL is doing with blockchain.

Interviewer: Okay. So, I have been searching, doing the research, is talking about when we talk about blockchain there's like the data transparency and traceability, the security something like that can you maybe give some small explanation for that?

Interviewee: Yeah, absolutely. So, from a blockchain perspective, blockchain is a computer protocol, right? It's a layer of technology. So, if you want to start very basic, it's a layer of technology. You have the technology that's behind the internet right? The computers talking to each other it's called TCP/IP, that's one protocol. Above that, then you have blockchain which is a shared ledger right? Shared between you and I. I have a copy of the ledger, you have a copy of the ledger and if we're 10 different business partners doing business together we all have the same copy of the same ledger that's updating at the same time. And then you have smart contracts which is another layer of technology that automates the sharing of this information. And then you have what we see on screen right? The user interface or a mobile app or a web browser right? So, these are different layers of technology blockchain is one of those layers. Again, I touched on the general concept of the distributed ledger. So, a ledger is just a record of transactions. Like your bank accounts right, it's a record of money going in, money going out, hopefully there's more coming in right? But it's still a record of transactions and a distributed ledger is the same principle. It's electronic version. It uses cryptography so it is secure right there's a consensus algorithm. Always a difficult word even for me. And since we're all in, we're all sharing this ledger at the same time it builds trust because if I update something you see it instantaneously, right? You see it, so you would hopefully trust that I'm doing the right thing and if we're 50 people more than 50 have to agree to this information. So, it is a trust mechanism. So, it's a way

to share trusted information between multiple parties at the same time, in a safe way using cryptography. The other aspect of the distributed ledger is the blockchain right? Like I mentioned earlier, it's a chain of blocks of information all attached to one another by again the technology by the consensus. So, you have timestamp, you have an audit trail between all the blocks, and that again can share you use the right word transparency and auditability. So, by sharing information, it have the transparency by the blockchain mechanism the chain of blocks, we have the auditability because we have a trace of the changes to the information as it progresses through a logistics process or a supply chain.

Interviewer: Okay, so how was the application of blockchain actually helps in this logistics sustainability like link to each other?

Interviewee: Specifically, to sustainability. Again, it's about measuring something that we haven't measured before right? So, again if you we use the DHL example of many different partners involved in that logistics process. Well, typically each of these partners would have their silos information, they will have their silos computer system, that's not necessarily talking with each other. So, that makes it very difficult to actually count and measure the environmental impact as we move forward through that very complex logistics process. So, if I'm party number one, your party number two, I have information in my system, I have to make a very big effort to give you all the information. Then, you have to recreate that information in your computer system. So, imagine if we're 12, 15, 20 different parties reconciling that information between all our computer systems is very difficult right? It's time consuming, it's labour intensive from a human standpoint and sometimes you lose the information as you recreate it in somebody else's computer system. So, that's where blockchain plays something very important is that we're not recreating information between all our systems, it's shared between

all the parties at the same time. So, that makes gathering information more easy, it makes a good tool to trace the environmental impact between all these different parties. So, again, if I'm number one, I know my environmental impacts, you know yours, but at the end the product we would have to reconcile all these bits of information to give a proper study of the environmental impact at the end for the consumer.

Interviewer: Okay, I got your point. It is a good explanation, I think. So, can you provide some um information about the advantages when you implementing this blockchain?

Interviewee: Of course, again we talked a bit about it, One, is the reconciliation of information between data silos, right? So, between computer systems we don't need to do that. Two, it is digital, it's not paper based, so we can program it, and we can automate this digital information. Three, it saves an incredible amount of time. So, in a logistics process, if I'm shipping something to you in Malaysia by boats right? Again, I have to do my documentation, put the shipment on the vessel, it crosses the ocean. I actually have to send you a physical copy of the bill of lading, the principal documents in a DHL envelope overseas. So, you can receive those goods right? So, if DHL loses the envelope, then there might be delays. If I provide you the wrong information in my original set of documents, I have to create a new one and send it to you again. So, that might create delays right? So, relying on physical paperwork is very expensive, it's very time consuming and it's prone to delays. And using digital information instead, is another advantage where we can save some time, same sort of costs in the logistics process. And going back to your ESG, of course well then, you can measure what you were not measuring before.

Interviewer: So, you think that blockchain is actually more linked to economy pillar, right? Is it?

Interviewee: I think it has the transparency, very important economical impacts. Absolutely. And I can tell you about other proofs of savings, money savings. By using blockchain instead of other processes, so going back to your question yes economic it can have a direct economic impact.

Interviewer: So how do you think that those logistic service providers can continuously gain those advantages for their company or as well as the customers?

Interviewee: So, a logistic service provider is in the middle of a process right? And they use, like I mentioned before, they use a lot of different parties to accomplish what they're trying to accomplish. So, by optimizing and automating some of their data processes, they can save money. I gave you the bill of lading, example, by paper. By going digital, you can save money, then you can save time, and you can save money and you can save penalties maybe from customs by being digital instead of paper. And again it's collecting information that they were not collecting before from an environmental perspective and sharing that information with other parties.

Interviewer: Okay so for you is there any challenges that face when implementing this blockchains while aiming for reaching this logistic sustainability?

Interviewee: Oh, absolutely. Blockchain is still at very early stages in development within an enterprise setting. The actual technology is a bit proven for 10 years, 20 years, 30 years, right? Cryptography is a proven technology. But from a business perspective, we are only now starting to use it. So, understanding the technology is challenge

number one. Challenge number two is having access to resources. Big companies have programmers that can program a blockchain solutions, but if you're a smaller company, you don't have the understanding, and you don't have the resources or the money to start programming a blockchain solution right? So that's challenge number two. Challenge number three for me is a bit regulatory where if you're dealing with a bank for example, and that bank or that government like customs is not mature enough from a technology perspective, then it makes it difficult to change the direction of a bank or a government right. I mean the government of Malaysia, I'm sure is advanced, you have governments in Singapore that is advanced, you have governments in China that are advanced. They understand technology they have the tools, but that's not true for all the 200 something countries in the world. You have some countries that are not as advanced from a technology perspective. So, trading with those countries or importing or exporting to those countries might make it difficult if you have a blockchain solution.

Interviewer: Okay so which challenges actually finds you the most burdened and what kind of burden actually it is? Maybe financial burden like what you say just now about the small company and a big company is it the most important challenge for you?

Interviewee: I think that right now where we stand the most burdensome challenge is really understanding what blockchain is? When you hear blockchain, what do most people think about? Bitcoin, right? Cryptocurrencies. But that's not the case. So, understanding how the technology works, understanding that for some solutions, it's the right solution but not for every solution. You can still use EDI, you can still use API, you can still use Excel spreadsheets for certain solutions. So, understanding the technology, I think is the biggest barrier that we have right now. And then resources, absolutely,

right? Not everybody has a coder that can understand this new technology and implement it in a digital way.

Interviewer: Okay, so for the challenges that you mentioned previously is there any solution taken to address those challenges?

Interviewee: Yes, so from an education standpoint, again you know this is what we do at the association. We do a lot of education, we do webinars, and workshops. We've built a course for logistics professionals to understand the business implication of blockchain technology. So, learning about the technology, learning it from a business perspective and not a coding perspective is one of the steps that we take. Second is advocacy. Where we talk with policy makers to understand their priorities, and we bring the priorities of our members to those policy makers and policy makers can mean a lot of people right? Can mean governments that impact supply chain again like customs or transportation agencies. In the USA, it might be FDA, Food and Drug Administration, people who regulate but it can also be other policy makers such as ISO, the international standards organization. So, they set business standards so impacting those business standards can be a good resource and then having a standard framework for the way that we do business which is not something that exists globally right now. Different countries use different standards, or some countries don't even use any standards. So, from a standards perspective, standards are there to help businesses do business together in the same way. So, if there's a standard for something, you follow it, I follow it. Then, we know what we're talking about. So, standardization is also very important. And of course, continuing to work together on different problems even from a technology perspective or a business perspective is very important. But education absolutely number one, advocacy working with policy makers number two.

Interviewer: So, from what you see mentioned just now, is it actually collaboration is one of the ways to tackle these challenges?

Interviewee: Oh yeah, absolutely. I mean if we're working together towards common goals, instead of always competing against each other. Then we can make progress faster, right? A lot of people used to use the word coo-petition, collaboration cooperating but in a competitive environment which is business, right? We're here to compete after all but we need to collaborate towards a common goal to move those goals forward. So, if two competing, airlines try to destroy themselves all the time, nobody is going to win right? As they work together and share certain problems together, then they can maybe advance those goals together. So, collaboration is very important.

Interviewer: So, I have been doing research about this DHL have been collaborating with few MNC companies like this Accenture, like BMW. Do you know more about that about this?

Interviewee: Again, specific to the DHL case no. But I know that the automobile industry is very much using blockchain. BMW, Mercedes, Tesla, of I know in France are all using some components of blockchain for different reasons. For example, a lot of automobile companies are producing electric cars now. And if you produce the batteries that go in these electric cars, a lot of the base materials like lithium, like Cobalt. We use Cobalt to eventually build batteries for electric cars. A lot of the worlds, Cobalt today comes from the Congo in Africa. In the Congo in Africa, unfortunately, there's still a lot of child slave laborers in mines. So, they use children to mine the minerals which will eventually become a battery that goes into an electric car. So, does Volvo or Mercedes or a Tesla want to be caught with child labor in their supply chain and slavery in their supply chain? No, they don't. So, they use blockchain to trace the minerals from the

mine through the many different steps of their supply chain and transformation of the Cobalt that will eventually become a battery in the car. To like tracing all these steps from the line itself, they can prove that there's no slavery involved in their supply chain. That's one-use case. Another use case is actually getting rid of the paper documentation, and this is what I know automobile did. I know wants to track the compliance certificate for many different parts that go into another build your average automobile has about 30 thousand different parts that come together that become a car, right? So, managing the compliance certificate for all these parts is very difficult, because they need to have compliance certificate for every market that they go to. So, think of an airbag, well an airbag needs to be compliant with the regulations of the country it's going to. So, North America they can have one set of regulations, in Europe they can have another set of regulations, and in Asia they can have another set of regulations. So, managing all the paperwork for all these different markets that they could they go to was very complex using paper. But now using blockchain they can trace easily these parts better and they can keep these the compliance certificate for all the markets that they're going to in an electronic form through again manufacturing and different vendors and different manufacturers and different plants and different markets.

Interviewer: So, I think that is the end of my question. Do you have any more maybe advice or maybe you can make some short summary for that, how does blockchain actually helps in this logistic sustainability

Interviewee: Uhmm, again for me, the main points to remember is that we need to understand the technology. It's not about Bitcoin, it's not about cryptocurrencies. We need to understand it properly, and we also need to do business in different ways again you know, I kind of explained that earlier we're always used to having a little computer system and looking at business like this right, and I do my thing but

I don't care what I'm doing. Uh, you know with my business partners, well, we need to open our eyes and we need to look at sustainability as an important portion of our supply chains and the way that we do business with our trading partners as well, we need to do things differently if we're going to affect change

Interviewer: Okay, so for me I think that sufficient information that I gained from you because you are really professional enough. So, I gained something that I couldn't get from the internet. So, I really appreciate this opportunity for having a talk with you. Yeah, it is my pleasure.

Interviewee: Well, it's my pleasure as well and if you have other questions that come to mind, you have my email, or we can use LinkedIn. Feel free to reach out anytime, and when I talk to DHL in the, I think second week of January. I'll suggest that if they have time, they can talk to you.

Interviewer: It's okay because my due date for this research is maybe four weeks more to go, so it is okay.

Interviewee: Okay, check what I'm talking to him because he's on vacation, he's out of the country, but let me just check when I'm talking to him and if it works, it works.

Interviewer: Never mind, you can just share information on your maybe LinkedIn profile because I have been using LinkedIn for awhile and then whenever I see there's blockchain, I'm very interested to look for it. So, I hope in future I can be taking part, involved in this supply chain particularly for this blockchain, for the better future, I think.

Interviewee: Absolutely. You know we have a variety of different LinkedIn Pages for the association. So, we post on there all the time, go follow our

pages and again if you see something and you have a question just send me a message and it'll be my pleasure to try to answer you.

Interviewer: Sure, thank you a lot. I try my best to help the Malaysians as well as the global supply chain about this blockchain.

Interviewee: Hey, who knows maybe you'll start the chapter in Malaysia.

Interviewer: I don't think so. I will try my best, but I don't think I can make it. But I will try my best.

Interviewee: Alright, nice speaking with you and good luck with your project.

Interviewer: Thank you. Same to you too. Have a nice day.

Interviewee: Have a nice day.

Interviewer: Okay, thank you. Bye-bye.

Interviewee: Bye.

INTERVIEW TRANSCRIPTION

Interviewer: Hi, good evening, Miss Ho.

Interviewee: Hi, good evening, Tong. Nice to meet you!

Interviewer: Nice to meet you too! So, how was your day? Because it might be quite busy right now since it is the closing for the end-of the year, right?

Interviewee: Yeah, so like, I mean as you know like people got holiday during year end so it can be quite busy in the office, but I think not bad, how about you?

Interviewer: I think, I am not bad too right now.

Interviewee: Great to hear that. I heard you are doing your research for your, I mean I am not too sure what is your project about, but I think definitely later you can talk more about your research right? So, how was your research doing now so far?

Interviewer: So far, I am still in the process to collect more information, so that's why I'm approaching to you and ask for your knowledge about blockchain which is related to my research.

Interviewee: Alright, okay. I hope I can help you, but I am not sure if you can hear, I am actually not feeling very well now. So, I hope that you can hear my well. I mean like I sounds a bit weird.

Interviewer: It's okay.

Interviewee: Okay. I will provide you as much information as I can, but of course like I am not very experienced in this, so everything is just based on my experience in DHL.

Interviewer: Yeah, thank you very much. So, shall we begin our interview session right now?

Interviewee: Sure, please move on.

Interviewee: Before everything start, let me introduce myself. My name is Tong Zhe Wei, and you can call me Tong. I am a final year student who conducting my final year project entitled 'The Implementation of Blockchain empowers logistics sustainability: A case study of DHL Company'. So, the aim for this interview is to gain some information from you regarding the blockchain technology as well as logistics sustainability. So, I would like to ask for you permission for allowing me to have the voice recording for that I can do for my transcription later on. Every data, information, as well as recording that I obtained from you will be used for the academic purposes and it won't expose to the public, so is it okay for you?

Interviewee: Sure, no worries for that.

Interviewer: So, let's get started with the first question. What do you know and understand about logistics sustainability? Are there any logistics sustainability related issues?

Interviewee: Well, I think logistics sustainability is one of the hottest topics nowadays. So, I think that logistics sustainability is more to the ways on how to sustain or ensure a more efficient logistics performance. So, for DHL, we do focus on sustainability and like zero-emissions

has always been our target. Not sure if you know there is a green logistics solution in our company named ‘GoGreen’ 2050. So, is like aiming to create a transparency supply chain and logistics, to minimize the CO2, carbon dioxide footprint in ocean freight, as well as carbon emissions in air freight and more. So, to make up this project to a success path, the innovation team in America have been making a great effort, so they invest for zero emission technologies and fuels like the electric vehicles, biogas, and the so call Bio-LNG and more. So, hopefully by 2050, we are able to achieve one of our missions which is to achieve net zero emission.

Interviewer: Okay, I understand. So, the second question is what do you know and understand about blockchain technology in your capacity? What are the ways, I am sorry, what are current issues or situation regarding blockchain technology?

Interviewee: Generally, I think blockchain technology is a distributed ledger system that used to for data control. So, it is used to record every single transaction between parties in a secure yet permanent manner. It is like by ‘sharing’ databases between multiple parties, connecting participants with different purposes for a connected business transaction. Blockchain is actually removes the need for intermediaries who were previously required to act as trusted third parties to verify, record or coordinate transactions. Honestly, blockchain is still in its infancy level as compared to others innovative technology. But it is getting attention from every industry especially logistics and healthcare industry. So, like using the highest levels of encryption and data protection to greatly improve service efficiency and quality is the prior things that emphasized the most by those stakeholders especially for those patients and medical companies. They always think that privacy is the things should come first. Because when you look at the data statistics, the internet usage and misuse of data have been increasing for recent years, in fact it

keeps on increase year by year. So, it means that the massive amount of data and information that going through the Internet are having the risk of data leakage, having more data security issues. So, with this blockchain, it is kinds of means that we can share the data more safely.

Interviewer: Okay. Nice! So, it is a clear explanation for me. So, please provide more information about how this blockchain technology being implemented in your logistics operation?

Interviewee: Yeah, sure! First, I think, obviously blockchain is mainly used for the data traceability and transparency. It guarantees every single record or transaction are exact, alter clear, and from an irrefutable source. Rather than numerous parties keeping up with their own dataset duplication, every partner now gets controlled admittance to a common dataset that making a solitary wellspring of truth. This means a certainty is given to everybody who is working with this information. So, they are utilizing the latest, precise, and dependable dataset. In blockchain, there is less worries for data leakage as all the data is accessible in such as a secure process, the complexity of information is always secure, and it is always real time. So, the security systems ensure that singular exchanges and messages are cryptographically signed. This guarantees fundamental security and feasibility, thereby assisting the executives to handle the current high dangers of hacking, information control, and information fragmentation. So, this proves that the data transparency provided by Blockchain really works for protecting data information. The second point is that blockchain is used for the asset management. Because it can be utilized to deal with the responsibility for resources and work with resource moves. For example, it tends to track the ownership of the title or goods like land titles or certifications as well as the rights, the so-called copyright and privileges. It can even be utilized to deal with the computerized twin

of an actual product or goods in reality. Also, we talk about smart contract when it comes to blockchain. This is the interesting part about blockchain actually. So, the smart contract in blockchain is an automated process that helps in increasing the efficiency of the entire supply chain. The digitized documents and real-time shipment information which are shared within the blockchain system is the key to the success of smart contract. So, once the pre-specified conditions are met, the trade or next step is automatically triggered. Transactions will be automated through "smart contracts" helps to increase the efficiency and further speed up the process. This means that it can reduce human intervention and reliance on third parties to verify that the terms of a contract have been met. So, like I mentioned before, blockchain can track the ownership of the title or goods, so smart contract can also help in transferring the ownership of the goods or titles. So, it is like transferring a kind of digital key from the existing owner to the new owner. Another point is the cryptocurrency payments. It is like an alternative digital payment method which is actually more reliable as compared to things like credit cards that we are using. Although it is not getting a lot much attention in the world, but it is getting more attention that before. Some countries like Central African have recognize this Bitcoin as the legal tender. So perhaps the logistics company especially those at the global level should start to consider this alternate digitized payment method for the ease of their customers, and for a more reliable way of making payment.

Interviewer: Okay, so it sounds that blockchain more to ensuring the data privacy, transparency, and security isn't? So, can you further explain on how the application of blockchain actually helps in logistics sustainability in your company? Maybe is like how the blockchain links to the environmental pillar?

Interviewee: Okay. Environmental. I think, as what I mentioned just now, blockchain is more focusing on the data privacy and transparency. This is because everything is digitized, every transaction is recorded through the blockchain technology, which means everything is computerized. So, no paperwork is needed to record the transaction. This will obviously help in logistics sustainability in terms of environmental as there is less resources wastage, less paper in use. Also, blockchains matched with logged records from sensors, can give this perceivability as a trusted, permanent record. So, store network experts and clients can get to a blockchain record with a connection point from which they can see every item's shipment status, documentation and precisely affirm item credits, for example, whether it was privately delivered or not. So, we can say that while producers, retailers, and end clients are all requesting for better and more dependable track-and-follow capacities for items, blockchain contributes for the environmental sustainability as it increases the efficiency and productivity, and it reduces the unrefined substances, and wastage of resources or goods.

Interviewer: Are you okay? Do you need to drink some water first?

Interviewee: Okay, just give me one moment. I am sorry.

Interviewer: Sure, is okay.

Interviewee: Okay, yeah, I think we can continue.

Interviewer: Okay, are you sure?

Interviewee: You can go on first and we first see how it goes.

Interviewer: Sure, okay, the next question is, is the company mainly focus on environmental sustainability pillar as just now what you mentioned

is totally about environmental pillar, right? So, is there any more pillar?

Interviewee: I think, environmental sustainability is of course one of the pillars that we focus on. We actually focus on the three pillars including economic and social. So, let's take smart contract in blockchain as an example. Smart contract is based on computer code, which minimizes the ambiguity of language and is presented through a tight logical structure. The entire content and its execution are transparent to all nodes, which can observe, record, and verify the contract status through the user interface. So, this contributes towards lesser delay or mistake in a supply chain process, thereby reducing human error which then avoid from unnecessary expenses. So, for social pillar, it is like blockchain helps in verifying the identification of the users or parties and it helps users to have better control on their data instead of worrying the leak of their confidential information. For example, our company has collaborated with Accenture to fight for the counterfeit pharmaceutical goods. The data transparency and traceability of blockchain allows product verification. So, it ensures the end customer at the point of purchase that their medicines are genuine and in perfect condition. Also, another point for social pillar is that blockchain is efficient in the sense of providing accurate information. It manages to tell customers the truth, the details about the origin of the products, the materials used to manufacture it, and is it being ethically and sustainably sourced and more. So, I think this is the point for social pillar.

Interviewer: I am agreeing with you. So, from that, what is your personal experience or opinion in the context of advantages developed from the blockchain implementation?

Interviewee: For me, obviously I think improved transparency and traceability in supply chain as well as logistics. Blockchain allows data to be permanent and easily shared, giving supply chain players more comprehensive track-and-trace capabilities than ever before. It increases the efficiencies by providing the real-time information. So, there is no such one day waiting time or longer waiting time like before. Like I say, the collaboration of DHL and Accenture, with blockchain, all the stakeholders like suppliers, warehouses, deliveryman as well as the customers, they are able to track the real-time information to have the proof of legitimacy for products in pharmaceutical shipments. Furthermore, it should be the faster and leaner logistics in the global market. As a global logistics service provider company, environment issues are also the thing that we should focus on. So, unlike those traditional processes that involve a lot of paper-based work which are time-consuming, at the same time prone to human error, and often require third-party intervention, our company is using blockchain to streamline these processes, transactions so that transaction can be completed faster and more efficiently. Credentials can be stored on the blockchain along with detailed transaction records, eliminating the need to exchange paper documents. So, there is no need to coordinate multiple ledgers, significantly speeding up clearing and settlement. In DHL, we are using those water-proof sticker for the labelling of containers, documents and so on. Blockchain, it can greatly reduce the usage of the water-proof item, reduce the costs and mistake for mislabelling and ensures the rapid transfer of the original shipment documents such as the tariffs, airways bills and more. And the third advantage is that I would say, blockchain technology ensures secure data exchange. So, in DHL, every data especially those customers and employee information like their photo id, shipment information, those are sensitive and critical. Blockchain can dramatically change the way when viewing critical information. So, by creating records that cannot be tampered with and are end-to-end encrypted,

blockchain helps to prevent fraud and unauthorized activity. So, privacy concerns can also be addressed on the blockchain, including by ancientizing personal data and restricting access. Information is stored on the entire computer network, rather than on just one individual servers, which makes it difficult for hackers to view the data. So, that is all I think about the advantages obtained from the blockchain implementation.

Interviewer: I got you! So, which sustainability pillar actually gained the most benefits from this blockchain implementation in your perspective?

Interviewee: I think economic pillar might have gained the most. Because although environmental pillar looks like being discussed or focused the most, actually the one which gaining the huge attention is economic pillar. So, economic will always be the first in logistics industry.

Interviewer: So, can you give some illustration for the statement which economic always comes the first in logistics industry?

Interviewee: Well, I think is like what I mentioned previously. Blockchain helps in reducing the use of paper, reducing the resources wastage. All of it is not only time-consuming but also cost consuming. So, everything needs money to be involved with. So, when there is less wastage, less carbon emission, that also means there will be less pollution towards the environment and hence less money used to invest for environmentally issues. The saved down cost can be used to invest for more innovative technology for further performance enhancement just like blockchain, IoT or even more. So, we can say that economic pillar is the one that is playing the most important role compared the other pillars.

Interviewer: I get what you mean! So, economic is the point for the success of the logistics sustainability, right? But, do you have any ways to ensure the advantages that can be continuously benefit to you as well as your company?

Interviewee: Well, it isn't easy to guarantee that advantages to be always existing. Since blockchain is still not widely implemented in our country, so the advantages couldn't be always there. For example, like what I said just now, data transparency and traceability was improved through blockchain. Native blockchain technology does not have privacy protection capabilities, on the blockchain public chain, each participant can have a complete data backup, all transaction data is open and transparent, if you know a participant's account, it is easy to obtain each transaction record and infer the number of properties they own, which is not conducive to personal privacy protection. Also, regarding the irreversible and immutable of data. Once the transaction is initiated, it is irrevocable. It might become a problem when someone had accidentally key in the wrong data. Because the data is immutable, it becomes an issue as the shared data is wrong and cause misunderstanding in the data sharing. Also, if there is someone who lost for his private key, it is impossible to perform any operations on the account afterwards. Unlike in real life, in some cases, bank cards can be withdrawn if they are wrong, and bank cards can be reported and replaced if they are lost. So, we have to be extremely careful about the data protection and don't lose your private key or else you will be in huge trouble.

Interviewer: Okay, I will remember that. So, there wasn't a specific way to ensure the continuous advantages for you?

Interviewee: Yeah, for me, I think so. Actually there is no such way to guarantee the continuous advantages to be obtained, what I can say is always do the best like check carefully before doing anything.

Interviewer: Okay. So, what you mentioned just now, is it actually the challenges for blockchain implementation?

Interviewee: Yeah, I think you are right.

Interviewer: In your point of view, is there any more challenges faced when implementing blockchain technology while aiming for reaching logistics sustainability?

Interviewee: Of course, there are. The first thing, the most important one, I think it might be the technical limitations. Because blockchain technology has achieved certain results, whether it is a public chain or a private chain. But, how to make our offline assets on the chain is an important challenge faced by blockchain technology, that is, how to map the real assets under the chain to the chain. This is also actually the foundation of the future digital economy. The digital wallet we are now familiar with is to map the equivalent of money to a blockchain-based network wallet, and then realize transactions through the network. At present, the research on digital currency has gradually become clear, and the digital currency of the central bank has also surfaced. So, in the future, how to put more off-chain assets, such as government affairs, logistics, public welfare, justice, medical care, education, energy, and more on the chain is a problem that needs to be thought about by majority of people with lofty ideals. In other point of view, there is a technological hurdle for businesses transitioning from initial implementation to their full launch. Because some blockchain implementations, for example, have been known to scale inadequately and suffer from excessive latency, despite the fact that fresh innovations are being created to solve these scalability and performance challenges. So, as a result, it actually brings the issue of high energy consumption and computing power requirements. The second challenge that we often talk about

is the regulation and governance part. Blockchain not to say to be the new technology but it is still lack of the attention by the public. So, with no legal or compliance precedent to follow, which poses serious problems for IoT manufacturers and service providers, I think that is one of the reasons which is making people to avoid using blockchain because they might feel they are not secure and being scared off from the using it. Yeah, one more point, the lack of knowledge and awareness regarding blockchain. People or the generation nowadays are lacking curiosity. They might know what is blockchain, but they don't really know about how exact it works or what exactly it is, or how does the blockchain benefits their business. Instead of taking the risk, they would just remain the same, remain the current technologies that they are using now. Also, the lack of knowledge and awareness could be due to the lack of expertise in this blockchain field. So far, I haven't seen any courses that specifically build up only for blockchain, so everyone might know for the name 'Blockchain' instead of the real part of what blockchain is. So, I personally think that knowledge and awareness is actually the biggest stumbling stone for this blockchain implementation. This is because the lack of knowledge is making people not dare to taking the risk as the investment cost to build up this blockchain is actually quite huge. It requires initial expenses like hiring expertise, creating software, doing some necessary research before really launching the blockchain technology. So, I think it is a foundation that should be emphasized on if we wish to have a good and deep foundation regarding blockchain.

Interviewer: Okay, I understand what you mean. I actually stand with the point that knowledge and awareness is actually the biggest challenge in this case. So, among these challenges that you mentioned just now, which challenge found to be bringing the most burden towards you as well as the company? Like what kinds of burden? Is it a financial burden?

Interviewee: Yeah, I think it is most likely the financial burden. For me, the challenge that is the most burden is the knowledge and awareness. Like I said, the lack of knowledge and awareness requires high investment cost to build the software, hire expertise, invest for multiple research projects and more.

Interviewer: I see! So, is there any solution taken to tackle the challenge that you mentioned previously? Does the solutions effective and further helps in enhancing the logistics sustainability?

Interviewee: Well, I think we have taken several actions to tackle the challenges mentioned before. Like, for example, creating a culture of collaboration. In particular, strengthen cooperation with data experts or big companies that developed and widely used blockchain technology is the key point for collaboration. So, by increasing the international discourse power in the field of blockchain, I believe this can enhance the efficiency, productivity of the supply chain as well as logistics, bring blockchain to be known by more people and making they have a better realization of the blockchain governance. In this case, DHL has been collaborating with few big mnc company such as BMW, Accenture, CISCO and more. So, let take Accenture as the example. DHL works with Accenture to create a blockchain-based serialization project that offers track-and-trace features particularly for the pharmaceutical industry. So, in this case, it is like the serialization process is the 'naming' or giving each pharmaceutical products with their own unique identity such as the origin of the product, the raw materials used to make up the products, the expiration date, the batch number and more. So, it is like through like serialization, it allows or helps all the stakeholders for the product verification. Also, for the governance and regulation issue, there is a blockchain consortia, BiTA, (Blockchain in Transport Alliance), it is being emerged to tackle this issue. For

more detail maybe you can search from the Internet. For another challenge which are the lack of knowledge and awareness, of course, building up blockchain knowledge and awareness among the generation and public is the only way. So, I think by having a strong foundation, the knowledge and awareness regarding blockchain will definitely bring those organization especially logistics service providers companies to a new digitized world. As they manage to discover the real blockchain, identify and realize the value of new operating models, I can say that they will definitely invest blockchain into their business. Yet, like what I say previously that it might become a financial burden for small companies to start investing blockchain into their business. So, it is actually vital for those big companies to first provide their partner organizations or individual contributors with the time, the tools, and resources they require to successfully contribute to each blockchain project. For example, we as the company that have the blockchain experts, we should provide or share some of our resources like equipment, software maybe, with our partners so that they realize the importance of blockchain. So, it is more to a way to bringing more companies especially logistics service providers companies to be more involved in this blockchain technology so that there will be bright future for the logistics industry. Why did I say so is because, when there are more companies familiar with blockchain, it will surely ease the transaction processes, promote for a better efficiency and productivity for the supply chain and logistics system. Because there is no need to teach them from the start when dealing with any company as most of them are getting to use the blockchain technology. Also, when there are more companies agree to utilize the single blockchain solution, that means the value of the blockchain is getting higher for each participant within the digitized system. So, it is actually a win-win situation for all. For the big companies that are sharing their blockchain experts, software with other small companies, they are gaining loyalty and good

relationship as well as enhancing their own efficiency and productivity, while for the company which are just get to know about the blockchain, they able to cut down some initial investment cost until they are really having a good profit and manage to create their own blockchain technology. Yeah, I think it is one of the initiatives that should be taken for a better blockchain implementation.

Interviewer: Okay, for you, which solution is the most effective and applicable for majority challenges? Like how to keep yourselves or the company to remain the high effectiveness when applying the particular solution?

Interviewee: I personally think that collaboration might the best because collaboration is created on the basis on hoping to gain a mutual benefit for both the parties. So, with collaboration, it eases the success process when the experts of both collaborated parties effectively utilize their competitive advantages while minimize the cost needed for a long-term collaboration. So, aligning with the most important logistics pillar, which is the economic pillar as I mentioned earlier, collaboration is definitely the best solution that can be utilized for most of the challenges. And for your second questions which is how to remain high effectiveness, well, I think, be someone who respect other parties and look at overall benefits instead of just focusing on our own benefits. Make decision under discussion of all in order to reach a consensus. Always remember that a well-organized and straightforward goal and objective is definitely the utmost factor that brings to a successful collaboration.

Interviewer: I got your point. Well, I think there is a lot of useful information and insight that I obtained from you. Is there anything that you would like to share or add on regarding to the topic like any advice for people who wish to implement blockchain while aiming for reaching a better logistics sustainability?

Interviewee: Okay, so, for me, blockchain is a powerful technology that should be widely implemented actually. So, everyone should be a risk taker. Although it seems to be a financial burden or risk when starting to invest in blockchain but still believe in it. Blockchain is the best! Try your best to get involved in Blockchain, it really helps in your business especially those company that wish to emphasize on logistics sustainability at the same time.

Interviewer: That's great! So I think, it comes to the end of our interview session. Thank you a lot for accepting my interview request. Although you are now kinds of maybe uncomfortable, take a good rest. So, without your help, I couldn't gain such valuable information. I really appreciate your help.

Interviewee: Sure, no problem. Thank you for inviting me for this interview session. So, I hope that I really provide you some information which will help you for your research. Good luck for your research, anyways.

Interviewer: Thank you a lot. That is the end for our interview. Take a good rest. I really appreciate a lot. Thank you very much. Goodbye.

INTERVIEW TRANSCRIPTION

Interviewer: Hi, nice to meet you, Mr. Kevin.

Interviewee: Hi, nice to meet you too. How are you doing?

Interviewer: I am fine. I am doing pretty well actually. So, how about you?

Interviewee: I am good too, thank you.

Interviewer: First, I like to take this opportunity to express my highest gratitude for willing to have an interview with me. So, I will keep it short in case you have anything to do after this.

Interviewee: Yeah, sure. You just take your time because I have time today and I had gone thru your questions, you can ask me any questions you like, I will try my best to answer you, okay?

Interviewer: Okay, so shall we start our interview now?

Interviewee: Yeah, sure. Let's process.

Interviewer: Okay. Before the interview session begin. Let me first introduce myself. My name is Tong Zhe Wei, and you can call me Tong. I am a final year student who conducting research entitled 'The Implementation of Blockchain empowers logistics sustainability: A case study of DHL Company'. So, this interview is to gain some information from you regarding the blockchain technology as well

as logistics sustainability. And, before that, I would like to ask for you permission for allowing me to have the voice recording for the transcription later on. So, every recording, data and information that I obtained from you will be used for the academic purposes and it won't expose to the public, is it okay for you?

Interviewee: Okay.

Interviewer: Okay, so the first question. What do you know and understand about logistics sustainability? Are there any logistics sustainability related issues?

Interviewee: Yeah, there are actually. In our experience, investors in the logistics industry, they are usually expressed their desire to see a more advanced, sustainable, and more efficient supply chain and logistics. So, what makes a sustainable logistics. I believe that the efficiency, reducing traffic, avoid congestion can reduce CO2 emissions, and warehousing is what we call the sustainable logistics. Also, economy. We actually have a sustainability program called GoGreen 2050, which aims to reduce the greenhouse gas emissions while helping the community to reach the two-degree goals. So, we aim to improve carbon efficiency by 50% by 2025 and operating 70% of our own pickup and delivery services with clean solutions. So, our goal is to lead in the market of green logistics with achievement including optimized transportation routing electric vehicles, and intelligent lighting in our logistics centers.

Interviewer: I think that is a great effort done by DHL. Let's proceed to the second question, what do you know and understand about blockchain technology? What are the current issues or situation regarding blockchain technology?

Interviewee: Okay, blockchain technology has been a game-changer in the current era. It is actually a technology that record information, is just like how bricks are stacked one by one. So, every brick has their own information like who stacked it, when it was folded, what material the brick used, and more. So, the goal of blockchain is we allow the digital information to be recorded and distributed, but not editable. So, blockchain is the foundation of immutable or records the transaction that cannot be delete or destroy. It also contributes to the data consistency, so meaning that the data is consistent, and anyone cannot change the data.

Interviewer: Okay, I believe that it is the general explanation about blockchain right? Can you further explain the blockchain technology that implemented in your logistics operation?

Interviewee: Okay, I think you are asking how we use blockchain technology with our company right? We use blockchain for data transparency in our logistics operation. We use the technology to record the confidential information such as shipments details and also customers' personal information. So, we have been using blockchain to offer stakeholders a clear view for the products information, trace on the origin of the products, and get some the real-time details of the shipments. Blockchain also increases data transparency and our logistics overall performance. At the same time, we also developed a Bitcoin wallet, called "YellowWallet" which only supports Bitcoin Lightning Network transactions and Bitcoin Core. So, this cryptocurrency payment is still under internal testing, and it is not publicly acknowledged yet. Other that the cryptocurrency, another thing is the very hot term, is called the smart contract. It is just like a contract that is not operate by the human. It is just like a code written on the blockchain that is automatically executed when an event or condition triggers without human manipulation or human involved. Also, it provides the flexibility to make a business

connection with other companies by using smart contract. Another good thing about blockchain is also the data security. Due to its nature, no one can easily change the data information easily without consent or authorization. So, this ensures that the security level of how we store confidential data.

Interviewer: You have a point there! So, can you further explain about how does the blockchain application helps in logistics sustainability in your operation? Maybe is like how the blockchain linked to those environmental, social or even economic pillars?

Interviewee: Okay, sure. So, I see that you already know that the sustainability pillars are divided into 3 pillars which are the environment, economic, and social pillars. So, I am going to talk about each of them and what we do to reach our goals. First of all, I talk about the environmental pillar. So, by utilizing blockchain technology, stakeholders have the abilities to monitor the real-time data like the products' shipments and this enables carrier or deliveryman to optimize their transportation routes for maximum efficiency while we also cutting back harmful CO2 emission. So, this is an innovative approach, I believe that it is a sustainable on a global scale. All I mentioned just now is related to the environmental. The second is about the economic. I think that what I mentioned just now also works on the economic part, it eliminates the need of paper and reduce cost associated with the third parties' vendors. So, how does it reduce the cost? So, everyone knows that blockchain is decentralized architect. It won't just like eliminates the expensive third-party fees just like the credit card processing fees. If you are using credit cards, the banks will charge you for the credit card processing fees. So, by using the blockchain technology, we can cut off this transaction fees because everything is automated. And it is more secure. Yeah, so that is the nature of blockchain actually. So, that is about the economic pillar. The third one, the social pillar. So,

the social pillar is we make it easy for all participants to easily to access the shipment information about the products, like I mentioned just now like the real-time location and estimated time for arrival. So, our customers have secure feeling, they know that where are their items, and the information, they are feeling secure. And, also by this transparency, we also allow our management teams to analyse like courier's performance with more transparency. So, overall, what we are doing this, this that our customers will have a better overall customer experience also courier will feel like fairer because everything is go through the transparency.

Interviewer: Okay, next, what is your personal opinion regarding the advantages developed from the blockchain implementation?

Interviewee: So, I think you are asking me the advantages by implementing blockchain technology. I think the advantage is like just now I mentioned, because with the blockchain, it has enhanced data transparency. People, we in company or anyone can access the database and its complete history. Another advantage is that with the blockchain, it increases our performance efficiency because it has a very clear view about our courier and deliveryman's performance.

Interviewer: So, what do you think about the sustainability pillar that gained the most from this blockchain implementation?

Interviewee: Okay, for me. I think the economic pillar should be the most important for company. As it has a lot of financial benefits, so what are the benefits? It can help with the company or the society. Through the blockchain, we can reduce human mistake in operation, because everything is gone thru the blockchain right? It has also increased a better logistics performance, it also helps the global warming, it reduces reduce the emission of CO2 and also the paper usage. So, I believe that by implementing this blockchain, it is good

in our company, our customers, and our logistic partners. So, I think we are doing our part on helping the earth.

Interviewer: That is a good point. But is there any method to ensure the advantages to be continuously benefit to you as well as your company?

Interviewee: Okay, I think right now the problem we have now is that not many people understand the benefits of blockchain technology. So, I think that knowledge is one of the most important ways to ensure the advantages to be continuously benefit the company or the society. Because you know that knowledge increase the understanding as well as the willingness of people to accept the blockchain implementation. Because many doesn't about blockchain and how it can benefit them. So, many logistics company are not really into this blockchain technology. So, I believe that the knowledge about the blockchain should be one of the things that is very important. Just like we in the DHL, we, I mean the DHL's blockchain center of Excellence, it is a centre at the DHL's headquarter, Germany there has invented our own blockchain protocol is called the Baseline Eco-system System Service (BLESS). By inventing this BLESS, we allow other blockchain protocols to communicate with our blockchain technology. This is one of the things that we have implemented for our blockchain. I think blockchain is famous but not many people know what exactly it is. A lot of people don't what is it even people who working in logistics, unless they are working in IT.

Interviewer: Okay, I actually stand with your point because I have been asking other employees who working in DHL, but some of them seem like not really know about blockchain. But is okay. We proceed to next question. Is there any more challenge when implementing

blockchain technology while aiming for reaching logistics sustainability?

Interviewee: Yeah, of course there are some challenges when we are implementing this blockchain. Actually, there are a lot of the challenges, but I will includes two main issues in the blockchain. So, I think the two of the main issues that we are having right now is the high investment cost of this blockchain technology and the lack of understanding about the technology just like I mentioned. Because the blockchain technology is still very new, it seems many people heard of it, but it still not a lot of experts. So, to develop or to utilize the blockchain technology, you need a blockchain expertise of course, also like you need some experts who really know about like Ethereum and Hyperledger, things like that. These are all blockchain terms. Ethereum is just like smart contract, while Hyperledger is for the purpose of collaboration. We also have maintenance cost in blockchain. The cost is quite expensive since not many people know that. Also, another thing is the anonymity. You know like blockchain is carried out with the hash operations. It is encrypted with private key, and public keys to protect the privacy of personal data, transactions. So, I will say that anonymity is also an advantage and disadvantage. The good thing is with the anonymity, we can achieve complete openness of data. You know data breach? So, if you are using a centralized server, company, the hacker can hack you if you are using centralized, right? Because the nature of the blockchain, we are using the decentralized technology, so the identity is not easy to be leaked. I think the downside is the difficulties to track the criminals by using the technology for illegal purposes. They can use like blockchain to carry out illegal activities such as money laundering, asset theft, stuff like that. The relevant identity information of criminals cannot be obtained through the address alone, so it results in criminals being undetectable at large, causing regulatory difficulties. So, I think laws and regulation are really

important in this case. Another thing is that this technology is still very new, so it lacks of the laws and governance about blockchain makes many businessmen, investors to scare to invest into blockchain technology.

Interviewer: So, as what you stated just now all the challenges, so which challenges found to be bringing the most burden towards you as well as the company? Is it a financial burden?

Interviewee: Yeah, I think the biggest problem right now is the market adoption and also the lack of understanding about this technology. Without the market adoption and a lot of people knowing this, it is difficult to improve. So, to resolve this, one of the ways is need more blockchain experts with experiences.

Interviewer: So, it is actually linked to the financial burden?

Interviewee: What kinds of financial burden you are asking?

Interviewer: Because as you said the challenges is the market adoption as well as the lack of understanding. So, if you want to gain more knowledge about blockchain, many of us will do some research through Internet, but I believe that just by doing those research through Internet might not be sufficient. As what you said, hiring more blockchain experts, so is it actually cost a lot of money if you wish to hire more experts?

Interviewee: Yes, of course, there will be costly because the market is still new and there are not many experts in this field.

Interviewer: Okay. So, this means that financial burden is the heaviest burden for you. So, are there any solutions taken to overcome the challenges

mentioned previously? Are the solutions effective and helps in this logistics sustainability?

Interviewee: Okay, so what do we do for this? We have been collaborating with few partners including Accenture, BMW, and CISCO. These are some of the partners we have been working on and one of the projects that we are working with is with Accenture. There is a blockchain-based serialization project that to track the pharmaceutical goods. So, this project is to ensure the customers, they receive the real products, not the fake one, because you know that pharmaceutical goods are very important to human health and if you receive the fake one, it could harm your health. So, we collaborate with Accenture to ensure that every pharmaceutical product that being sourced or shipped using DHL is the real, original products. Customers can track every information regarding the products such as the origin of the product, the raw materials of products, the batch number, expiration date, and also the real-time location of the products. So, is the one of the projects that we have done. We are still working on and without the help of the company like Accenture, we DHL couldn't effectively implement this project. So for the challenge, lack of knowledge challenge, like I say. To overcome this challenge, we will like to collaborate with those bigger companies like IT companies or blockchain companies because they are the one who expert in blockchain, so we learn from them, is the best way I can say. That is how we can learn something new and something real about blockchain.

Interviewer: Okay, so you said that your company have a lot of solution, is that the collaboration is the best solution taken by the company or in your perspective as well?

Interviewee: Yes, by far, I will think that collaboration is the best way to learn.

Interviewer: Okay, so like from this collaboration. Do you gain some else more than what you said just now? Like through collaboration, you can gain more knowledge. So, beside gain more knowledge, do you have any more advantages for carrying out this collaboration?

Interviewee: Yeah, of course. So, I think learning is just one of the benefits. Because it can help to enhance the business relationship and it allows our company to learn from each other. Also, it can increase our company's reputation and our customer confidence.

Interviewer: Okay, I am actually agreeing with you and that is the end of my questions. Do you have more information to share about this blockchain technology or logistics sustainability?

Interviewee: Okay, maybe I will do a short summary for that. So, blockchain is a digitalized technology that contributes to the data transparency, consistency and traceability, So, we also used the smart contract to deal with other companies. Blockchain promotes logistics sustainability by reducing the CO2 emissions and also resources wastage, while increasing the efficiency of data tracing in the delivery process. So, the advantages of blockchain including the high data transparency, security and operation efficiency. However, there are some challenges like the lack of understanding, high investment cost and also the anonymity, it remains still some of the issues that we have. So, other than that, collaboration is the way that I think the most applicable and useful.

Interviewer: That's great! So, it comes to an end for our interview session. Thank you very much for accepting my interview request, and willing to have a talk with me. I really appreciate your help as your insight were really valuable for my research!

Interviewee: I think same to you. Thanks for inviting me for this interview. It is my pleasure to assist you today. I hope I have given you enough information for your research.

Interviewer: Yes, you are! And there is the consent form which I attached in the interview protocol, so maybe can you sign and send it back to me later?

Interviewee: Yeah, sure. I will send you later. So, good luck for your research! Bye.

Interviewer: Thank you, bye.