

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

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## APPROVAL

I/We hereby declare that I/We have read and go through this dissertation/report/thesis and certify that, this dissertation/report/thesis is satisfactory in the sense of scope and quality as a partial fulfilment of the requirement for the award of Bachelor's Degree of Technology Management (Supply Chain Management and Logistics) with Honours

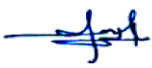






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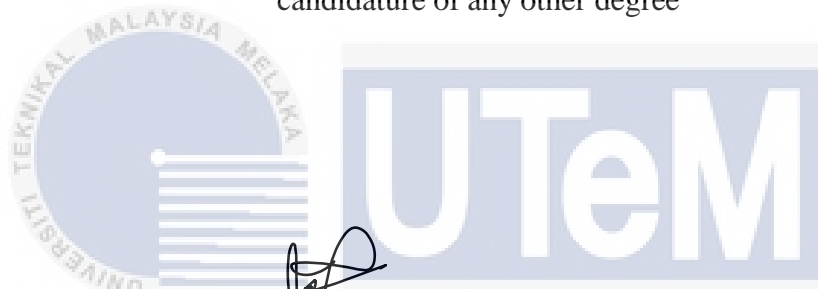
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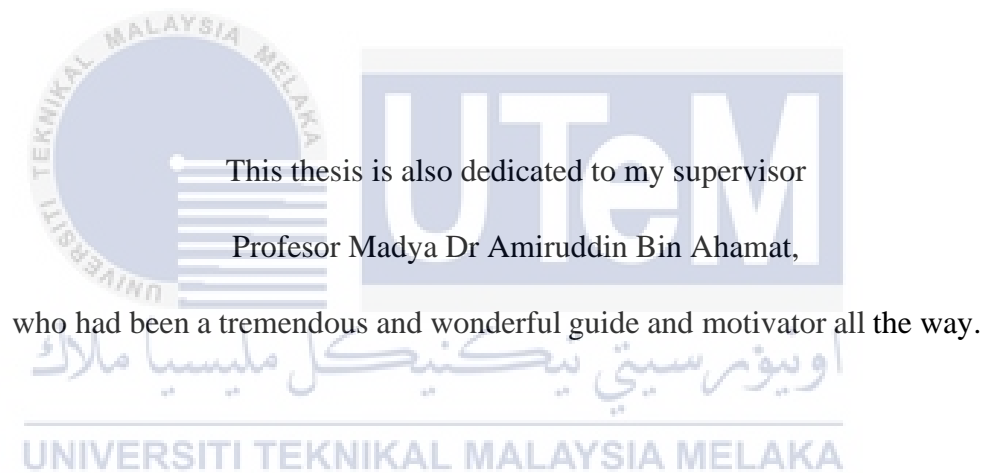
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## DEDICATION

This thesis is dedicated to my family,  
for the immense support and motivation throughout the whole process.



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 bermanfaat 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, kekurangan pengetahuan dan kesedaran didapati sebagai cabaran paling membebaskan 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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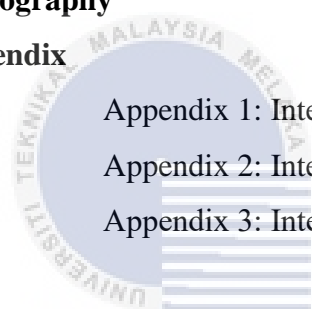
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## LIST OF ABBREVIATIONS

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 <sup>2</sup>	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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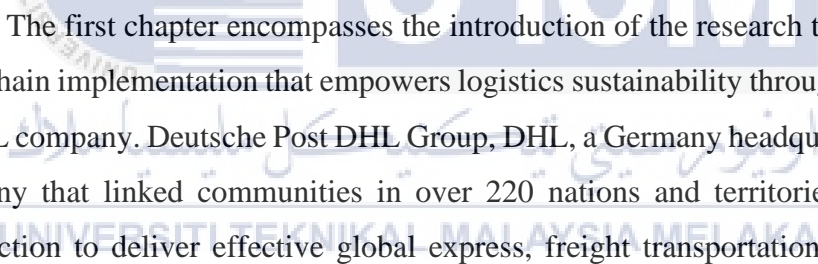


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## CHAPTER ONE

### 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 disruption, facilities malfunction, 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 CO<sub>2</sub> 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 (Pauku, 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.