
## Faculty of Technology Management and Technopreneurship

# Exploring Blockchain Technology Adoption in Tanker Shipping Companies: An Integrated Analysis Using the TASC Model and PESTLE Framework

**Hussien Alshami**

**Master of Science in Technology Management**

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**Hussien Alshami**

**A Thesis Submitted**

**In Fulfillment of the Requirements for the Degree of**
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## DECLARATION

I declare that this thesis entitled “Exploring Blockchain Technology Adoption in Tanker Shipping Companies: An Integrated Analysis Using the TASC Model and PESTLE Framework” Is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.



Signature : …….....

Name : **Hussien ALshami**

Date : **19/02/2025**

**APPROVAL**

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Master of Philosophy.

Signature : _____

Supervisor Name : **Professor. Mohd Syaiful Rizal bin Abdul Hamid**

Date : 23/02/2025

## DEDICATION

This thesis is dedicated to the Almighty God, my family, my lecturers as well as my friends. Thank you for your love, guidance, understanding, and support. Thank you for being with me throughout my journey.

**Abstract**

This study explores the adoption of blockchain technology in the tanker shipping companies, focusing on two primary objectives: assessing the likelihood of adoption using the Technology Adoption in Supply Chains (TASC) model and identifying business opportunities and risks through the PESTLE framework. The research employs a qualitative approach, conducting semi-structured interviews with stakeholders from two Chinese tanker shipping companies—one preparing to adopt blockchain technology and the other having no intention to adopt it. Eight participants were purposively selected based on their roles in decision-making, IT, chartering, and operations, representing a comprehensive view of the blockchain adoption process within the companies. The TASC model assessed the likelihood of blockchain adoption by examining factors such as the characteristics of technology, organizational characteristics, and inter-firm relationships. The findings indicate that blockchain adoption is more likely in organizations with advanced digital capabilities and strong management support, though barriers such as integration complexity and high costs persist. Meanwhile, the PESTLE analysis identified opportunities such as cost savings and operational streamlining, while also highlighting risks like regulatory uncertainties, financial constraints, and public misconceptions. Successful adoption will depend on addressing these risks, ensuring technological compatibility, and fostering organizational adaptability. This study provides valuable insights and considerations for decision-makers regarding blockchain adoption in the tanker shipping industry and contributes to the limited literature on blockchain within this industry. Future research can investigate the long-term impact of blockchain adoption across different shipping company sizes and geographic locations.

**Abstrak**

Kajian ini meneroka penerapan teknologi blockchain dalam sektor perkapalan tangki dengan memberi tumpuan kepada dua objektif utama: menilai kebarangkalian penerapan menggunakan model Teknologi Penerimaan dalam Rantaian Bekalan (TASC) dan mengenal pasti peluang serta risiko perniagaan melalui rangka kerja PESTLE. Kajian ini menggunakan pendekatan kualitatif melalui temu bual separa berstruktur dengan pihak berkepentingan daripada dua syarikat perkapalan tangki di China—satu sedang bersedia untuk menerima pakai teknologi blockchain manakala satu lagi tidak berhasrat untuk menggunakannya. Lapan orang peserta telah dipilih secara bertujuan berdasarkan peranan mereka dalam membuat keputusan, teknologi maklumat, penyewaan kapal, dan operasi, yang mewakili pandangan menyeluruh terhadap proses penerapan blockchain dalam syarikat. Model TASC digunakan untuk menilai kebarangkalian penerapan dengan meneliti faktor seperti ciri teknologi, ciri organisasi, dan hubungan antara firma. Dapatan kajian menunjukkan bahawa penerapan blockchain lebih berkemungkinan berlaku dalam organisasi yang mempunyai keupayaan digital yang tinggi dan sokongan pengurusan yang kukuh, walaupun berhadapan dengan halangan seperti kerumitan integrasi dan kos yang tinggi. Analisis PESTLE pula mengenal pasti peluang seperti penjimatan kos dan penstrukturan operasi, serta menyoroti risiko seperti ketidakpastian peraturan, kekangan kewangan, dan salah tanggapan awam. Penerapan yang berjaya bergantung pada keupayaan untuk menangani risiko ini, memastikan keserasian teknologi, dan menggalakkan daya penyesuaian organisasi. Kajian ini memberikan pandangan dan pertimbangan yang berguna kepada pembuat keputusan mengenai penerapan blockchain dalam industri perkapalan tangki serta menyumbang kepada literatur yang terhad dalam bidang ini. Kajian masa hadapan boleh meneliti kesan jangka panjang penerapan blockchain merentas saiz syarikat perkapalan dan lokasi geografi yang berbeza.

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## TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

## LIST OF ABBREVIATIONS

| | |
|---|---|
| AAA | Authentication, Authorization, and Accounting |
| AI | Artificial Intelligence |
| B2B | Business-to-Business |
| BIMCO | Baltic and International Maritime Council |
| BP | British Petroleum |
| COSCO | China Ocean Shipping Company |
| COVID | Coronavirus Disease |
| DLT | Distributed Ledger Technology |
| ERP | Enterprise Resource Planning |
| EVP | Executive Vice President |
| GSBN | Global Shipping Business Network |
| IBM | International Business Machines Corporation |
| IEEE | Institute of Electrical and Electronics Engineers |
| IMO | International Maritime Organization |
| ISO | International Organization for Standardization |
| IT | Information Technology |
| OBOR | One Belt One Road Initiative |
| OOCL | Orient Overseas Container Line |
| P2P | Peer-to-Peer |
| PESTLE | Political, Economic, Social, Technological, Legal, and Environmental Analysis |
| PSA | Port of Singapore Authority |
| SPG | Shanghai Port Group |
| TAM | Technology Acceptance Model |
| TASC | Technology Adoption in Supply Chains |
| TOE | Technology-Organization-Environment Framework |
| TPB | Theory of Planned Behavior |

| | |
|---|---|
| TRA | Theory of Reasoned Action |
| UNCTAD | United Nations Conference on Trade and Development |
| UTAUT | Unified Theory of Acceptance and Use of Technology |
| VAKT | Blockchain-Based Commodity Trading Platform |

## LIST OF PUBLICATIONS

Alshami, H., & Bin Abdul Hamid, M. S. R. (2024). An insight into the impact of blockchain characteristics and applications on the ship management companies. SRPH Journal of Applied Management and Agile Organisation, 6(2), 8–17. https://doi.org/10.47176/sjamao.6.2.8

# CHAPTER 1

# INTRODUCTION

## 1.1 Research Background

Sea shipping plays an essential role in the global economy as a critical part of the supply chain, responsible for transporting approximately 90% of world trade, with around 11 billion tons of goods being moved by sea each year. This volume equates to 1.5 tons per person based on the current global population (International Chamber of Shipping, 2021). This prominence is due to the unique features of sea shipping, which offers cost-effective and efficient long-distance transportation of goods and materials between continents, positioning the industry at the core of global trade (UNCTAD, 2018).

Despite its significance, the shipping industry is traditionally considered slow in adopting new technologies, and many of its transactions are viewed as time-consuming and costly (Ganne, 2018). For example, it has been estimated that around 20% of operational budgets in shipping are spent on information management due to the complexities of manual documentation and outdated systems (Czachorowski, 2017). The industry continues to rely on a large volume of physical documents, including sales contracts, charter party agreements, bills of lading, port documents, and letters of credit. These documents play a crucial role in ensuring payments are processed and that the carriage and delivery of cargo are legally recognized (Loklindt et al., 2018). Each document must pass through a complex network of parties involved in the shipping supply chain, contributing to delays and increasing the potential for inefficiencies.

One of the emerging technologies that is seen as potentially transformative for the shipping industry is blockchain. Blockchain is a digital infrastructure that allows multiple participants to manage information and conduct transactions securely, without intermediaries. The technology's potential to digitize and automate processes could address some of the challenges faced by the maritime and shipping industries by providing more efficient ways to handle critical documentation and ensuring transparency in transactions (Green, Smith, & Johnson, 2020b).

Furthermore, the blockchain's distributed ledger system ensures that all transactions are securely recorded and that the risk of tampering or fraud is minimized. This feature is particularly relevant for industries that rely on large volumes of paperwork and numerous stakeholders. For shipping companies, blockchain offers the possibility of streamlining processes, reducing administrative costs, and enhancing operational efficiency by simplifying documentation workflows (Filom, 2020). It has been identified as having various potential applications, including smart contracts, which can automate and verify agreements between parties without the need for manual intervention (Loklindt et al., 2018).



## 1.2 Problem Statement

Blockchain is an emerging technology that has gained prominence, primarily through its application in cryptocurrencies. However, in recent years, there has been a growing focus on its applications in various industries, including maritime and shipping (Green, Smith, & Johnson, 2020b). Experts and researchers have identified several potential uses of blockchain technology that could transform the shipping industry, offering opportunities to enhance operational efficiency and reliability (Fauser, 2020). These applications include the real-time, secure, and

reliable exchange of documents, smart contracts, smart bills of lading, money transfers, ship history tracking, and quicker transaction processing times (Filom, 2020).

Although blockchain technology has already been implemented in certain sectors of the shipping industry, particularly container shipping, where platforms such as Maersk and IBM's TradeLens facilitate transactions, document sharing, and container tracking, adoption in the tanker shipping sector remains in its early stages (TradeLens, 2021). Companies in the tanker shipping industry are still evaluating the advantages and disadvantages of blockchain technology. Unlike container shipping, where blockchain is being integrated into operations, tanker shipping has been slower to adopt this technology.

There are several reasons for the slower adoption of blockchain in the tanker shipping sector compared to container shipping. The nature of the cargo in tanker shipping—often high-risk products such as oil and chemicals—makes safety and operational reliability a top priority. This leads to a cautious approach toward adopting new technologies, as companies must prioritize minimizing risks and maintaining operational stability (Lam & Dai, 2020). Additionally, tanker shipping involves fewer stakeholders, reducing the immediate pressure to adopt digital solutions that streamline interactions among multiple parties (Svanberg et al., 2019). However, despite this cautious approach, blockchain adoption is crucial for tanker shipping companies as it can significantly improve efficiency, security, and transparency in operations, ultimately enhancing both safety and competitive advantage in a rapidly evolving global market (Wang et al., 2020).

As identified in the literature review, most studies on blockchain technology in the shipping industry focus on container shipping, where the technology is already being

implemented. There is a lack of studies addressing blockchain's specific applications in the tanker shipping sector, which has distinct operational processes and business models (Di Gregorio & Nustad, 2017). This gap in the literature highlights the need for research that explores blockchain adoption in the tanker shipping sector, where companies are still in the process of evaluating the technology's potential impact on their operations.

This research builds on previous studies that have examined blockchain's implications for supply chains in a general context. For example, Di Gregorio and Nustad (2017) conducted a broad study of blockchain technology's introduction in the shipping industry, utilizing semi-structured interviews with industry representatives from shipping companies, IT, and public institutions. However, they acknowledged that their research's general scope limited its ability to address sector-specific concerns. As such, they recommended that future studies focus on individual sectors, such as tanker shipping, to provide a more detailed understanding of blockchain's potential.



Therefore, this study aims to investigate the adoption of blockchain technology in tanker shipping companies and to explore the business opportunities and risks associated with its implementation. Identifying these elements is crucial for decision-makers in tanker shipping companies, as it will enable them to evaluate the adoption of blockchain more precisely and make informed decisions regarding its potential benefits and challenges. By focusing on the tanker shipping sector, this research will contribute to filling the existing knowledge gap and provide valuable insights into the specific factors that influence blockchain adoption in this sector.

## 1.3 Research Objectives

The primary aim of this research is to explore the adoption of blockchain technology in the tanker shipping sector. Given the unique characteristics of this industry, this study focuses on identifying the key factors that influence adoption and examining the associated opportunities and risks. The objectives of this research are defined as follows:

i) To investigate the likelihood of blockchain technology adoption by tanker shipping companies using the TASC model, considering the specific operational and organizational dynamics of this sector.

ii) To explore the business opportunities and risks associated with blockchain adoption in tanker shipping companies through a PESTLE framework analysis, highlighting both potential benefits and risks during implementation.



## 1.4 Research Questions

The research questions have been designed to guide this study in investigating the adoption of blockchain technology in the tanker shipping sector. These questions focus on understanding both the likelihood of blockchain adoption and the key opportunities and risks that could influence decision-making in the industry.

The research questions are as follows:

i) What is the likelihood for blockchain technology to be adopted by tanker shipping companies?

ii) What business opportunities and risks should tanker shipping companies

consider when adopting blockchain technology?

## 1.5 Research Scope

The maritime shipping industry is a critical component of the global supply chain, encompassing various sectors such as container shipping, tanker shipping, bulk carriers, and cruise ships (NAAEE, 2018). This research focuses specifically on tanker shipping companies, which transport liquid cargo, including oil and chemicals in bulk, and play a significant role in fulfilling the world's energy and manufacturing needs. According to the UNCTAD (2018) report, the global trade of crude oil, refined petroleum products, gas, and chemicals reached 3.2 billion tons, emphasizing the importance of the tanker shipping sector.

The study concentrates on two tanker shipping companies in China, chosen for their differing approaches and perceptions of blockchain technology adoption. One company has an established plan to implement blockchain technology and has begun the process of integrating digital solutions. The second company has not yet initiated any formal plans for blockchain adoption. The selection of these two companies, one with plans to adopt blockchain technology and one without—provides valuable insights into the likelihood of blockchain technology being adopted in the tanker shipping sector. By examining both companies, the research can explore the opportunities for improving operational efficiency and risks related to the challenges of implementation. This approach offers a broader understanding of how companies in this sector evaluate the potential of blockchain technology, helping to identify key factors influencing their decisions regarding adoption.

The research's scope is designed to provide in-depth insights into blockchain adoption

in tanker shipping, while maintaining a manageable size for the study. By focusing on two companies with contrasting adoption strategies, the research offers a balanced view of the opportunities and risks associated with blockchain technology, which can serve as a guide for other companies in the tanker shipping sector.

It is also important to note that the business processes of tanker shipping companies are standardized to a significant extent (Lyridis & Papaleonidas, 2019). As a result, the findings of this research could be applicable to tanker shipping companies globally, offering valuable insights for companies evaluating the adoption of blockchain technology.

## 1.6 Significance of the Research

The significance of this research lies in its contribution to the understanding of blockchain technology adoption in the tanker shipping industry. While blockchain has been widely explored in other shipping sectors, particularly in container shipping (Ganne, 2018; Green, Smith, & Johnson, 2020b), its adoption in the tanker shipping sector remains under-researched. This study seeks to fill this gap by providing insights into both the opportunities and risks associated with blockchain technology in tanker shipping.

The findings of this research are particularly valuable for stakeholders within the tanker shipping industry. Tanker shipping is responsible for transporting a large portion of the world's energy needs, and the sector's operations involve high-risk cargo such as oil and chemicals (Lyridis & Papaleonidas, 2019). This high-risk environment necessitates stringent operational protocols, which in turn can slow the adoption of innovative technologies like blockchain (Loklindt et al., 2018). By identifying the key factors that influence the likelihood of blockchain