



**COMPARATIVE STUDY ON THE TRANSPORTATION COST
AND ENVIRONMENTAL IMPACT OF CONSTRUCTION
MATERIALS IN INTERNATIONAL TRADE**



**A THESIS SUBMITTED IN PARTIAL FULFILLMENT
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IN MANAGEMENT OF LOGISTICS**

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Thesis entitled

**COMPARATIVE STUDY ON THE TRANSPORTATION COST
AND ENVIRONMENTAL IMPACT OF CONSTRUCTION
MATERIALS IN INTERNATIONAL TRADE**

by
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Abstract

With the rapid development of the logistics industry, Sino-Thai customs plays an increasingly important and urgent role in logistics. However, in the past, the understanding of international logistics transportation was limited to traditional methods that were both high in cost and high in pollution, which led to a series of problems. Therefore, this paper intends to study the following three issues: 1. The transportation cost of construction materials in international trade, 2. The transportation process of construction materials in international trade. These problems have caused adverse effects on Sino-Thai logistics, such as high costs and significant environmental pollution. To solve the above problems, this study adopts a qualitative analysis approach. For each problem, we propose a corresponding solution within 1–2 days. It is hoped that these solutions will help promote the development of the e-commerce logistics industry and contribute to the sustainable and healthy growth of the logistics sector.

(Total 60 pages)

Keywords: Transportation Modes, Environmental Impact, Green Logistics, Challenges and Strategies

Student's Signature Thesis Advisor's Signature

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CHAPTER 1

INTRODUCTION

1.1 Background and Significance of the Problem

1.1.1 Research Background

In international trade, the transportation of construction materials is an important and complex link. It not only plays a key role in global economic development, but also has a profound impact on the environment. With the deepening of globalization and the continuous growth of infrastructure construction demand, the scale of international trade in construction materials continues to expand, and its transportation volume has also increased rapidly. However, the special properties of construction materials, including heavy weight, large volume, and diverse types, require a large amount of resources to be consumed during transportation, resulting in high logistics costs and a large environmental burden (Ferrari, Bianchi, & Rossi, 2023). Therefore, this study will focus on the cost and environmental issues in the international transportation of construction materials.

First, the transportation cost of construction materials accounts for a significant proportion in international trade. Since building materials usually have the characteristics of low added value, high weight and large volume, their economic burden in transportation is particularly prominent. There are many factors affecting transportation costs, including transportation distance, transportation mode, fuel price fluctuations, loading and unloading and storage costs. In addition, the choice of transportation mode largely determines the cost level. For example, sea transportation is the most common mode of international transportation of building materials. Although its unit price is low, it takes a long time to transport and is also restricted by factors such as port conditions and weather changes; while air and land transportation

have high timeliness, but their costs are more expensive. Especially in cross-border trade, land transportation is also affected by infrastructure conditions, border control and policy factors. With the fluctuation of global fuel prices and the implementation of relevant carbon emission tax policies, the cost issue of building material transportation has become more complicated, which has brought direct economic pressure to enterprises and trade activities.

Secondly, the international transportation of building materials has a significant impact on the environment and is one of the areas of concern in the current sustainable development issues. The transportation industry is one of the main sources of global greenhouse gas emissions, and the transportation of building materials has a particularly prominent impact on the environment due to its high frequency and high energy consumption. In the transportation of construction materials, especially cross-border transportation, sea and land transportation dominate. Although sea transportation has certain advantages in energy efficiency, it is still an important source of greenhouse gas emissions. The heavy oil fuel it uses releases a large amount of carbon dioxide, sulfur oxides and other pollutants, causing damage to air quality and marine ecosystems. Land transportation, which relies on internal combustion engine vehicles, contributes more significantly to air pollution. In addition, unreasonable planning of transportation routes and insufficient loading rates of vehicles or ships have further aggravated resource waste and environmental pollution (Mpuure, Smith, & Lee, 2024). As the world pays more attention to environmental protection, the transportation industry, especially the international transportation of construction materials, is facing unprecedented pressure. Governments and enterprises are exploring more environmentally friendly transportation methods to reduce carbon emissions and pollution.

Finally, with the continuous increase in labor costs, the logistics industry is facing increasing cost pressure. Labor is a key factor in the logistics process, involving multiple links such as transportation, warehousing, loading and unloading. Especially in labor-intensive logistics business, the increase in labor costs directly drives the increase in overall logistics costs. This trend not only affects the operational efficiency

of enterprises, but may also lead to price increases, thereby affecting market competitiveness. At the same time, rising labor costs have also prompted companies to seek more efficient operating methods, such as the introduction of automation technology and intelligent management to reduce the burden of labor costs. However, the introduction of these technologies often requires a large initial investment (Zheng, Wang, & Li, 2018). Therefore, how to achieve cost control and efficiency improvement against the backdrop of rising labor costs has become a key issue to be addressed in the current logistics industry.

Against this backdrop, the concept of environmentally friendly transportation has gradually become a core issue in the field of international construction material transportation. The introduction of concepts such as low-carbon transportation, green logistics and sustainable supply chains has provided directional guidance for the industry. For example, by optimizing transportation routes, improving loading efficiency and introducing new energy transportation tools (such as electric trucks and liquefied natural gas ships), companies can reduce carbon emissions and achieve cost savings to a certain extent. At the same time, the development of digital technology has also provided technical support for the environmentally friendly transportation of construction materials, such as dynamic monitoring and data analysis of the transportation process through logistics management systems, thereby reducing resource waste and improving transportation efficiency. However, environmentally friendly transportation measures usually require a large amount of initial capital investment, including the development and application of new technologies, the construction of new energy infrastructure, etc. This is a daunting challenge for small and medium-sized enterprises, and has also triggered extensive discussions on economic feasibility. How to control transportation costs while reducing environmental impact and find a balance between economic and ecological benefits has become a key issue in current research.

1.1.1.1 Rising Transportation Costs

Rising transportation costs are one of the core challenges in international trade in building materials, which directly affects the economic nature of trade and the market competitiveness of enterprises. The following aspects specifically reflect the causes and effects of rising transportation costs:

(1) Fuel price fluctuations: As the instability of the global energy market increases, fuel price fluctuations have become the main driving force for rising transportation costs. Sea, road and rail transportation are all heavily dependent on fuel supply, and the increase in fuel costs directly raises the overall transportation costs.

(2) Rising labor costs: Globally, the problem of labor shortage in the logistics industry is becoming increasingly prominent, especially the high demand and low supply of positions such as truck drivers and port operators, which has pushed up labor costs. This has further exacerbated the pressure on transportation costs.

(3) Infrastructure and technology investment: International logistics networks have increasing requirements for transportation equipment, storage facilities and transportation technology. Enterprises need to continue to invest in more efficient and advanced transportation tools and management systems. Although these investments have improved logistics efficiency, they have also increased short-term operating costs.

The rise in transportation costs has a far-reaching impact on the trade in construction materials. On the one hand, higher transportation costs have weakened the international market competitiveness of construction materials products; on the other hand, it has also put forward higher requirements for trade efficiency and logistics services, prompting enterprises to face greater pressure in cost control and transportation mode optimization.

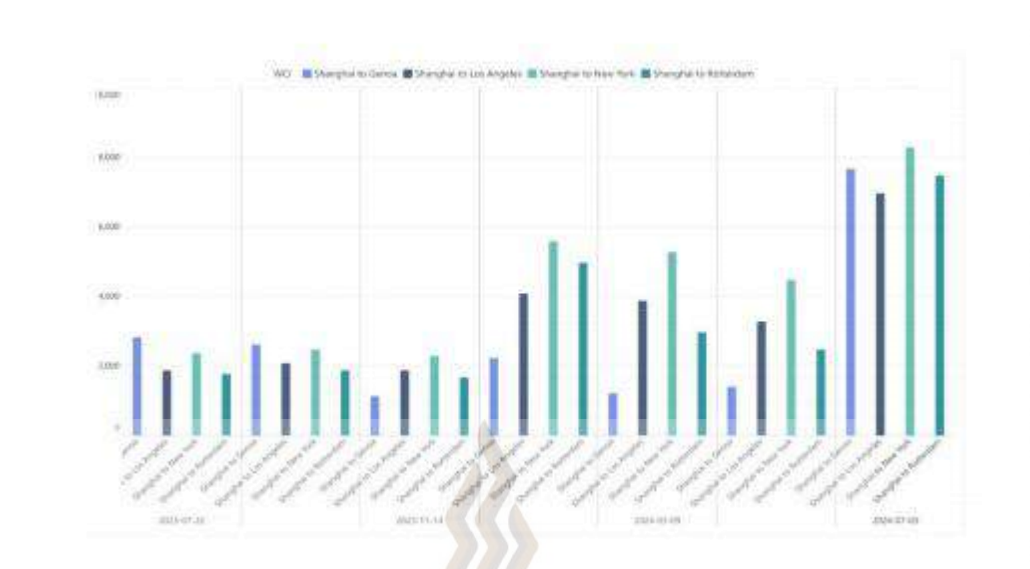


Figure 1.1 Drewry WCI: Trade Routes from Shanghai (US \$ /40ft)

Source: Drewry, 2025

1.1.1.2 Concerns About Environmental Sustainability

The impact of the transportation process of construction materials trade on the environment is mainly reflected in carbon emissions, energy consumption and pollutant emissions. The following are specific manifestations and problems:

(1) Greenhouse gas emissions: Transportation is a significant source of greenhouse gas emissions globally, especially in the road, air and maritime sectors. Road transport relies on internal combustion engine vehicles that burn fossil fuels (such as gasoline and diesel), releasing large amounts of carbon dioxide (CO₂) and nitrogen oxides. Emissions from this sector account for the largest share of global transport emissions, and emissions continue to rise as the number of cars increases. Rail transport is relatively environmentally friendly, but it still emits greenhouse gases when using diesel locomotives. Emissions from electrified railways depend on the source of electricity, and if electricity comes mainly from fossil fuels such as coal, emissions are still high.

(2) Environmental sustainability issues are no longer just a manifestation of social responsibility, but have also become a key factor affecting the long-term development of international trade in building materials. In the current

context of global climate governance and low-carbon economic transformation, how to reduce the environmental burden of building materials trade has become a focus of great concern to the international community and the industry.

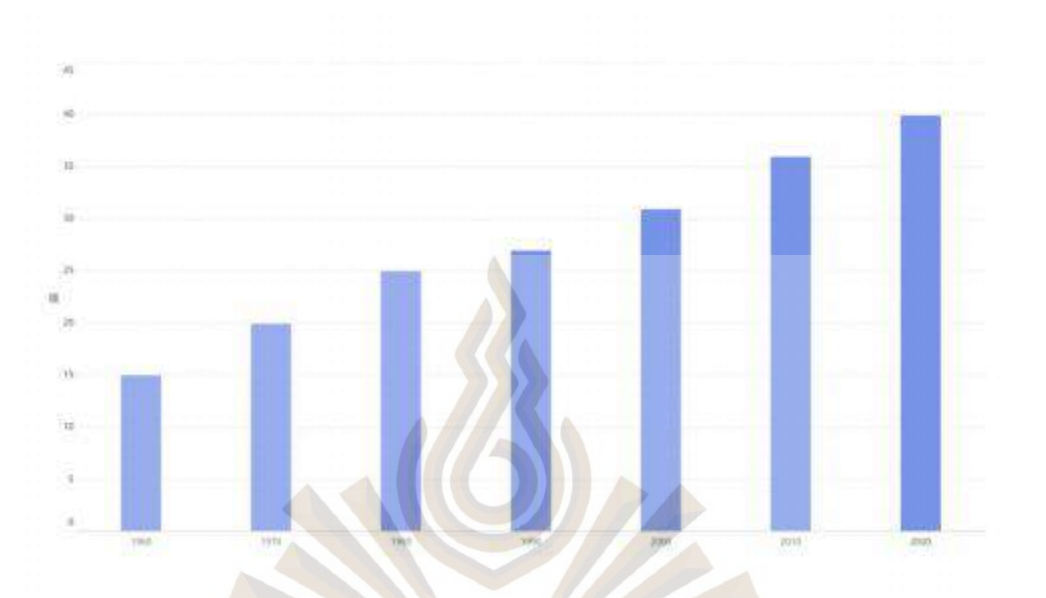


Figure 1.2 Global CO2 Emissions (Fossil and Land Use)
from the Past Five Global Carbon Budgets

Source: Carbon Brief, 2024

1.1.2 Research Significance

Currently, there is insufficient research on the transportation costs and environmental impacts of building materials in international trade both domestically and internationally, resulting in a significant research gap. This thesis aims to provide new perspectives and rich materials for a comprehensive understanding of transportation costs and environmental impacts through systematic research and in-depth analysis. This effort will not only deepen theoretical discussions in the academic community but also provide strong theoretical support and practical guidance for the sustainable development of the logistics industry.

In international trade, the transportation of building materials is crucial for both China as an exporter and Thailand as an importer. China, as one of the largest producers

of building materials, offers competitive and high-quality materials that meet Thailand's growing infrastructure and urbanization needs. For Thailand, importing from China provides economic benefits by reducing construction costs, ensuring a stable supply chain, and mitigating risks from domestic production limitations and price fluctuations.



Figure 1.3 Value of Goods Exported from China to Thailand from 2007 to 2022

Source: Statista, n.d.

1.2 Research Objectives

1.2.1 To compare and analyze the transportation costs and environmental impact of trading construction materials that China exports to Thailand.

1.2.2 To provide an effective decision guidance when choosing the mode of transportation.

1.3 Research Questions

1.3.1 What are the main drivers of transportation costs and environmental impacts of Chinese exports to Thailand?

1.3.2 Which mode of transport is the most cost-effective and environmentally sustainable for shipping construction materials from China to Thailand?

1.4 Research Framework

Cost and environmental optimization

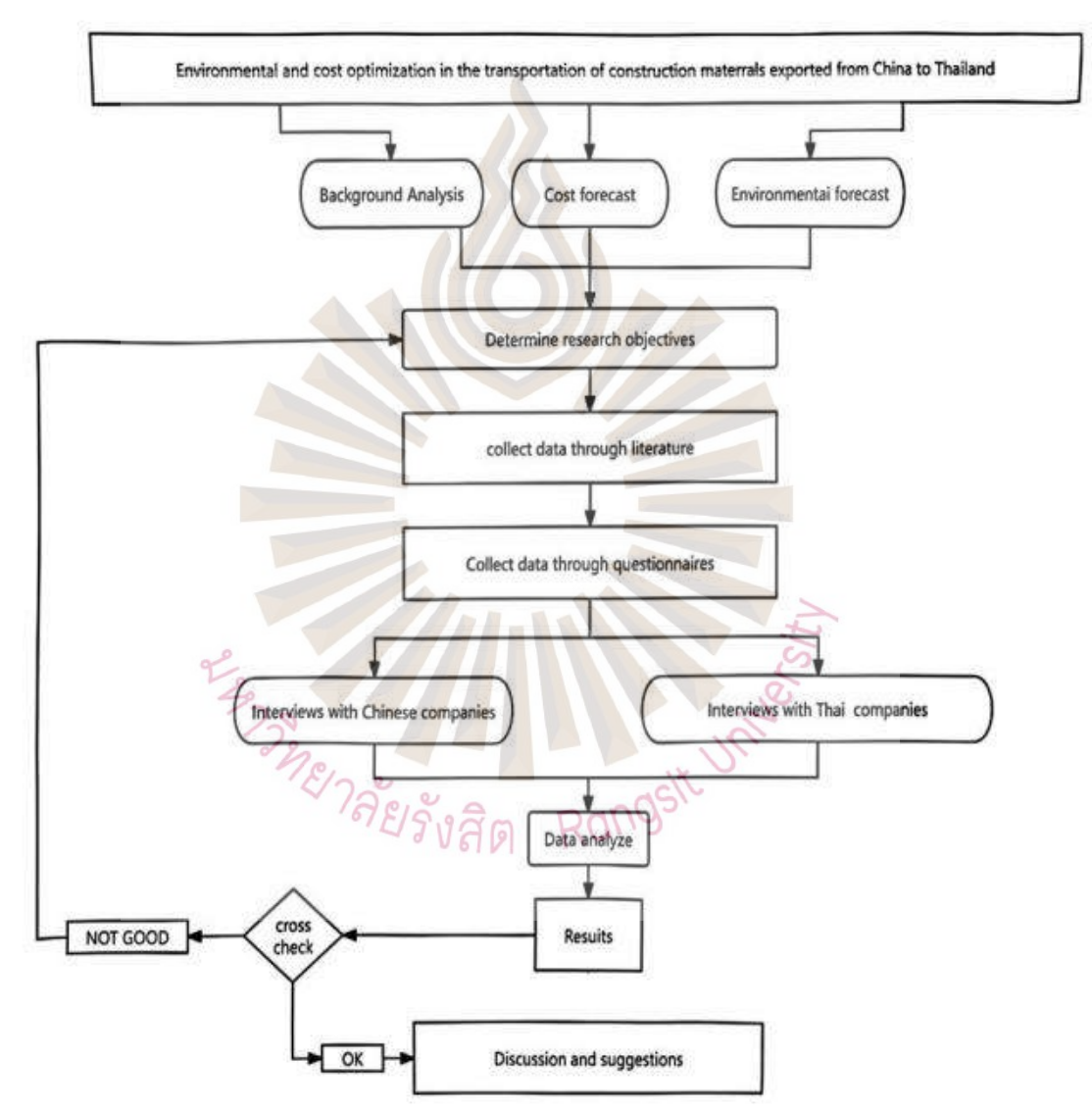


Figure 1.4 Research Framework

1.5 Definition of Terms

Green Logistics

Green Logistics is a logistics management method that reduces carbon emissions and resource waste by optimizing transportation methods, improving loading efficiency, and adopting new energy technologies (such as electric trucks or liquefied natural gas ships) (Meng, Liu, & Chen, 2024).

Carbon Emissions

Refers to the total amount of carbon dioxide and other greenhouse gas emissions generated by fuel combustion during transportation, which is a key indicator for measuring the environmental impact of transportation (Mpuure et al., 2024).

Low-Carbon Economy

An economic model that aims to reduce greenhouse gas emissions and achieves a balance between environmental protection and economic growth through technological innovation and industrial restructuring (Meng et al., 2024).

Loading Efficiency

The ratio of the actual load of a transport vehicle to its maximum load capacity. Improving the loading efficiency is an important way to reduce costs and energy consumption (Meng et al., 2024).

CHAPTER 2

LITERATURE REVIEW

2.1 Key Related Researches on Transportation Costs And environmental Impact in Construction Material Logistics

As global transportation demand increases, the logistics and transportation sectors face rising costs and environmental impact challenges. How to improve transportation efficiency and reduce carbon emissions has become an important topic in sustainable development research. In this context, Larrodé and Muerza (2020) proposed a new solution: optimizing the cost-effectiveness and environmental impact of the transportation system by integrating light freight and passenger rail transportation with last-mile delivery. This thesis will review the main ideas in this chapter, analyze their potential for improving transportation efficiency and reducing environmental burden, and explore the progress and shortcomings of existing research.

2.1.1 Research Background and Problems

Traditional freight and passenger rail systems are usually operated separately, which leads to waste of resources and low efficiency. According to Larrodé and Muerza (2020), integrating these two modes of transportation can effectively improve cost efficiency and reduce energy consumption. Rail transportation itself, as a low-carbon emission mode of transportation, has been considered the key to reducing the environmental burden in the transportation sector. However, how to effectively combine rail transportation with last-mile delivery remains an urgent problem to be solved. The study focuses on analyzing the combination of rail transport and last-mile delivery, proposes feasible solutions, and conducts a quantitative analysis of its implementation effect.



Figure 2.1 Global Greenhouse Gas Emissions by the Transportation Sector

Source: ResearchGate, n.d.

2.1.2 Main Points

The study of Larrodé and Muerza (2020) focuses on the following aspects:

1) Integration of light freight and passenger rail transport: The study shows that by utilizing the existing railway network and combining light freight and passenger rail transport, it is not only possible to effectively reduce transportation costs, but also to make significant progress in reducing energy consumption and carbon emissions. Especially in areas with high passenger and freight demand, rail transport provides an efficient and environmentally friendly solution.

2) Last-mile delivery: Although rail transport has significant advantages in long-distance transportation, it still faces many challenges in the final delivery link (i.e., last-mile delivery). Larrodé and Muerza (2020) suggest that the use of electric delivery vehicles or automated delivery systems can further improve efficiency and reduce carbon emissions in the last-mile delivery of cities or between cities.

3) Trade-off between economic efficiency and environmental impact: The study emphasizes that the trade-off between cost-effectiveness and environmental impact is the key to improving the sustainability of transportation systems. Through data analysis, Larrodé and Muerza (2020) showed that under certain conditions, integrating light freight and passenger rail transport can not only reduce overall transportation costs, but also significantly reduce greenhouse gas emissions.

2.1.3 Research Innovation and Limitations

The study of Larrodé and Muerza (2020) provides a novel perspective on the integration of rail transport and last-mile delivery. Its innovation lies in that traditional rail transport and last-mile delivery are usually studied as two independent fields, and this study proposes a feasible model to improve the efficiency and sustainability of the transportation system by integrating the two.

However, the study also has certain limitations. First, the study is based on theoretical models and lacks large-scale field data verification. Second, although the study emphasizes the advantages of integrating light freight and passenger rail, in actual operation, the flexibility and adaptability of the railway system still need further research. In addition, the automation technology of last-mile delivery is still in the development stage. How to apply this technology in the actual environment of different cities is also an important direction for future research.

2.1.4 Conclusion and Future Research Directions

Overall, the study provided by Larrodé and Muerza (2020) provides useful insights into improving the efficiency and sustainability of rail transport systems. By integrating light freight and passenger rail transport and introducing innovative models for last-mile delivery, it is possible to not only improve transport efficiency but also significantly reduce environmental impact. Future research can further focus on how to implement this approach in different cities and regions, evaluate its economic and environmental benefits, and explore more feasible technical solutions to achieve a more efficient transport system (Larrodé & Muerza, 2020).

2.2 International Trade Theory

With the increase in trade between China and Thailand, the optimization of logistics mode has become crucial. Especially under the promotion of the Belt and Road

Initiative, the Trans-Asia Railway, as an important transportation channel, has a far-reaching impact on the optimization of cargo transportation and logistics systems between the two countries. Lin, Zhao, and Wu (2024) systematically evaluated the impact of the Trans-Asia Railway on the choice of logistics mode between Thailand and China by applying the analytic hierarchy process (AHP) and the technology ranking method (TOPSIS). This study provides a new perspective on how to choose the optimal logistics mode, especially when evaluating the cost, efficiency and environmental impact of multiple modes of transportation, providing an effective decision support tool.

2.2.1 Research Background and Problems

With the construction and operation of the Trans-Asia Railway, railway transportation, as a green and low-carbon mode of transportation, has gradually become an important choice in logistics transportation. Lin et al. (2024) proposed that traditional logistics modes, such as road and sea transportation, are facing increasing cost and environmental pressures. Especially between Thailand and China, the advantages of railway transportation are gradually emerging: it can not only shorten transportation time, but also reduce carbon emissions. However, how to make the best choice among multiple modes of transportation is still a complex decision-making problem. Lin et al. (2024) evaluated the specific impact of the Trans-Asian Railway on the choice of logistics mode between Thailand and China through the AHP-TOPSIS method, revealing the potential and challenges of railway transportation in the Thai-Chinese logistics system.

2.2.2 Main Research Methods and Analysis

Lin et al. (2024) used a combination of AHP (analytic hierarchy process) and TOPSIS (technical ranking method) for analysis:

- 1) AHP method: The AHP method analyzes multiple decision factors of different logistics modes, including cost, time, reliability, environmental impact,

etc., by constructing a multi-level decision tree model. The advantage of the AHP method is that it can quantify the relative importance of different factors based on expert judgment, thereby providing systematic support for decision-making.

2) TOPSIS method: The TOPSIS method is a ranking method based on geometric distance, which can evaluate the advantages and disadvantages of each logistics mode by comparing the distance between each scheme and the ideal scheme. In this study, the TOPSIS method was used to rank multiple logistics modes to help decision makers choose the most suitable logistics scheme. By combining these two methods, Lin et al. (2024) systematically evaluated the advantages of the Trans-Asian Railway in the logistics transportation between Thailand and China, especially when considering factors such as transportation cost, transportation time, transportation reliability and environmental impact, railway transportation showed obvious advantages.

2.2.3 Main Findings of the Study

The main findings of the study by Lin et al. (2024) can be summarized as follows:

1) Cost-effectiveness: When comparing different logistics modes, railway transportation has a greater advantage in cost-effectiveness compared with road and sea transportation. Railway transportation can provide relatively stable prices, especially in the transportation of bulk goods, and has strong competitiveness.

2) Transportation time and efficiency: The construction of the Trans-Asian Railway has shortened the transportation time, especially when compared with sea transportation, railways can significantly improve transportation efficiency and reduce transportation cycles. This makes railways an attractive option in cross-border logistics.

3) Environmental impact: Railway transportation is significantly superior to road and sea transportation due to its low carbon emissions. Lin et al. (2024) emphasized that railways have important advantages in reducing greenhouse gas emissions and air pollution, which is one of the important reasons why they have become part of green logistics.

4) Comprehensive evaluation: Combining the AHP and TOPSIS methods, the study shows that the role of the Trans-Asian Railway in the Thai-Chinese logistics system cannot be ignored, especially when considering the environment and long-term cost-effectiveness, rail transportation should be one of the preferred options.

2.2.4 Innovation and Limitations of the Study

Lin et al. (2024) used the AHP-TOPSIS method to evaluate the impact of the Trans-Asian Railway on the choice of logistics mode between Thailand and China, which is an important innovation of the study. Through multi-level and comprehensive decision analysis, the study not only provides a quantitative evaluation of the railway transportation mode, but also reveals the relative advantages between different logistics modes. In addition, the combination of the AHP-TOPSIS method also provides a flexible decision-making framework that is suitable for logistics mode selection problems in different contexts.

However, the study also has some limitations. First, the decision factors of the study mainly rely on expert evaluation and lack actual transportation data support. Second, although the potential of the Trans-Asian Railway is widely recognized, in actual operation, challenges in infrastructure construction, management issues, and policies and regulations of railway transportation still need to be further addressed.

2.2.5 Conclusion and Future Research Directions

Overall, the study by Lin et al. (2024) provides systematic theoretical support for the impact of the Trans-Asian Railway on the choice of logistics mode between Thailand and China. Through the combination of the AHP-TOPSIS method, the study clarified the advantages of railway transportation in terms of cost, efficiency and environment, and provided a strong reference for decision makers in choosing the most suitable logistics mode. However, future research can further focus on the following aspects:

1) Field data verification: Future research can verify the accuracy and reliability of the AHP-TOPSIS method through field data, especially in the context of different regions and different types of goods.

2) Railway transportation infrastructure: With the continuous expansion of the Trans-Asian Railway network, research should further focus on the construction and improvement of railway transportation infrastructure to solve the bottleneck problem in transportation.

3) Policy support and market mechanism: The promotion of railway transportation also requires the cooperation of policy support and market mechanism. Future research can explore how the government can promote the popularization of railway transportation through policies and provide necessary support for it (Lin et al., 2024).

2.3 Theory No.3 Transportation Economics Theory

As traffic demand and supply continue to change, how to understand and predict individual and collective choice behavior in traffic decision-making has become an important research issue in the field of transportation. Dixit, Sharma, and Kumar (2017) explored how incentive mechanisms and background factors in traffic choice affect the decision-making process through the method of experimental economics. This study provides a new perspective for traffic decision-making, emphasizing the profound impact of situational factors and incentive design on the behavior of decision makers, especially in urban traffic management and policy making.

2.3.1 Research Background and Problems

Traffic choice involves multiple aspects of decision-making, such as choosing transportation tools, driving routes, and travel time. Traditional traffic models are mostly based on rational choice theory, assuming that decision makers have complete information and complete rationality. However, real-life decisions are often affected by a variety of irrational factors, such as situational factors, psychological biases, and social

norms. Dixit et al. (2017) explored the impact of incentive mechanisms and decision-making backgrounds on individual traffic choices from the perspective of experimental economics, and proposed a new method to understand and predict traffic behavior.

2.3.2 Main Research Methods and Analysis

Dixit et al. (2017) used experimental economics methods to analyze the role of incentives and situational factors in traffic choices by designing experiments. Experimental economics provides researchers with an experimental environment where variables can be controlled, allowing researchers to observe individuals' decision-making behaviors under different incentive and situational settings under simulated conditions.

1) Experimental design: The authors set up different incentive schemes through experiments to simulate situations that may be encountered in real traffic decisions, such as traffic congestion, price fluctuations, and government subsidies. Participants need to make traffic choices under these settings to observe their behavior patterns.

2) Behavioral economics perspective: By combining the theory of behavioral economics, Dixit et al. (2017) considered people's preferences and limitations in making decisions, such as overconfidence, loss aversion, and social influence. The study shows that these irrational factors play an important role in traffic decisions, and traditional economic models often ignore these factors.

3) Incentive and situational analysis: The study also explored the impact of different incentive methods (such as monetary rewards, time compensation, etc.) and situational backgrounds (such as traffic congestion, environmental protection, etc.) on individual choices. The experimental results show that transportation choices are not only based on economic costs and benefits, but also significantly influenced by situational factors.

2.3.3 Main Research Findings

The main findings of the Dixit et al. (2017) study can be summarized as follows:

1) The impact of incentives on choice: Incentives play a significant role in transportation choices. Different forms of incentives, such as cash rewards or time compensation, can effectively change individuals' transportation choice behaviors. For example, policies that reward travel can encourage people to choose more environmentally friendly or economical modes of transportation.

2) The importance of background factors: Transportation decisions not only rely on individual economic rationality, but are also influenced by social, cultural and situational factors. For example, traffic congestion and environmental pollution problems can lead to different attitudes towards different transportation options, and social norms and collective behavior can also affect individual decisions.

3) The impact of behavioral biases: The theory of behavioral economics shows that some decisions in transportation choices are often affected by irrational factors. When choosing a mode of transportation, people often ignore long-term costs and tend to choose options with higher immediate returns. Loss aversion and overconfidence are common behavioral biases.

4) Policy recommendations: Based on the experimental results, Dixit et al. (2017) put forward some targeted policy recommendations. For example, the government can effectively guide individuals to choose more environmentally friendly and efficient modes of transportation by designing appropriate incentive mechanisms (such as rewarding low-carbon transportation modes, subsidizing public transportation, etc.).

2.3.4 Research Innovation and Limitations

Dixit et al. (2017) innovatively provided a new perspective by applying experimental economics methods to the field of transportation choice, helping researchers better understand the hidden behavioral patterns in transportation decisions.

Compared with traditional economic models, experimental economics considers more contextual and psychological factors, providing a new methodology for transportation management and policy making.

However, the research also has certain limitations. First, although the experiment can control variables, the context of the experimental setting may be different from the real world, resulting in limited external validity of the experimental results. Second, the research mainly relies on the voluntary behavior of the participants and may not fully simulate the actual transportation decision-making situation. Future research can verify the universality of the experimental results through further field surveys and cross-cultural experiments.

2.3.5 Conclusion and Future Research Directions

Dixit et al. (2017) provided strong theoretical support for understanding the incentive mechanism and background factors in transportation choices. Through the method of experimental economics, the study revealed the profound impact of situational factors and behavioral biases on transportation decisions. This not only provides a theoretical basis for the design of transportation policies, but also proposes new directions for future transportation management and planning.

2.3.6 Future Research can be Extended to the Following Directions

1) Multi-dimensional incentive mechanism research: further explore the comprehensive impact of different types of incentives (such as economic incentives, social incentives, etc.) on transportation choices, especially the trade-off between long-term incentives and short-term incentives.

2) Cross-regional and cross-cultural comparison: The behavioral patterns of transportation choices may be different in different regions and cultural backgrounds. Future research can compare transportation decisions in different countries or regions to reveal the cultural and social factors involved. Comprehensive

consideration of environmental factors: As the world pays more attention to environmental issues, future research can further explore how to promote more environmentally friendly and sustainable transportation choices through policy guidance and incentive mechanisms (Dixit et al., 2017).



CHAPTER 3

RESEARCH METHODOLOGY

3.1 Population and Samples

3.1.1 Population

Chinese Building Material Companies

- 1) Export companies: 5,000 companies
- 2) Logistics: 50 companies

Thai Companies that Import Building Material from China

- 1) Import companies: 189 companies
- 2) Logistics: 56 companies

3.1.2 Sampling

- 1) Chinese Exporter 5000 Companies, select 2 companies
- 2) Chinese Logistics 50 Companies, select 2 companies
- 3) Thai Importer 189 Companies, select 2 companies
- 4) Thai Log 56 companies, select 2 companies

For 1) Chinese Exporter Company (Appendix Questionnaire 1)

A. International Trade Manager or Sales Manager: Responsible for export business and market development, and have a deep understanding of the factors affecting transportation costs (such as raw material procurement, packaging and transportation mode selection).

B. Logistics or Supply Chain Manager: Familiar with the company's selected transportation mode and its cost allocation, and can provide details related to logistics.

C. Environmental Protection or Sustainable Development Manager (if any): Understand the specific measures for environmental management in the export link (such as green packaging or environmentally friendly transportation solutions).

Interview questions: Analysis of international transportation costs and environmental management strategies of Chinese export enterprises.

(Focus: factors affecting transportation costs, transportation mode selection, environmental management measures).

For 2) Chinese Logistics Company (Appendix Questionnaire 2)

A. Operations Manager: Responsible for the design, execution and cost optimization of the transportation network, and can provide detailed data related to transportation costs.

B. Project Manager (Building Materials Related Projects): Directly responsible for the transportation of building materials, and understand the specific problems and solutions in transportation.

C. Person in charge of environmental compliance or quality management: Understand the environmental protection measures taken by the logistics company during transportation such as pollution reduction technology or strategies).

Interview questions: Transportation cost optimization and environmental protection practices of Chinese logistics enterprises.

(Focus: transportation network design, construction material transportation issues, pollution reduction technology).

For 3) Thai importer company (Appendix Questionnaire 3)

A. Purchasing manager: Have a deep understanding of the cost sharing method of international transportation imports, customs fees and transportation costs of imports.

B. Supply chain or logistics manager: Familiar with the transportation process of construction materials from China to Thailand, and understand the impact of the choice of transportation mode.

Interview questions: Analysis of transportation cost allocation and logistics mode selection of Thai import enterprises.

(Focus: international transportation cost allocation, customs clearance fees, and the impact of transportation modes on cost and efficiency).

For 4) Thai logistics company (Appendix Questionnaire 4)

A. Operations manager: Familiar with the specific transportation plan from the port to the destination (such as the construction site) and its cost structure.

B. Marketing manager or business manager: Have a certain understanding of the relationship between the cost of logistics services and customer needs (including transportation efficiency and environmental friendliness).

C. Person in charge of environmental compliance: Responsible for understanding the company's environmental management practices during transportation.

Interview questions: Exploration of transportation cost structure and environmental protection measures of Thai logistics enterprises.

(Focus: transportation plan design, balance between customer demand and logistics costs, environmental management strategy).

3.2 Research Instruments

This study employs a questionnaire survey as the primary data collection tool to comprehensively understand the cost and environmental impact of construction materials transportation. The questionnaire integrates both quantitative and qualitative analysis to capture respondents' perceptions, experiences, and opinions regarding key issues in the transportation process.

In addition to the questionnaire survey, this research also incorporates a qualitative research approach through expert interviews. These interviews are conducted with

professionals who have extensive experience in international trade, logistics, and the transportation of construction materials. The expert interviews aim to delve deeper into the complexities that may not be fully captured by the survey data. They provide nuanced insights into cost structures, environmental impacts, operational challenges, and emerging trends in the industry. By integrating expert perspectives with survey results, the study ensures a more robust and triangulated analysis, thereby enhancing the overall validity and reliability of the research findings.

3.2.1 Questionnaire Design Principles

In order to ensure the effectiveness and scientificity of the questionnaire, the questionnaire designed for this study follows the following principles:

- 1) Concise and clear: The question design strives to be concise and clear, avoiding complex terms and multiple choices to ensure that all respondents can understand and answer accurately.
- 2) Structured: The questionnaire adopts a structured design, and the questions are gradually developed in a logical order to avoid leading questions and ensure that the collected data is reliable.
- 3) Combination of quantitative and qualitative: By setting a combination of closed questions and open questions, it is possible to quantitatively analyze the general views of the respondents and deeply explore their specific opinions and suggestions.
- 4) Targeted: The content of the questionnaire targets different links in the transportation of construction materials, including transportation costs, environmental impacts, sustainable development measures, etc., to ensure that all dimensions of the research issues are covered.

3.2.2 Questionnaire Structure

The questionnaire of this study is mainly divided into the following parts:

- 1) Basic information part: including basic background information of respondents, such as age, gender, work experience, position, company or industry,

etc., the purpose is to understand the background of respondents so as to effectively classify and analyze the data.

2) Transportation cost issue: This part aims to understand the respondents' cognition and actual situation of the transportation cost of construction materials, including transportation routes, cost composition, transportation efficiency and other contents. The questions may involve the following aspects:

2.1) Transportation mode selection (such as road, rail, sea transportation, etc.) and its cost comparison.

2.2) Difficulties in controlling transportation costs and its influencing factors.

3) Environmental impact issue: This part will explore the respondents' cognition of the environmental impact of the transportation of construction materials and its solution strategies, including carbon emissions, energy consumption, noise pollution and other contents. The questions may involve the following aspects:

3.1) Carbon emissions and energy consumption during transportation.

3.2) Pollution emissions of transportation vehicles and their impact on the environment.

3.3) The relationship between transportation infrastructure construction and environmental impact.

3.4) Measures to mitigate environmental impact and the effectiveness of current policies.

4) Sustainable development and alternatives: This section aims to assess respondents' awareness of sustainable transportation solutions and alternative modes of transportation, including green logistics, the use of clean energy vehicles, etc. Questions may cover the following aspects:

4.1) Attitudes and acceptance of environmentally friendly transportation methods (such as electric trucks, liquefied natural gas transportation vehicles, etc.).

4.2) The implementation status and difficulties of green logistics.

4.3) The impact of policy and technical support on promoting sustainable transportation.

5) Open questions: Finally, some open questions are designed to allow respondents to freely express their views and suggestions on the transportation of construction materials, especially their opinions on optimizing transportation costs, reducing environmental impacts, and promoting sustainable development.

3.2.3 Reliability and Validity Test of the Questionnaire

In order to ensure the reliability and validity of the questionnaire, this study will carry out the following steps:

1) Reliability test: Use Cronbach's Alpha coefficient to test the reliability of the questionnaire to ensure that the contents of the questionnaire are consistent and can reflect the true opinions of the respondents. Generally, if the Cronbach's Alpha coefficient is greater than 0.7, it means that the questionnaire has good reliability.

2) Validity test: Test the content validity of the questionnaire through expert review and presurvey. Expert review will help ensure that the questionnaire questions can accurately capture the core content of the research questions, and pre-survey will help to find potential problems and deficiencies in the questionnaire design, so as to make adjustments.

Through the above design, the questionnaire will provide sufficient data support for the research and provide a scientific basis for analyzing the cost-effectiveness and environmental impact of the transportation of construction materials.

3.3 Data Collection

This study uses a questionnaire survey method to collect data, aiming to gain an in-depth understanding of the cost structure, environmental impact and sustainable development measures in the transportation of construction materials. The data collection

process will strictly follow scientific design steps to ensure that the collected data is representative, accurate and reliable, providing a solid foundation for subsequent analysis.

3.3.1 Questionnaire Design

In order to ensure that the questionnaire can comprehensively and systematically reflect the research issues, the questionnaire content has been carefully designed according to the research objectives and research questions. The questionnaire is divided into several main parts: basic information of respondents, transportation costs, environmental impacts, sustainable development measures and open questions. The questions in each part are presented in a logically clear and easy-to-understand manner, and a combination of quantitative questions (such as multiple-choice questions and scoring questions) and qualitative questions (such as open questions) is used to ensure the multi-dimensionality and depth of the data.

3.3.2 Sample Selection and Survey Objects

The sample for data collection will be composed of personnel from construction material transportation companies, construction project managers and industry experts. The main target groups of the study include:

- 1) Construction material transportation company practitioners: including transportation company managers, operators, drivers, etc., who are directly involved in the transportation process of construction materials.
- 2) Construction project managers: including construction company managers, project managers, procurement managers, etc., who are responsible for the management and operation of construction projects, involving the transportation and cost management of construction materials.
- 3) Industry experts and scholars: scholars or industry consultants who focus on the fields of construction material transportation, logistics, environmental impact assessment, etc.

3.3.3 Data Collection Methods

The data will be collected through a combination of online and offline methods to ensure that a wide range of representative sample data is obtained.

1) Online data collection: The questionnaire is mainly published through online questionnaire platforms (such as Wenjuxing, Google Forms, etc.), and respondents can fill in the questionnaire through electronic devices (such as mobile phones, computers, etc.). The advantage of online questionnaires is that they can quickly cover a wide range of respondents, especially participants from different regions, which facilitates large-scale data collection.

2) Offline data collection: Data collection is carried out through thesis questionnaires or mobile devices at places such as enterprises, construction project sites, or industry conferences related to the transportation of construction materials. Offline surveys are suitable for respondents who cannot participate through online platforms, especially some elderly respondents or employees of local companies.

3.3.4 Survey Implementation Steps

1) Questionnaire distribution and collection: First, distribute online questionnaires to the target group through channels such as email, social media platforms, and industry association websites. At the same time, at the construction project site or industry conference, the research team will directly distribute thesis questionnaires to participants or use mobile devices to fill them out on site. The questionnaire takes 10 to 15 minutes to fill out, and respondents can complete it at a convenient time.

2) Data collection period: The collection cycle of the questionnaire survey is expected to be two weeks, during which multiple reminders and follow-ups will be made to ensure the maximum recovery rate. During the collection process, ensure that all respondents can participate on a voluntary and confidential basis to ensure the authenticity and integrity of the data.

3.4 Data Analysis

3.4.1 Thematic Analysis

In this study, I used Thematic Analysis to analyze the relationship between transportation costs and environmental impacts in the international trade of construction materials. First, I familiarized the collected data and reviewed and sorted out the factors related to transportation costs and environmental impacts, such as transportation mode and transportation distance. Through this process, I made a preliminary arrangement of the data and identified the key factors related to the research topic.

Next, I categorized these factors and identified several major themes, focusing on the relationship between transportation costs and environmental impacts. The main themes include:

- 1) The relationship between transportation mode and cost-effectiveness.
- 2) The role of transportation route selection on environmental impacts.
- 3) The relationship between transportation efficiency and cost and environmental impacts.

In the process of reviewing and refining these themes, I ensured that they could accurately reflect the relationship between transportation costs and environmental impacts in the data and provide a clear framework for subsequent analysis.

CHAPTER 4

RESEARCH RESULTS

This chapter systematically analyzes the mechanisms by which transportation mode, fuel costs, transportation distances, environmental protection measures, and policy environments affect both transportation costs and environmental impacts in the international trade of construction materials. Based on questionnaire data, a preliminary literature review, and expert interviews, and by integrating quantitative data with real-world case studies, this study reveals the interplay among multiple factors and their dual impact on enterprise operations and environmental sustainability.

4.1 The Impact of Transportation Mode on Cost Structure

The survey indicates that 85% of respondents believe that the mode of transportation (such as maritime, land, or air) has a significant influence on the final cost of construction materials. In expert interviews, an executive with over 20 years of experience in the construction industry elaborated on the following points:

- 1) Application of Multimodal Transport and Differentiated Cost Effects.
- 2) Maritime Transport: As a commonly used method in China-Thailand trade, it is suitable for bulk cargo with lower unit transportation costs, though it typically involves longer transit times.
- 3) Rail Transport: Positioned between maritime and road transport, it offers a balance between timeliness and cost advantages, making it ideal for bulk shipments with higher time sensitivity.
- 4) Road Transport: Noted for its high flexibility, it is suitable for short distances or “last-mile” deliveries, albeit at a higher unit freight cost.

Experts emphasize that in practical operations, enterprises must consider not only the costs associated with a single mode of transport but also additional expenses

such as storage, insurance, and transshipment. It is crucial to develop diversified transportation strategies based on order characteristics and market demand to achieve overall cost optimization.

Furthermore, early literature (for example, studies by Limao and Venables) indicates that while transportation mode directly determines freight costs, it also exerts a leverage effect on insurance costs, cargo losses, and logistics management expenses. Experts add that when selecting a transportation mode, companies should seek a balance between cost and timeliness, using multimodal transport to mitigate the limitations that may arise from reliance on a single mode.

4.2 The Impact of Fuel Costs, Transportation Distance, and Policy Factors

Statistical data shows that 82% of respondents believe that fluctuations in fuel prices significantly affect overall transportation costs, and 90% consider that increased transportation distances lead to higher unit transportation costs. Expert interviews further point out:

1) Transmission Mechanism of Fuel Cost Fluctuations:

The instability of oil prices forces transportation companies to face rising operating costs. Companies need to establish dynamic risk management mechanisms, such as long-term contracts and price hedging, to smooth out the risks associated with cost volatility.

2) Marginal Cost Effects of Transportation Distance:

Long-distance transportation not only increases fuel consumption but also incurs additional expenses, such as vehicle maintenance and toll fees, demonstrating a nonlinear increase in marginal costs. Experts recommend optimizing route design and reducing transshipment links in cross-border transportation to alleviate the cost pressures associated with longer distances.

3) Policy Environment and Regulatory Adjustments:

Constantly evolving environmental requirements and changes in trade policies exert a dual impact on transportation costs. In the short term, stricter emission standards and tariff adjustments may increase the burden on companies; in the long term, however, these factors drive the logistics industry toward a greener transformation. Experts suggest that establishing a dedicated policy research team to track domestic and international regulatory changes in real time is a crucial measure for companies to manage policy risks.

4.3 Long-term Effects of Environmental Protection Measures and Green Supply Chain Management

Against the backdrop of an increasing global awareness of environmental issues, environmental protection measures have become more prominent in the international trade of construction materials. The survey shows that 88% of respondents support the use of transportation modes powered by low emissions or renewable energy, and 80% believe that green supply chain management plays a positive role in reducing environmental pollution. Expert interviews add:

1) Environmental Impact Factors:

In international transportation, the primary environmental impacts include exhaust emissions from vehicles, energy consumption, noise pollution, and potential oil spills. In long-distance transportation, exhaust emissions from fuel combustion have a direct impact on air quality and climate change.

2) Environmental Performance of Different Transportation Modes.

3) Maritime transport, while generally having lower energy consumption per unit of cargo, can lead to marine pollution if vessels are outdated or poorly managed.

4) Rail transport typically offers higher energy efficiency and lower emissions, with ongoing electrification trends further reducing environmental burdens.

5) Road transport, due to frequent stops and high fuel consumption, tends to have a relatively greater environmental impact.

6) Industry Environmental Initiatives.

The industry has widely promoted the use of low-sulfur fuel, the installation of exhaust treatment systems, optimization of transportation networks, and exploration of new energy transportation tools (such as new energy trucks and intelligent dispatch systems). Under the impetus of the “Belt and Road” initiative, ongoing improvements in China-Thailand infrastructure have also created favorable conditions for a green transformation. Experts believe that green supply chains not only help reduce environmental pollution but also enhance corporate competitiveness under policy incentives, thereby creating long-term developmental advantages.



CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

Based on the integration of survey data, literature review, and expert interviews, this chapter summarizes the key findings of the study and proposes targeted recommendations. The aim is to provide decision-making references for transportation management and environmental protection in the field of international construction material trade.

5.1 Conclusion

This study draws the following main conclusions:

1) The Critical Role of Transportation Mode Selection:

Different transportation modes exhibit significant differences in cost structure, timeliness, and risk management. Maritime transport is suited for bulk orders with lower time sensitivity; rail transport strikes a balance between cost and timeliness; and road transport is ideal for short-distance and last-mile deliveries. Enterprises should build a multimodal transport system based on actual needs to achieve the optimal balance between cost and efficiency.

2) Significant Impact of Fuel Costs and Transportation Distance:

Fluctuations in fuel prices and longer transportation distances significantly increase transportation costs. Companies need to establish dynamic monitoring platforms and risk management mechanisms while optimizing their transportation networks to reduce fuel consumption and operating expenses. Experts note that global oil price volatility and policy adjustments in recent years have led to an overall upward and fluctuating trend in transportation costs.

3) Long-term Value of Environmental Protection Measures and Green Transformation:

Although environmental protection technologies and green supply chain management require considerable initial investments, they contribute to reducing energy consumption and environmental pollution in the long run. Moreover, under policy incentives, these measures can create a competitive advantage. Initiatives such as promoting low-sulfur fuels, new energy vehicles, and intelligent dispatch systems are providing effective pathways for green transformation.

4) Dual Impact of the Policy Environment:

Adjustments in environmental regulations and transportation policies may increase corporate burdens in the short term; however, in the long term, they will drive the logistics industry toward green transformation and efficiency improvements. Strengthening communication and cooperation between the government and enterprises is of paramount importance to achieving a win-win outcome.

5.2 Recommendations

Based on the above conclusions, the following recommendations are proposed:

1) Formulate Diversified Transportation Strategies:

1.1) Enterprises should flexibly adopt various transportation modes — maritime, rail, road, etc. — based on order characteristics, market demand, and geographic distribution, thereby constructing an efficient multimodal transport system.

1.2) It is recommended to introduce advanced logistics dispatch systems and big data analytics tools to enable real-time dynamic monitoring and optimized allocation of transportation resources.

2) Establish Risk Management Mechanisms for Fuel Costs and Transportation Distance:

2.1) Develop real-time data monitoring platforms to track fluctuations in fuel prices and mitigate fuel cost risks through long-term contracts, price hedging, and other measures.

2.2) Optimize transportation network design by employing strategies such as regional distribution centers and route optimization to reduce additional costs associated with longer distances and transshipment.

3) Promote Green Supply Chain Development:

3.1) Actively introduce transportation equipment powered by low emissions or renewable energy to drive technological upgrades in logistics.

3.2) Construct a comprehensive green management system that spans the entire chain — from packaging and storage to distribution—to achieve a balance between cost savings and environmental benefits.

3.3) Collaborate with research institutions to develop low-carbon transportation models that meet actual enterprise needs, and leverage policy incentives to accelerate green transformation.

4) Strengthen Policy Interpretation and Collaborative Cooperation:

4.1) Establish a dedicated policy research team to monitor domestic and international environmental regulations and transportation policy developments in real time, ensuring that enterprises can adjust their operational strategies while remaining compliant.

4.2) It is recommended that governments and enterprises jointly establish information-sharing platforms to align policy formulation with actual business needs, thereby jointly promoting the green transformation of the industry.

5) Expand Future Research Directions:

5.1) Conduct in-depth studies on the application of intelligent logistics and big data in controlling transportation costs.

5.2) Investigate risk management and countermeasures in cross-border supply chains.

5.3) Explore mechanisms for internalizing carbon emission costs and their impact on corporate decision-making.

5.4) Analyze the economic benefits of international logistics green transformation pathways and the application of new energy technologies.

5.5) Additionally, consider the overall synergy of supply chains and the contributions of information-based and digital management to cost optimization, thereby providing more comprehensive decision-making support for enterprises.

By integrating questionnaire data, theoretical literature, and expert interviews, this research not only reveals the complex relationship between transportation costs and environmental impacts but also provides a systematic theoretical basis and practical guidance for enterprises seeking to achieve cost control and green transformation in the context of globalization.



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APPENDICES



The image features a large, faint watermark of the Rangsit University logo in the background. The logo is a circular emblem with a stylized flame or sunburst at the top, radiating lines forming a circle, and the university's name in Thai and English at the bottom.

APPENDIX A

MASTER'S THESIS EXPERT INTERVIEW SCRIPT

题目：国际贸易中建筑材料的运输成本与环境影响的比较研究

访谈目的：

本次访谈旨在深入了解建筑材料国际运输（尤其是中泰之间）的成本结构、环境影响因素，以及行业专家对未来趋势的看法。您的专业见解将为本研究提供重要的数据支持。

受访者信息：

- 姓名：
- 职位/单位：
- 相关经验：

访谈问题

一、受访者背景

1. 请您简单介绍一下您的职业背景以及在建筑材料国际运输方面的经验？
2. 您所在的企业或机构在建筑材料国际运输中扮演什么角色？

二、建筑材料国际运输的成本结构

3. 影响建筑材料国际运输成本的主要因素有哪些？（如运输方式、燃油价格、关税、仓储、管理成本等）

4. 在中国—泰国贸易中，不同运输方式（如海运、公路运输、铁路运输）的成本差异如何？

5. 近年来，中泰建筑材料运输成本有哪些显著变化？主要原因是什么？

6. 企业如何在运输过程中降低成本？目前有哪些有效的成本控制措施

三、建筑材料运输的环境影响

7. 在建筑材料国际运输过程中，主要的环境影响因素有哪些？（如废气排放、噪音污染、能源消耗等）

8. 不同运输方式（海运、陆运、铁路运输）对环境的影响有何不同？

9. 目前行业内是否采取了环保措施来减少运输对环境的影响？如果有，主要包括哪些措施？

四、行业趋势与未来展望

10. 在“一带一路”政策和区域经济合作的背景下，您认为未来中泰建筑材料运输的成本趋势如何？

11. 随着可持续发展理念的推广，您认为未来国际物流行业会如何优化运输方式，以降低环境影响？

12. 未来是否会有新的技术或政策（如新能源车辆、碳税、智能物流）对建筑材料国际运输产生重大影响？

五、补充与建议

13. 除了上述问题，您是否有其他关于本研究的见解或建议？

14. 您认为未来在这一领域还有哪些值得研究的问题？

访谈时间：_____

访谈方式：（线上/线下/电话）_____

访谈记录：是否允许录音？（是/否）_____

感谢您抽出时间参与本次访谈，您的意见对本研究具有重要价值！

1. 关于我的职业背景和经验

我在建筑行业已有超过 20 年的从业经历，从项目管理到供应链整合都有深入实践。目前，我主要负责公司各项成本控制工作，尤其是在建筑材料采购与国际运输环节中，曾多次参与中外大型项目，对跨国物流流程、成本构成以及风险控制都有较为系统的认识。

2. 企业在国际运输中的角色

浙江大华建筑有限公司主要负责建筑工程的实施，同时我们直接参与建筑材料的采购。对于国际运输，我们既是需求方，也通过与海外供应商、物流公司和报关机构的密切协作，扮演协调者和监督者的角色，确保材料从国外供应地高效、安全地到达施工现场，并力求在运输过程中降低整体成本。

3. 影响运输成本的主要因素 主要包括：

- 运输方式选择：不同模式（海运、铁路、公路）的定价和运力不同。
- 燃料及能源价格：油价波动直接影响运输工具的运行成本。
- 关税及政策调整：各国的贸易政策和关税变化会对成本产生影响。
- 仓储、保险和中转费用：物流环节中额外的操作费用。
- 市场波动与风险成本：包括汇率变化、突发事件等风险因素。

4. 中泰贸易中不同运输方式的成本差异

- 海运：通常适用于大宗货物，运费相对较低，但周期较长；
- 铁路运输：时效与成本介于海运和陆运之间，适合时效要求较高的大宗运输；
- 公路运输：灵活性强、适合短途或最后一公里配送，但单位运费较高。

在中泰贸易中，我们通常以海运为主，并根据具体需求辅以铁路或公路进行接驳配送。

5. 近年来运输成本的显著变化及原因 近年来主要呈现出两个趋势：

- 成本上升：全球燃油价格的不稳定、各国环保要求提高以及部分运输政策的调整，都使得运输环节的费用增加。
- 波动性增强：疫情及国际局势变化使得物流链不时出现中断或延误，导致短期内成本波动较大。

6. 降低运输成本的措施

我们采取了多项措施：

- 优化运输路线与资源整合：通过合理规划运输路线，减少中转环节，充分利用集装箱满载率；
- 信息化管理：利用物流信息平台监控运输动态，提前预判风险，调整运输计划；
- 长期战略合作：与多家优质物流服务商建立稳定合作关系，获取更具竞争力的报价；
- 定期成本评估与调整：依托大数据分析，及时调整采购和运输策略，降低不必要的支出。

7. 国际运输过程中的主要环境影响因素

主要包括运输工具的废气排放、能源消耗、噪音污染以及潜在的油污泄漏等问题。尤其在长途运输过程中，燃油燃烧产生的排放对空气质量和气候变化有直接影响。

8. 不同运输方式的环境影响差异

- 海运：虽然单位运输量的能耗较低，但船舶老旧、管理不善可能导致海洋污染和废气排放问题；

- 铁路运输：通常能效较高、排放较低，且铁路系统的电气化趋势有助于进一步降低环境负担；
- 公路运输：燃油消耗大、尾气排放较多，加上交通拥堵及频繁启停，对环境的影响相对更明显。

9. 行业内的环保措施

是的，目前行业内已经在采取多种环保措施：

- 推广使用低硫燃料和环保燃料；
- 安装尾气处理系统及定期检修运输工具；
- 优化运输网络，减少空驶和重复运输；
- 探索新能源运输工具的应用，如新能源卡车和智能调度系统。

10. “一带一路”背景下的成本趋势

在“一带一路”政策推动下，中泰之间的基础设施建设和跨国合作日益增强，这将有助于提升物流效率和通关速度，长期来看有望降低运输成本。不过，短期内国际市场的不确定性和政策调整可能仍会引起一定波动。

11. 国际物流优化与环境影响降低

随着可持续发展理念的深入推广，未来国际物流行业将更加注重绿色运输：

- 技术升级：推广新能源运输工具和智能调度系统；

- **多式联运优化**：通过科学整合海运、铁路、公路等多种方式，降低整体能耗；
- **管理数字化**：利用大数据和物联网提高运输效率，减少资源浪费，从而降低环境影响。

12. 新技术与政策对国际运输的影响

新能源车辆、智能物流系统、碳税政策等都将对国际运输产生深远影响。新能源技术可以有效降低燃料成本和排放；智能物流有助于优化调度、减少空驶；而碳税等环保政策将促使企业加速绿色转型，调整成本结构。

13. 对本研究的其他见解或建议

我建议在研究中不仅关注运输成本和环境影响的直接关系，还应考虑供应链整体协同效应以及信息化、数字化管理对成本优化的贡献。此外，政策环境的变化与国际合作模式也应作为重要研究维度，帮助企业更好地应对未来挑战。

14. 未来值得研究的问题

未来可深入探讨的课题包括：

- 智能物流与大数据在运输成本控制中的应用；
- 跨国供应链风险管理与应对策略；
- 碳排放成本内化机制及其对企业决策的影响；
- 国际物流绿色转型路径与新能源技术应用的经济效益分析。

Master's Thesis Expert Interview Script

Title: Comparative Study on the Transportation Cost and Environmental Impact of Construction Materials in International Trade

Interview Purpose:

This interview aims to gain in-depth understanding of the cost structure, environmental impact factors, and future trends of international transportation of construction materials (especially between China and Thailand). Your professional insights will provide important data support for this study.

Interviewee Information:

- Name:
- Position/unit:
- Related experience:

Interview Questions

I. Interviewee background

1. Please briefly introduce your professional background and experience in international transportation of construction materials?
2. What role does your company or organization play in the international transportation of construction materials?

II. Cost structure of international transportation of construction materials

3. What are the main factors affecting the cost of international transportation of construction materials? (such as transportation mode, fuel price, tariffs, warehousing, management costs, etc.)
4. In China-Thailand trade, what are the cost differences of different transportation modes (such as sea transportation, road transportation, and rail transportation)?

5. In recent years, what significant changes have there been in the cost of transporting construction materials between China and Thailand? What are the main reasons?

6. How can enterprises reduce costs during transportation? What are the effective cost control measures currently in place?

III. Environmental impact of construction material transportation

7. What are the main environmental impact factors in the international transportation of construction materials? (Such as exhaust emissions, noise pollution, energy consumption, etc.)

8. What are the different impacts of different modes of transportation (sea, land, and rail) on the environment?

9. Has the industry taken environmental protection measures to reduce the impact of transportation on the environment? If so, what are the main measures?

IV. Industry trends and future prospects

10. In the context of the "Belt and Road" policy and regional economic cooperation, what do you think will be the cost trend of China-Thailand construction material transportation in the future?

11. With the promotion of the concept of sustainable development, how do you think the international logistics industry will optimize transportation methods in the future to reduce environmental impact?

12. Will there be new technologies or policies (such as new energy vehicles, carbon taxes, and smart logistics) that will have a significant impact on the international transportation of construction materials in the future?

V. Supplement and Suggestions

13. In addition to the above questions, do you have other insights or suggestions about this study?

14. What other issues do you think are worth studying in this field in the future?

Interview time: _____

Interview method: (online/offline/telephone) _____

Interview record: Is recording allowed? (yes/no) _____

Thank you for taking the time to participate in this interview.

Your opinions are of great value to this study!

1. About my professional background and experience

I have more than 20 years of experience in the construction industry, and have in-depth practice from project management to supply chain integration. At present, I am mainly responsible for the company's various cost control tasks, especially in the procurement of construction materials and international transportation. I have participated in many large-scale Chinese and foreign projects and have a relatively systematic understanding of cross-border logistics processes, cost structure and risk control.

2. The role of enterprises in international transportation

Zhejiang Dahua Construction Co., Ltd. is mainly responsible for the implementation of construction projects, and we are directly involved in the procurement of construction materials. For international transportation, we are not only the demand side, but also play the role of coordinator and supervisor through close cooperation with overseas suppliers, logistics companies and customs declaration agencies to ensure that materials arrive at the construction site efficiently and safely from foreign supply places, and strive to reduce the overall cost during transportation.

3. The main factors affecting transportation costs Mainly include:

- Transportation mode selection: different modes (sea, rail, road) have different pricing and capacity.
- Fuel and energy prices: Oil price fluctuations directly affect the operating costs of transportation tools.

- Tariffs and policy adjustments: Trade policies and tariff changes in various countries will have an impact on costs.
- Warehousing, insurance and transit fees: additional operating costs in the logistics link.
- Market fluctuations and risk costs: including risk factors such as exchange rate changes and emergencies.

4. Cost differences of different modes of transport in China-Thailand trade

- Ocean transport: usually suitable for bulk goods, with relatively low freight, but a longer cycle;
- Railway transport: timeliness and cost are between sea transport and land transport, suitable for bulk transport with high timeliness requirements;
- Road transport: flexible and suitable for short-distance or last-mile delivery, but with higher unit freight.

In China-Thailand trade, we usually focus on sea transport, and use railways or roads for connecting delivery according to specific needs.

5. Significant changes in transportation costs in recent years and their causes In recent years, there have been two main trends:

- Rising costs: The instability of global fuel prices, the increase in environmental protection requirements of various countries, and the adjustment of some transportation policies have increased the cost of transportation.
- Increased volatility: The epidemic and changes in the international situation have caused interruptions or delays in the logistics chain from time to time, resulting in large cost fluctuations in the short term.

6. Measures to reduce transportation costs We have taken a number of measures:

- Optimize transportation routes and resource integration: through reasonable planning of transportation routes, reduce transit links, and make full use of container full load rate;

- Information management: use logistics information platform to monitor transportation dynamics, predict risks in advance, and adjust transportation plans;
- Long-term strategic cooperation: establish stable cooperation with many high-quality logistics service providers to obtain more competitive quotations;
- Regular cost evaluation and adjustment: rely on big data analysis to adjust procurement and transportation strategies in time to reduce unnecessary expenses.

7. Main environmental impact factors in international transportation

Mainly include exhaust emissions, energy consumption, noise pollution and potential oil leakage of transportation tools. Especially in long-distance transportation, emissions from fuel combustion have a direct impact on air quality and climate change.

8. Differences in environmental impacts of different modes of transport

- Ocean transport: Although the energy consumption per unit of transport volume is low, old ships and poor management may lead to marine pollution and exhaust emissions;
- Railway transport: Generally, it has higher energy efficiency and lower emissions, and the electrification trend of the railway system will help further reduce the environmental burden;
- Road transport: High fuel consumption, high exhaust emissions, coupled with traffic congestion and frequent starts and stops, the impact on the environment is relatively more obvious.

9. Environmental protection measures in the industry

Yes, the industry is currently taking a variety of environmental protection measures:

- Promote the use of low-sulfur fuel and environmentally friendly fuel;
- Install exhaust gas treatment systems and regularly inspect transportation tools;
- Optimize the transportation network to reduce empty trips and repeated transportation;

- Explore the application of new energy transportation tools, such as new energy trucks and intelligent scheduling systems.

10. Cost trends under the background of the “Belt and Road”

Driven by the “Belt and Road” policy, infrastructure construction and cross-border cooperation between China and Thailand are increasing, which will help improve logistics efficiency and customs clearance speed, and is expected to reduce transportation costs in the long run. However, in the short term, the uncertainty and policy adjustments in the international market may still cause some fluctuations.

11. Optimization of international logistics and reduction of environmental impact

With the in-depth promotion of the concept of sustainable development, the international logistics industry will pay more attention to green transportation in the future:

- Technology upgrade: Promote new energy transportation tools and intelligent scheduling systems;
- Multimodal transport optimization: Reduce overall energy consumption by scientifically integrating multiple modes such as sea, rail, and road;
- Digital management: Use big data and the Internet of Things to improve transportation efficiency, reduce resource waste, and thus reduce environmental impact.

12. The impact of new technologies and policies on international transportation

New energy vehicles, intelligent logistics systems, carbon tax policies, etc. will have a profound impact on international transportation. New energy technologies can effectively reduce fuel costs and emissions; intelligent logistics can help optimize scheduling and reduce empty trips; and environmental protection policies such as carbon taxes will prompt companies to accelerate green transformation and adjust cost structures.

13. Other insights or suggestions for this study

I suggest that in the study, we should not only focus on the direct relationship between transportation costs and environmental impacts, but also consider the overall synergy of the supply chain and the contribution of information and digital management to cost optimization. In addition, changes in the policy environment and international cooperation models should also be taken as important research dimensions to help companies better cope with future challenges.

14. Issues worth studying in the future

Topics that can be further explored in the future include:

- The application of intelligent logistics and big data in transportation cost control;
- Risk management and response strategies for cross-border supply chains;
- Carbon emission cost internalization mechanism and its impact on corporate decision-making;
- Economic benefit analysis of the green transformation path of international logistics and the application of new energy technologies.



The logo of Rangsit University is a circular emblem. At the top is a stylized flame or sunburst. Below it is a circular ring composed of many small, triangular segments. The text "มหาวิทยาลัยรังสิต" is written in Thai script along the bottom arc of the ring, and "Rangsit University" is written in English along the bottom arc of the ring.

APPENDIX B

QUESTIONNAIRE IOC FORMAT

Survey Transportation

Survey: Transportation Costs and Environmental Impact in International Trade of Building Materials

Survey Objective:

This survey aims to study the relationship between transportation costs and environmental impact in international trade of building materials, analyzing how different transportation modes affect costs and the environment.

Basic Information (Optional):

Item		Information
Occupation		
Years in International Trade		Years
Survey Questions (IOC Format):		
Factor	Question	Choice (Yes/No)
Transportation Mode	Do Transportation modes (such as sea, land, or air) significantly affect the final cost of building materials?	☐ Yes ☐ No
Transportation Time	Does choosing a low-Cost transportation method usually increase delivery time?	☐ Yes ☐ No
Fuel Costs	Do fluctuations in fuel prices for cross-border transportation significantly impact the overall cost of building materials?	☐ Yes ☐ No

Survey Questions (IOC Format):		
Factor	Question	Choice (Yes/No)
Transportation Distance	Does an increase in transportation distance generally lead to higher unit transportation costs for Building materials?	☐ Yes ☐ No
Mode Comparison	Does land transportation typically result in higher unit transportation costs compared to sea transportation?	☐ Yes ☐ No
Environmental Measures	Does choosing environmentally friendly transportation methods (such as low-emission or renewable energy-powered transportation) usually increase initial costs but help reduce environmental impact in the long run?	☐ Yes ☐ No
Packaging Waste	Does packaging waste generated during transportation have a significant impact on the environment?	☐ Yes ☐ No
Green Management	Can green supply chain management (such as using renewable energy transportation) effectively reduce environmental pollution in international building materials trade?	☐ Yes ☐ No
Policy Impact	Do changes in transportation regulations and environmental policies directly affect the cross- border Transportation costs of building materials?	☐ Yes ☐ No

Survey Questions (IOC Format):		
Factor	Question	Choice (Yes/No)
Technological Applications	Can digital logistics management (such as intelligent transportation scheduling) effectively improve transportation efficiency and reduce environmental impact?	☐ Yes ☐ No

Instructions:

Please select “Yes” or “No” for each question. Your answers will be used solely for research analysis, and all information will be kept strictly confidential.

Thank you for your participation!



Survey Results on Transportation Costs and Environmental Impact in International Building Materials Trade

Sample Size: 100 People

Question	"Yes" Responses	"No" Responses
Does the mode of transportation significantly affect the final cost of building materials?	85	15
Does choosing a low-cost transportation method usually lead to longer transportation times?	78	22
Do fluctuations in fuel prices significantly impact the overall transportation costs of building materials?	82	18
Does increasing transportation distance generally lead to an increase in unit transportation costs?	90	10
Are land transportation unit costs usually higher than those of sea transportation?	70	30
Do environmentally friendly transportation methods typically have higher initial costs but reduce environmental impact in the long term?	88	12
Does packaging waste have a significant impact on the environment?	75	25
Can green supply chain management effectively reduce environmental pollution?	80	20
Do changes in transportation regulations and environmental policies directly affect transportation costs?	85	15
Can digital logistics management improve transportation efficiency and reduce environmental impact?	92	8

BIOGRAPHY

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