A COMPARATIVE STUDY ON THE ADVANTAGES AND DISADVANTAGES OF TRANSPORTATION MODE SELECTION IN THE EVALUATION OF THAILAND'S EXPORT FRUIT MARKET COMPETITIVENESS

BY

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Abstract

This study evaluates the competitiveness of Thailand's tropical fruit exports to China by analyzing the advantages and disadvantages of air, sea, and land transportation modes. As China's largest supplier of tropical fruits, Thailand faces challenges in balancing cost efficiency, transit time, and quality preservation. Through interviews with six Thai exporters and Chinese importers, combined with secondary data analysis, the research identifies critical factors influencing transportation decisions. Key findings reveal that sea transport dominates (51% of exports) due to its low cost but struggles with prolonged transit times (4–10 days) and quality degradation; land transport (48% of exports) offers a balance between cost and speed (2–7 days) but faces bottlenecks from customs delays and inadequate cold chain infrastructure; and air transport (0.54% of exports) ensures freshness for premium fruits like durians but remains cost-prohibitive. The study highlights challenges such as inconsistent cold chain management, border clearance inefficiencies, and seasonal demand fluctuations. Recommendations include adopting multimodal logistics strategies, investing in IoT-enabled cold chain technologies, streamlining customs digitization, and leveraging emerging routes like the China-Laos Railway. These insights provide actionable guidance for exporters, policymakers, and stakeholders to enhance Thailand's competitiveness in China's fruit market while addressing sustainability and cost-effectiveness.

(Total 76 pages)

Keywords: Thai Fruit Export Competitiveness, Transportation Modes Selection, Cost and Time Efficiency

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CHAPTER 1

INTRODUCTION

1.1 Background and Significance of the Problem

As an export-oriented economy, Thailand's agricultural industry—particularly its tropical fruit exports play a vital role in the national economy. Blessed with unique geographical and climatic conditions, Thailand produces a diverse array of tropical fruits that are highly competitive in the global market due to their distinct flavors and variety. Among Thailand's primary export destinations, the Chinese market has become increasingly significant due to its vast consumer base and rising demand for tropical fruits. However, the perishable nature of fruits makes their quality and freshness highly dependent on the chosen transportation mode, making it essential to evaluate and compare the impacts of different transport modes on the competitiveness of Thailand's fruit exports.

Sea and land transportation are the main ways of transporting Thai fruits to China, and both transportation methods face various challenges during peak fruit export periods. According to a report by the Thai Ministry of Commerce, in 2022, sea freight accounted for 51% of Thailand's fruit exports to China, land freight accounted for 48%, and air freight accounted for 0.54%.

The cost advantage of sea freight is obvious, but the transportation time is long and the transportation cycle is not fixed Land transportation has high flexibility, but is affected by various factors such as vehicle condition, road conditions, weather, and customs clearance queues, resulting in high uncertainty in transportation time and significant changes in transportation costs (Xinhua News Agency Bangkok Bureau, 2023).

China is Thailand's largest fruit export market. According to data from the Thai Ministry of Commerce, the total amount of Thai fruit exports to China in 2022 was 2.17 million tons, worth 4.9 billion US dollars (approximately 34.4 billion yuan), an increase of 3.72%. The top five export varieties were bananas, coconuts, durians, dragon fruit, and longan. China is the largest export market for Thai durian, accounting for 95% of the total export volume, and also the country with the highest coconut exports from Thailand, with an export volume of 523,000 tons (Xinhua News Agency Bangkok Bureau, 2023).

In terms of fruit import value, the top ranked fruit categories are fresh durian, fresh cherry, frozen durian, banana, mangosteen, and coconut green. The above six types of fruits account for 76% of China's total fruit imports (World Agrochemical Network, 2024).

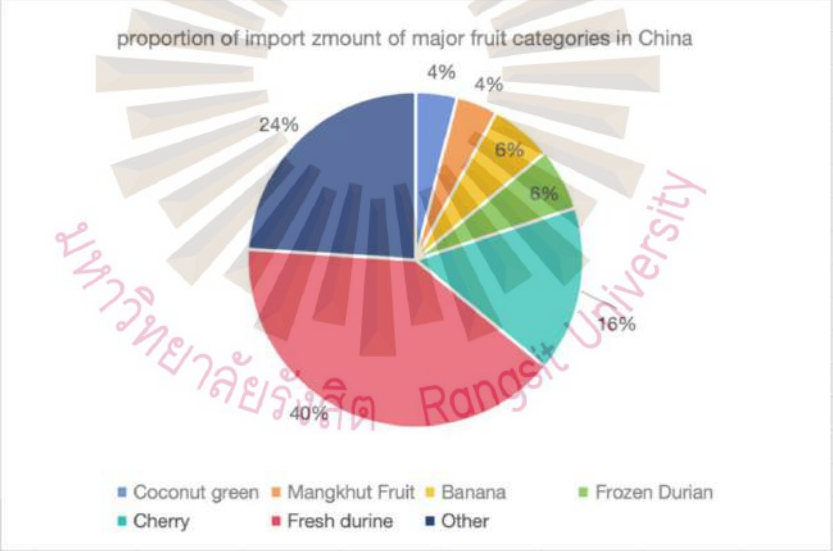
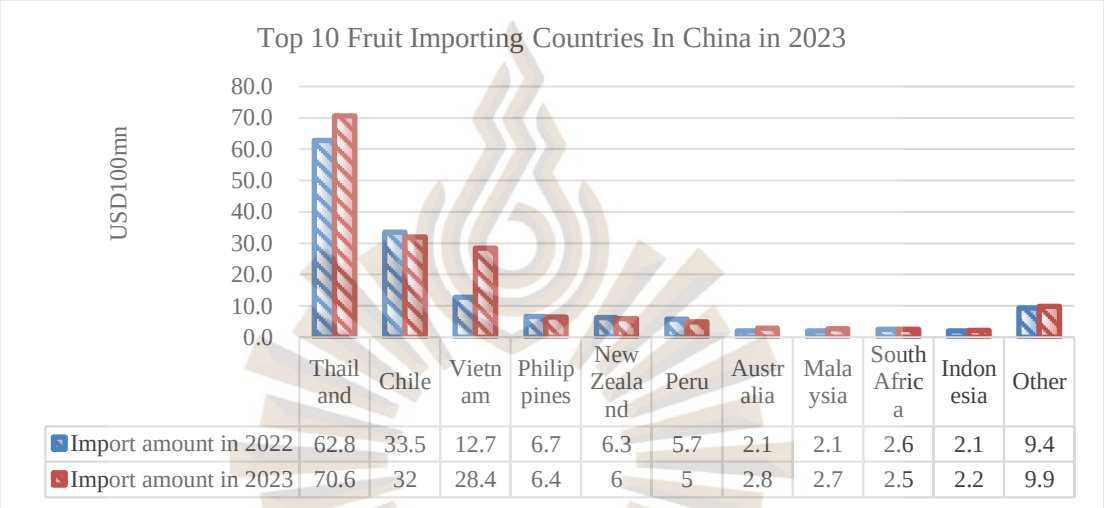


Figure 1.1 Proportion of Import Mount of Major Fruit Categories in China

Source: World Agrochemical Network, 2024

Thailand is the largest supplier of fruit to China, with an import value rising to $70.6 billion in 2023, driven by durian and other premium fruits. Vietnam shows rapid growth, with exports nearly doubling to $28.4 billion, leveraging its proximity and competitive pricing. To maintain its lead, Thailand should optimize logistics, diversify export products, and enhance value-added offerings like processed fruits (World Agrochemical Network, 2024).



	Thailand	Chile	Vietnam	Philippines	New Zealand	Peru	Australia	Malaysia	South Africa	Indonesia	Other
Import amount in 2022	62.8	33.5	12.7	6.7	6.3	5.7	2.1	2.1	2.6	2.1	9.4
Import amount in 2023	70.6	32	28.4	6.4	6	5	2.8	2.7	2.5	2.2	9.9

Figure 1.2 TOP 10 Fruit Importing Countries in China in 2023

Source: World Agrochemical Network, 2024

According to data from the Thai Ministry of Commerce, the sing Asian Yer Pao daily news reports that although Thailand holds an important position in the Chinese market, it faces competition from other countries. For example, durian from Vietnam is gradually increasing its market share in the Chinese market. In 2022, China's total fruit imports from Vietnam increased by over 41%, while imports from Thailand declined slightly. The advantage of Vietnamese durian lies in its longer harvest season and shorter transportation time due to its geographical location, resulting in lower costs.

In addition, Thai durian also faces competition from other countries such as the Philippines. In January 2023, China began allowing the import of durian from third countries, further increasing the competitive pressure of Thai durian in the Chinese

market (The Sing Sian Yer Pao Daily News, 2024).

In response to these issues and situations, this study provides two variable factors, time and cost, for research. By comparing and analyzing the advantages and disadvantages of different transportation methods for Thai fruit exports to China, it provides reference opinions and basis for market operators, investors, relevant government departments, etc., which can help improve the current problems and difficulties faced and increase the trade share of Thai fruits in the Chinese imported fruit market.

The selection of a suitable transportation mode for tropical fruits influences not only the level of freshness and preservation but also affects logistics costs and delivery times—factors that directly impact the overall economic benefits within the export supply chain. While traditional sea shipping is cost-effective, its longer transit times can compromise fruit freshness and delay market supply. On the other hand, air freight offers faster delivery and superior preservation but at a higher cost, potentially limiting competitiveness in price-sensitive markets. Additionally, new transportation routes, such as those developed under the "Belt and Road" initiative and the China-Thailand Railway, introduce alternative options that balance transit time and cost.

With China's vast geography and diverse climate, Thailand's fruit exporters must make strategic decisions in selecting transportation modes to maximize market competitiveness. This study evaluates and compares the advantages and disadvantages of various transportation modes in terms of time efficiency and cost control for exporting tropical fruits from Thailand to China. Furthermore, it provides strategic recommendations for enhancing Thailand's export competitiveness by optimizing logistics resources, improving cross-border transport efficiency and reliability, ensuring fruit quality during transit, and increasing supply chain transparency with advanced information technology.

To systematically compare the advantages and disadvantages of different transportation modes, this study utilizes data from fruit exporter surveys. Based on these findings, a competitiveness model is constructed to analyze the performance of each transportation mode with regard to time and cost, revealing key factors that influence competitiveness in specific scenarios.

Through these methods, this study aims to highlight the competitive differences across transportation modes for tropical fruit exports from Thailand to China and provide a scientific basis for Thai exporters in selecting the most suitable transportation options. Additionally, the findings will assist policymakers in making informed decisions on infrastructure development, promoting sustainable growth in Thailand's fruit export industry, and fostering deeper trade cooperation between Thailand and China. This research will also contribute valuable insights and strategic references for the global agricultural export trade model.

1.2 Research Objectives

1.2.1 To compare the advantages and disadvantages of different transportation modes for fruit exports from Thailand to China.

1.2.2 To analyze cost efficiency and satisfaction to assess the current logistics modes used for fruit exports from Thailand to China.

1.2.3 To evaluate the macro and micro factors affecting transportation decisions, including seasonal fruit variations, logistics infrastructure, and service fees.

1.2.4 To explore Thailand's export competitiveness in the Chinese market and identify opportunities and challenges for future improvement.

1.3 Research Questions and Assumptions

In evaluating the competitiveness of Thailand's export fruit market, three primary transportation modes air, sea, and land are considered. This study investigates the selection of export logistics for Thailand's main tropical fruits, analyzing the advantages and disadvantages of each mode in terms of cost and time to optimize strategies and enhance competitiveness in the global fruit trade.

The following research questions and assumptions guide this analysis:

1.3.1 Research Questions

1) What are the advantages and disadvantages of different transportation modes for fruit exports from Thailand to China?

2) How can the cost efficiency and satisfaction of the current logistics modes used for fruit exports from Thailand to China be analyzed?

3) What macro and micro factors affect transportation decisions, including seasonal fruit variations, logistics infrastructure, and service fees? (3 Transportation modes)

4) How competitive is Thailand's export market in China, and what opportunities and challenges exist for future improvement? (3 Transportation modes)

1.4 Benefit of Research

This study holds significant value and relevance for Chinese importers, Thai exporters, the governments of China and Thailand, researchers and students, as well as customer reviewing the article.

1) For Chinese importers, the study provides a detailed comparison of the advantages and disadvantages of air, sea, and land transportation modes, helping them optimize import decisions based on cost, timeliness, and cargo characteristics. It

also offers insights into the impact of seasonal factors and logistics infrastructure on the fruit supply chain, enabling better supply chain stability and procurement planning.

2) For Thai exporters, the research offers scientific evidence through cost-benefit analyses and satisfaction surveys, helping them select optimal transportation modes, reduce logistics costs, increase profit margins, and better understand their competitive strengths and weaknesses in the market. This allows them to optimize strategies to address challenges and seize opportunities.

3) For the Chinese government, the study highlights the current logistics landscape of Thai fruit exports, providing valuable references for improving import policies and fostering regional economic cooperation, as well as offering a basis for cold chain logistics collaboration and investment.

4) For the Thai government, the findings identify bottlenecks such as inadequate infrastructure and high transportation costs, enabling the formulation of supportive policies to streamline export processes and enhance fruit export competitiveness, which aligns with the goals of the Belt and Road Initiative and the China-Thailand Free Trade Agreement.

5) Furthermore, the study provides a rich dataset and case references for future academic research, offering inspiration for similar topics and demonstrating scientific research methods such as SPSS analysis, which can guide other scholars in their work.

6) Finally, consumers benefit indirectly from optimized transportation modes through lower costs, more stable pricing, and the efficient supply of fresh fruits.

1.5 Research Framework

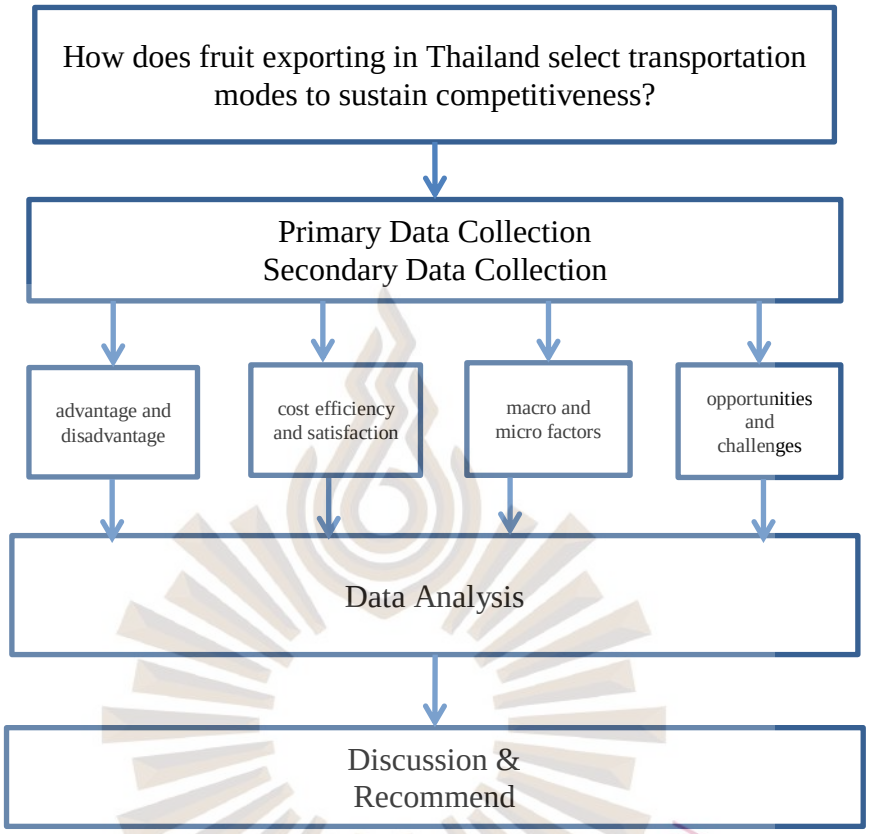


Figure 1.3 Research Framework

CHAPTER 2

LITERATURE REVIEW

2.1 Empirical Studies on Transportation Mode Selection

2.1.1 Introduction to Transportation Mode Selection

Transportation mode selection is a critical component of logistics management, particularly for perishable goods like fruits. This section reviews key empirical studies that explore the factors influencing transportation mode selection, with a focus on their relevance to Thailand's fruit export industry. These studies highlight the importance of balancing economic and environmental objectives to achieve sustainable logistics.

2.1.2 Environmental and Economic Trade-offs in Transportation

Timilsina and Dulal (2010) conducted a comprehensive study on the environmental impacts of transportation, particularly in urban settings. They emphasized the need for multi-faceted policy tools, such as emission standards and fuel taxes, to mitigate the negative effects of transportation on the environment. This study is particularly relevant for developing countries like Thailand, where economic growth must be balanced with environmental sustainability. For Thailand's fruit exports, this means adopting policies that minimize environmental impact while maintaining cost-efficiency.

Key Findings:

1) Transportation contributes significantly to urban pollution and environmental degradation.

2) Policy interventions, such as stricter emission standards and fuel taxes, can help reduce these impacts.

3) Developing countries need adaptable policies that balance economic growth with environmental sustainability.

2.1.3 Balancing Time Efficiency and Environmental Sustainability

Li et al. (2019) explored the China-Europe freight trains under the Belt and Road Initiative, focusing on the balance between time efficiency and environmental sustainability. Their study revealed that while rail transport offers significant advantages in terms of reduced transit time and lower emissions compared to traditional maritime transport, it also faces challenges such as dependency on subsidies. This finding is particularly relevant for Thailand's export industry, which needs to minimize subsidy dependency while ensuring market competitiveness.

Key Findings:

1) Rail transport can significantly reduce transit time and emissions compared to maritime transport.

2) Dependency on subsidies limits the long-term feasibility of rail transport.

3) Strategies that minimize subsidy dependency while ensuring market competitiveness are crucial for sustainable logistics.

2.1.4 Cost Optimization and Machine Learning in Transportation Mode Selection

Patil, Patange, and Pardeshi (2023) introduced a novel approach to transportation mode selection by integrating a total logistics cost (TLC) framework optimized through machine learning. Their study focused on determining the most cost-efficient transportation mode between sea and air, based on factors such as product value and

market demand. This framework is particularly relevant for Thailand, where high-value perishable goods like fruits require careful consideration of transportation options.

Key Findings:

1) Machine learning can optimize logistics decisions based on cost-effectiveness and product value.

2) Air transport may be justified for high-value perishable goods to preserve freshness.

3) Cost optimization frameworks can help logistics managers make more informed decisions.

2.1.5 Case Studies and Comparative Analysis

Several case studies have been analyzed to illustrate the importance of transportation mode selection. For example, Li et al. (2019). the China-Europe rail service has been successful in balancing speed and cost while reducing environmental impact This case study provides valuable insights for Thailand, which can learn from successful strategies that integrate sustainability into logistics operations.

Case Study: China-Europe Rail Service

1) Transit Time: Significantly shorter compared to maritime transport.

2) Environmental Impact: Lower emissions compared to air transport.

3) Cost: Competitive with maritime transport, despite higher initial investment.

2.1.6 Summary of Empirical Studies

In summary, the empirical studies reviewed in this section highlight the multifaceted nature of transportation mode selection. They emphasize the need for a balanced approach that considers economic, environmental, and quality preservation factors. These studies provide a solid foundation for understanding the complexities

involved in logistics decision-making, particularly for perishable goods like fruits. The insights gained from these studies will be instrumental in analyzing Thailand's fruit export logistics system in the context of its specific market and regulatory conditions.

2.2 Factors Influencing Transportation Mode Selection

2.2.1 Introduction to Influencing Factors

The selection of an optimal transportation mode is influenced by a variety of factors that impact logistics efficiency, costs, and quality preservation. This section explores these factors in detail, with a focus on their relevance to Thailand's fruit export industry.

2.2.2 Cost as a Critical Factor

Transportation costs are a crucial consideration, especially for perishable exports. Traditional cost-based analyses, such as the TLC framework proposed by Patil et al. (2023), help optimize costs relative to product value and market demand. For Thailand, which aims to minimize export costs while maintaining competitiveness, such frameworks are essential.

Key Considerations:

1) Sea Transport: Lower costs but longer transit times.

2) Air Transport: Higher costs but faster transit times, suitable for high-value perishable goods.

3) Land Transport: Moderate costs with shorter transit times, suitable for regional exports.

2.2.3 Transit Time and Quality Preservation

Shorter transit times are essential for maintaining the quality of perishable goods. As highlighted by Li et al. (2019), the China-Europe rail service offers significant advantages in terms of reduced transit time compared to maritime transport. For Thai fruit exporters, transit time is a critical factor in ensuring that fruits reach the Chinese market in optimal condition.

Key Considerations:

1) Sea Transport: Longer transit times, potential quality degradation.

2) Air Transport: Fastest transit times, preserves freshness but higher costs.

3) Land Transport: Shorter transit times, suitable for regional exports.

2.2.4 Regulatory and Environmental Considerations

Regulatory frameworks and environmental concerns are increasingly important in transportation mode decisions. Timilsina and Dulal (2010), emphasized the role of regulatory and fiscal measures in mitigating the environmental effects of transportation. Integrating environmental metrics into logistics decisions can help Thailand align with international standards and strengthen its export position.

Key Considerations:

1) Emission Standards: Stricter standards can reduce environmental impact.

2) Fuel Taxes: Encourage more sustainable transportation modes.

3) Carbon Footprint: Reducing carbon footprint can enhance market competitiveness.

2.2.5 Quality Preservation and Transportation Mode Matching

Maintaining the freshness of tropical fruits during transport requires careful planning and the selection of appropriate transportation modes. Patil et al. (2023) demonstrated the importance of matching transportation modes with preservation needs, particularly for high-value perishable goods. For example, air transport may be justified for premium fruits that require rapid delivery to maintain freshness.

Key Considerations:

1) Reefer Containers: Essential for maintaining optimal temperature and humidity.

2) Temperature-Controlled Trucks: Suitable for land transport to preserve freshness.

3) Air Transport: Fastest delivery, suitable for high-value perishable goods.

2.2.6 Summary of Influencing Factors

In conclusion, the selection of an optimal transportation mode is influenced by a combination of factors, including cost, transit time, quality preservation, and regulatory and environmental considerations. These factors must be carefully balanced to ensure logistics efficiency, cost-effectiveness, and sustainability. The insights gained from these studies provide a comprehensive basis for analyzing Thailand's fruit export logistics system and identifying areas for improvement.

2.3 Competitiveness in Export Markets

2.3.1 Introduction to Export Market Competitiveness

Strategic logistics and transportation decisions have a direct impact on competitiveness in the international fruit market. This section explores how aligning

logistics with cost, time, and sustainability considerations can enhance export competitiveness, particularly for Thailand's fruit exports to China.

2.3.2 Logistics Strategy and Competitive Advantage

The competitive models proposed by Li et al. (2019) suggest that adjustments in pricing, carbon footprint reduction, and service quality can significantly enhance market competitiveness. For Thailand, optimizing these factors in logistics operations can improve its standing in the Chinese market. Rapid delivery and competitive pricing are essential in the perishable goods market, where consumer expectations are high. By adopting sustainable logistics practices, Thailand can differentiate itself from competitors and attract environmentally conscious consumers.

Key Strategies:

1) Pricing: Competitive pricing strategies to attract more customers.

2) Carbon Footprint Reduction: Implementing eco-friendly transportation modes.

3) Service Quality: Ensuring high-quality delivery and customer satisfaction.

2.3.3 Success Cases in Sustainable Transport

Case studies, such as Li et al. (2019), the China-Europe rail service, provide valuable insights into successful strategies that balance speed, cost, and sustainability. These studies demonstrate that integrating sustainability into logistics operations can contribute to competitiveness. For Thailand, reducing the environmental impact of transportation while managing transit time and cost is crucial for maintaining a competitive edge in the international fruit market.

Case Study: China-Europe Rail Service

1) Speed: Faster transit times compared to maritime transport.

2) Cost: Competitive with maritime transport, despite higher initial investment.

3) Sustainability: Lower emissions compared to air transport.

2.3.4 Connecting the Literature to the Thesis Topic

The literature collectively emphasizes the importance of a balanced approach that considers both economic and environmental objectives in transportation mode selection. Timilsina and Dulal (2010), and Li et al. (2019), highlight the necessity of policy interventions and infrastructure improvements to support sustainable logistics. These insights are essential for Thailand's long-term export strategy. Patil et al. (2023) provide an economic optimization model that aids in logistics decisions based on cost-effectiveness.

Role of Literature for Thesis:

The studies reviewed provide a comprehensive basis for the thesis by illustrating how various transport factors—cost, time, and quality—impact Thailand's export competitiveness. They also suggest frameworks for evaluating Thailand's fruit logistics system, particularly in managing time-sensitive exports to China. This foundation enables the thesis to build on established theories, refining them to address Thailand's specific market and regulatory conditions. By integrating these insights, the thesis aims to propose actionable recommendations for improving Thailand's fruit export logistics system, enhancing its competitiveness in the international market.

2.3.5 Case Study Analysis: Thailand's Fruit Export Competitiveness

To further understand the practical implications of the literature, a detailed case study analysis of Thailand's fruit export logistics to China is presented. This case study examines the current logistics practices, challenges faced, and potential areas for improvement.

Current Logistics Practices

Thailand's fruit export logistics to China currently rely heavily on sea and land transportation, with air transport used sparingly for high-value perishable goods. The primary ports and border checkpoints play a crucial role in facilitating these exports. For example, Laem Chabang Port in Thailand and the Mohan Border Checkpoint in Laos are critical transit points for fruit exports to China.

Challenges Faced

Despite the existing logistics infrastructure, several challenges impact the competitiveness of Thailand's fruit exports:

1) Long Transit Times: Sea transportation, while cost-effective, often results in longer transit times, affecting fruit quality.

2) Quality Degradation: Perishable fruits are prone to quality degradation during transit, especially if temperature-controlled storage is not maintained.

3) Environmental Impact: Traditional transportation modes, particularly those relying on fossil fuels, contribute to environmental degradation.

4) Regulatory Hurdles: Complex customs procedures and border delays can significantly impact transit times and increase costs.

Potential Areas for Improvement

1) Enhanced Infrastructure: Investing in modern refrigeration technology and improving border checkpoint facilities can reduce transit times and maintain fruit quality.

2) Policy Interventions: Implementing stricter emission standards and promoting eco-friendly transportation modes can mitigate environmental impacts.

3) Cost Optimization: Leveraging machine learning and advanced analytics to optimize logistics decisions can reduce costs and improve efficiency.

4) Sustainable Practices: Adopting sustainable logistics practices, such as using renewable energy sources and optimizing transportation routes, can enhance competitiveness.

2.3.6 Summary of Export Market Competitiveness

In summary, strategic logistics and transportation decisions are critical for enhancing competitiveness in the international fruit market. Aligning logistics with cost, time, and sustainability considerations can provide a competitive advantage. The insights gained from the literature provide a solid foundation for analyzing Thailand's fruit export logistics system and identifying areas for improvement. By integrating these factors into a cohesive strategy, Thailand can optimize its logistics operations to better meet the demands of the Chinese market, thereby strengthening its position as a leading exporter of fresh fruits.

2.4 The Current Transportation Modes and Routings

2.4.1 Introduction to Current Transportation Modes

Thailand exports a significant volume of fruits to China, utilizing multiple transportation modes to meet the diverse needs of its export market. Understanding the current transportation modes and their respective routings is essential for evaluating the efficiency and effectiveness of Thailand's fruit export logistics system. This longer transit times and potential quality degradation due to extended exposure to varying environmental conditions (Bangkok Post, 2023).

2.4.1.1 Main Thai Port: Laem Chabang Port (Chonburi)

Laem Chabang Port is Thailand's primary port for fruit exports. Located in Chonburi Province, it is strategically positioned to facilitate trade with major international markets. The port is equipped with modern facilities and infrastructure, including reefer container storage and handling capabilities, which are essential for maintaining the freshness of perishable fruits.

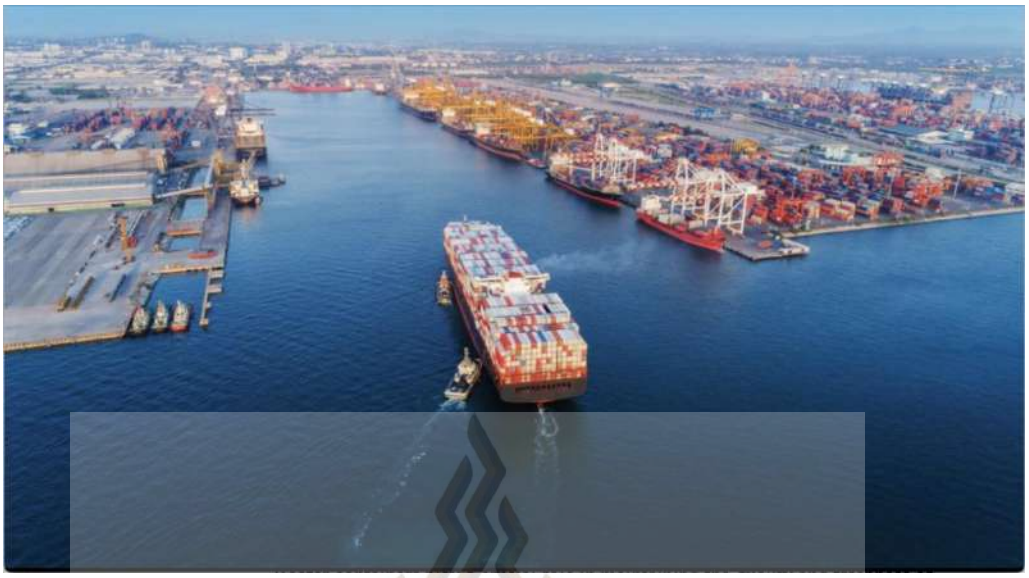


Figure 2.1 Laem Chabang Port
Source: Logistics Manager, 2024

2.4.1.2 Transit Points

Fruit exports from Laem Chabang Port typically transit through key ports in Southeast Asia, such as Singapore Port or Port Klang in Malaysia. These transit points serve as critical hubs for cargo consolidation and distribution, ensuring efficient and timely delivery to destination ports in China (International Cooperation Agency, 2023).

2.4.1.3 Chinese Destination Ports

The primary destination ports in China for Thai fruit exports include Guangzhou, Shanghai, and Xiamen. These ports are well-equipped to handle large volumes of perishable goods and are strategically located to facilitate rapid distribution to major consumer markets across China.

2.4.1.4 Refrigerated Container Logistics

Figure 2.2 Maersk Refrigerated Shipping Containers Stock

Source: Alamy, 2024

Reefer containers play a crucial role in maintaining the quality and freshness of fruit exports. Thai exporters partner with leading shipping lines such as Cosco and Maersk to ensure reliable and efficient transportation services. These shipping lines offer specialized reefer container solutions that maintain optimal temperature and humidity levels throughout the transit period.

2.4.1.5 Lead Time/Sailing Time

The transit time for sea transportation varies depending on the geographical location and external conditions of the destination port. Taking major ports in China as an example, the average sailing time from Sihanouk Port in Cambodia to ports in southern China (such as Guangzhou and Shenzhen) is 4-6 days, and to eastern ports (such as Shanghai and Xiamen) it is 7-10 days. This difference is mainly driven by the following factors:

(1) Port congestion: Shanghai Port's container throughput reached 47.3 million TEUs in 2022 (the world's largest), resulting in an increase of 1.2 days in average berthing waiting time (UN Trade and Development, 2023);

(2) Monsoon climate impact： The southwest monsoon in the South China Sea during summer can extend the navigation time of southern air routes by about 12-24 hours (China Meteorological Administration, 2023);

(3) Route density: Among the direct flights between China and Cambodia, there are 14 weekly trips to southern ports and 9 weekly trips to eastern ports (Cosco Shipping Lines Co., Ltd., 2023).

2.4.2 Land Transportation (Truck and Train)

Land transportation is another significant mode for Thailand's fruit exports to China, accounting for 48% of total exports. This mode offers several advantages, including shorter transit times and the ability to maintain better control over cargo handling and quality preservation. However, it also faces challenges such as border delays and infrastructure limitations (Bangkok Post, 2023).

The route from Chiang Khong, Thailand, to Yunnan, China, is mainly by land, although part of the journey can be taken by water, but not directly. The details are as follows:

1) By Land (Most Common Route)

(1) From Chiang Khong, you cross the border into Huay Xai, Laos, and then continue by road to Yunnan, China.

(2) The main route is via the Kunming-Bangkok Highway (R3A), which connects Thailand, Laos, and China. The total distance is approximately 500-600 km, allowing direct access to Xishuangbanna or further north in Yunnan Team (Chinese Headlines, 2023; Global Logistics Co., Ltd., 2023).

2) By Water + Land (Less Common Route)

(1) Chiang Khong is located along the Mekong River, so you can take a boat along the Mekong to Luang Prabang or Vientiane in Laos and then switch

to land transport to enter China.

(2) However, Mekong River transport is limited and does not directly reach Yunnan, so land transport is still required for the final leg.

If it's for cargo transport, land transport is typically preferred, as the Kunming-Bangkok Highway serves as a major logistics corridor between ASEAN and China, making trucking more convenient (Chinese Headlines, 2023; Kunming Municipal Bureau of Commerce, 2023).

2.4.2.1 Thailand to China via Laos

(1) Start Point

Fruit exports from Thailand's northeastern provinces, such as Nong Khai, Chiang Rai, often utilize the Laos route. This route is particularly efficient for exports destined for Yunnan Province in China (Kaithai Research Center, 2024).

(2) Key Crossing Point: Friendship Bridge (Nong Khai–Vientiane)

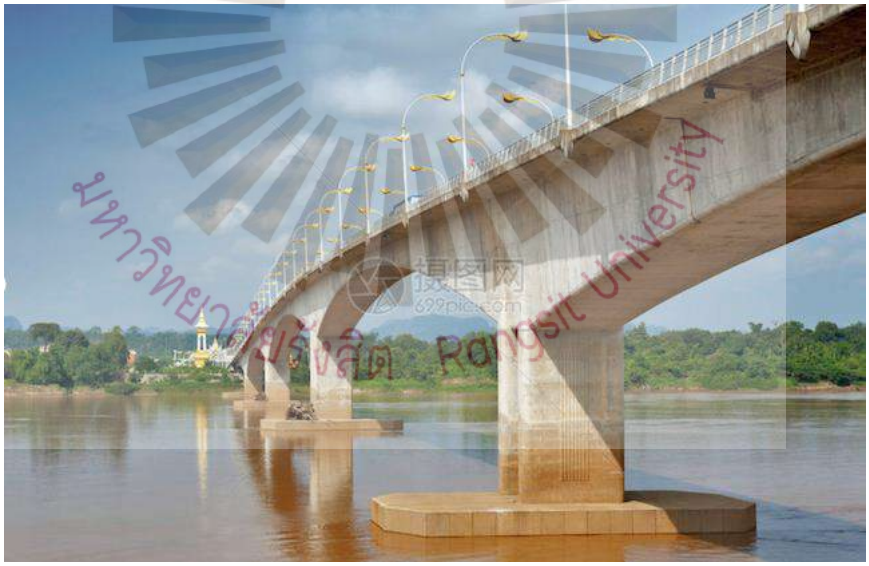


Figure 2.3 Thai Lao Friendship Bridge

Source: Photo Network, 2024

The Friendship Bridge serves as a critical crossing point between Thailand and Laos. It facilitates seamless transit of goods between the two countries, reducing border delays and enhancing logistics efficiency.

(3) Transit Through Laos: Boten (Northern Laos)

Boten is a key transit point in northern Laos, where goods are consolidated and prepared for onward transportation to China. The efficient handling of cargo at Boten is crucial for maintaining the freshness of perishable fruits (World Bank, 2018).

(4) China Entry Point: Mohan Border Checkpoint (Yunnan Province)

The Mohan Border Checkpoint is the primary entry point for goods from Laos into China's Yunnan Province. Efficient customs clearance procedures at Mohan are essential for reducing transit times and ensuring timely delivery of fruits to Chinese markets (Xinhua News Agency, 2024).

(5) Key Infrastructure: The China-Laos Railway

Figure 2.4 The China-Laos Railway

Source: Wikipedia, 2024

The China-Laos Railway, which connects Kunming in China to Vientiane in Laos, plays a crucial role in facilitating seamless rail transportation of goods. This infrastructure development has significantly enhanced the efficiency of land

transportation for Thailand's fruit exports.

2.4.2.2 Thailand to China via Vietnam

(1) Start Point

Fruit exports from Thailand's eastern provinces, such as Nakhon Ratchasima and Ubon Ratchathani, often utilize the Vietnam route. This route is particularly efficient for exports destined for Guangxi Province in China (BOI, 2015).

(2) Key Crossing Point: Mukdahan (to Savannakhet, Laos) or Thai-Cambodia border

The crossing points at Mukdahan (to Savannakhet in Laos) or the Thai-Cambodia border serve as critical transit hubs for goods destined for Vietnam and China. Efficient border management at these points is essential for reducing transit times and maintaining cargo quality (Warr, Menon, & Yusuf, 2009).

(3) Transit Through Vietnam: Hanoi and northern Vietnam

Transit through Vietnam involves key cities such as Hanoi and northern Vietnam, where goods are consolidated and prepared for onward transportation to China. Efficient handling and logistics operations in these areas are crucial for maintaining the quality of perishable fruits (Vietnam Expo, 2024).

(4) China Entry Point: Huu Nghi Border Checkpoint (Guangxi Province)

The Huu Nghi Border Checkpoint is the primary entry point for goods from Vietnam into China's Guangxi Province. Efficient customs clearance procedures at Huu Nghi are essential for reducing transit times and ensuring timely delivery of fruits to Chinese markets (MDCT Logistics, 2024).

2.4.2.3 Thailand to China via Myanmar

(1) Start Point

Fruit exports from Thailand's northwestern provinces, such as Mae Sot, often utilize the Myanmar route. This route is particularly efficient for exports destined for Yunnan Province in China.

(2) Key Crossing Point: Myawaddy (Myanmar)

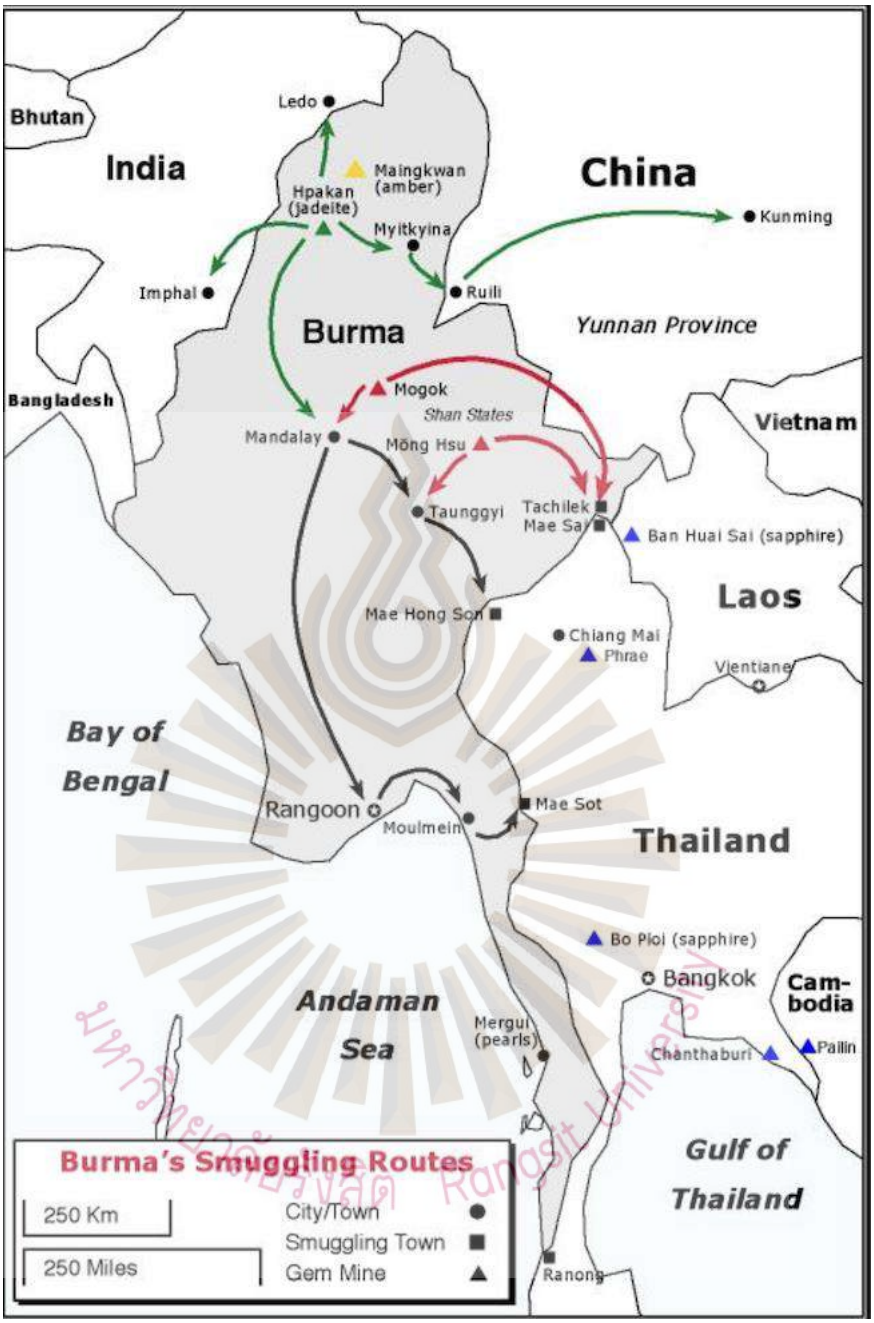


Figure 2.5 Thailand's Dem Border Towns Mae Sot and Mae Sai

Source: Ruby-Sapphire, 2024

The crossing point at Myawaddy in Myanmar serves as a critical transit hub for goods destined for China. Efficient border management at Myawaddy is essential for reducing transit times and maintaining cargo quality. However, this route is often subject to political and security risks, which can impact the reliability of transportation.

(3) Transit Through Myanmar: Yangon and Mandalay

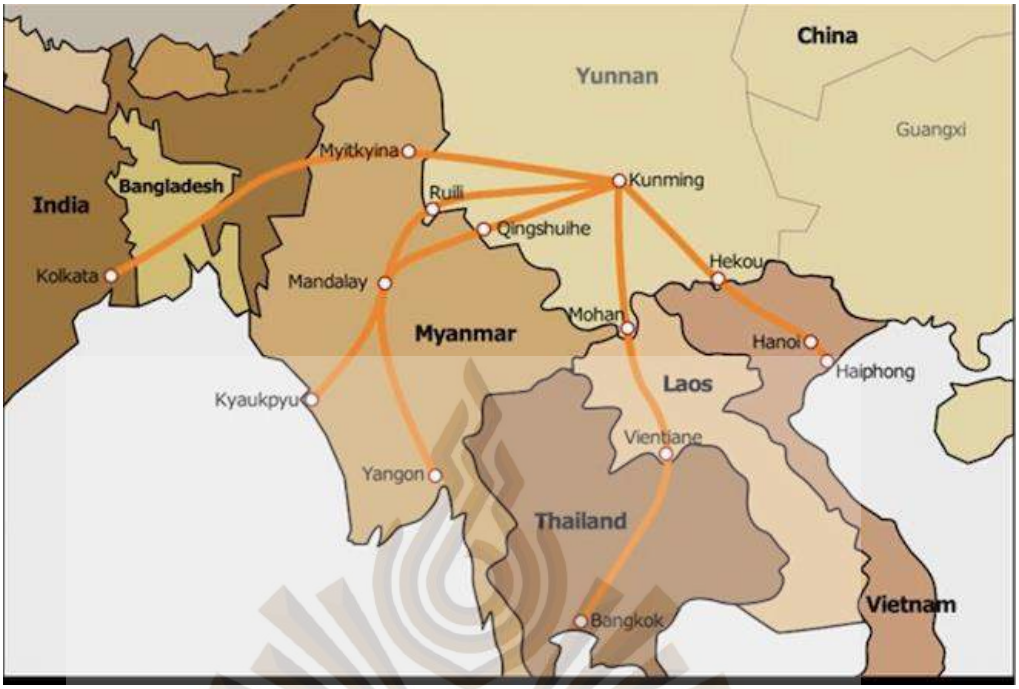


Figure 2.6 A Planned Ub of Belt and Road

Source: Hong Kong Trade Development Council, 2024

Transit through Myanmar involves key cities such as Yangon and Mandalay, where goods are consolidated and prepared for onward transportation to China. Efficient handling and logistics operations in these areas are crucial for maintaining the quality of perishable fruits. However, the infrastructure in Myanmar is less developed compared to Laos and Vietnam, leading to longer transit times and higher costs.

(4) China Entry Point: Ruili Border Checkpoint

Figure 2.7 Yunnan Itinerary and Travel Guide

Source: Blogger, 2024

The Ruili Border Checkpoint is the primary entry point for goods from Myanmar into China. Efficient customs clearance procedures at Ruili are essential for reducing transit times and ensuring timely delivery of fruits to Chinese markets. However, due to the complex geopolitical situation, this route often experiences delays and increased costs.

2.4.2.4 Key Features of Land Transport

(1) Refrigerated Trucks

Figure 2.8 Refrigerated Trucks
Source: Just Auto Media Pty Ltd., 2024

Refrigerated trucks play a crucial role in maintaining the freshness of perishable fruits during land transportation. These trucks are equipped with temperature-controlled compartments that ensure optimal conditions for preserving fruit quality. The use of refrigerated trucks is essential for maintaining the quality of fruits, especially during longer transit times.

(2) Transit Time

The transit times for land transportation vary depending on the route. For the Laos route, it takes approximately 2-3 days to reach Yunnan, while for the Vietnam route, it takes around 3-5 days (SG Sagawa (Thailand) Co., Ltd., 2023). The Myanmar route is generally less efficient, with transit times ranging from 4-7 days, primarily due to road conditions and political risks (Thaiest, 2023).

(3) Border Checkpoints

Efficient border checkpoints are crucial for reducing transit times and maintaining cargo quality. The Huu Nghi border checkpoint (Vietnam) and the Mohan border checkpoint (Laos) are key transit hubs that facilitate seamless transit of goods between Thailand and China. Efficient customs clearance procedures at these

checkpoints are essential for reducing delays and maintaining the quality of perishable fruits (Loan, 2024).

2.4.3 Air Transportation

Air transportation is the least utilized mode for Thailand's fruit exports to China, accounting for only 0.54% of total exports. However, it offers significant advantages for high-value, time-sensitive shipments, particularly for premium fruits that require rapid delivery to maintain freshness(Bangkok Post, 2023).

2.4.3.1 Major Airports in Thailand (Departure Points)

Thailand has several major airports that serve as departure points for fruit exports. These include:

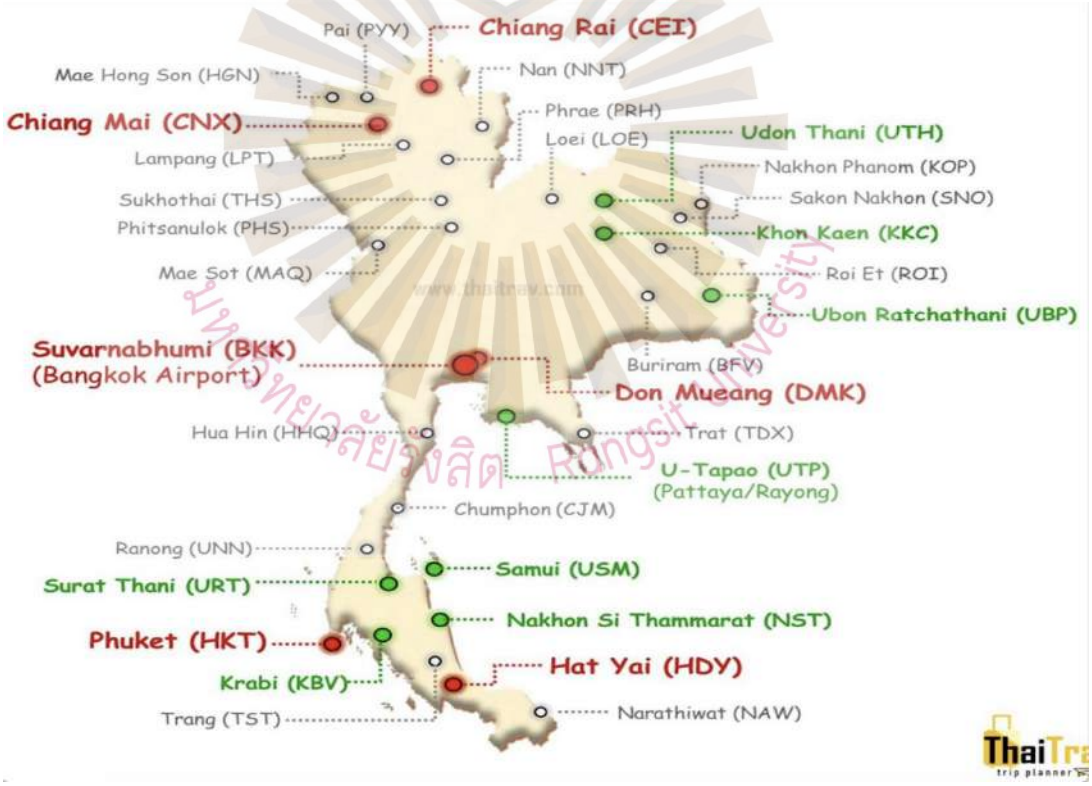


Figure 2.9 Thailand Airports Map

Source: ThaiTrav, 2024

(1) Suvarnabhumi Airport (BKK): The primary international airport in Bangkok, offering extensive cargo handling facilities.

(2) Don Mueang Airport (DMK): A secondary international airport in Bangkok, also handling significant cargo traffic.

(3) Chiang Mai International Airport (CNX): Serving the northern region of Thailand, particularly for exports from provinces like Chiang Mai and Chiang Rai.

(4) Phuket International Airport (HKT): Serving the southern region of Thailand, particularly for exports from provinces like Phuket and Surat Thani.

2.4.3.2 Destination Airports in China

The primary destination airports in China for Thai fruit exports include:

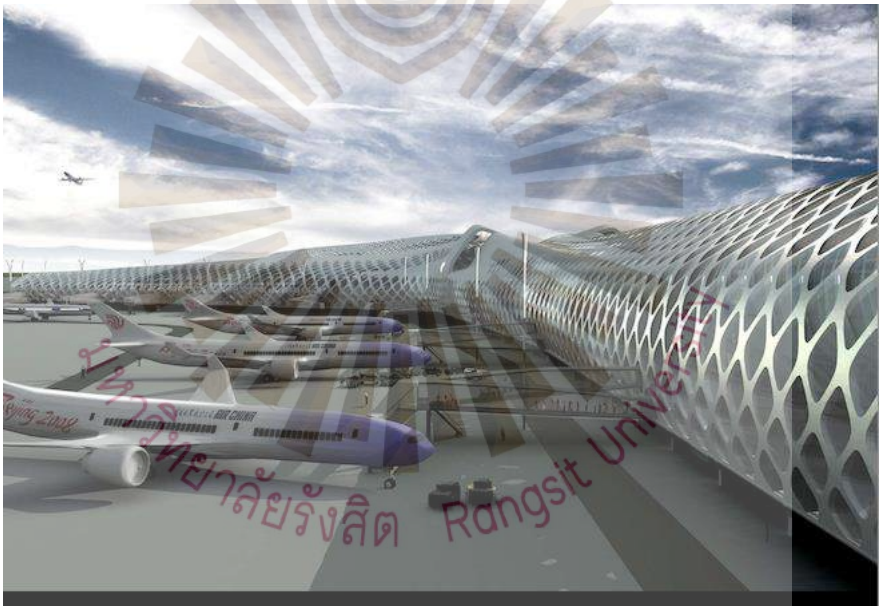


Figure 2.10 Shenzhen Bao'an International Airport

Source: Architizer, 2024

(1) Guangzhou Baiyun International Airport (CAN): The primary hub for fresh fruit imports in Southern China, serving Guangdong Province.

(2) Beijing Capital International Airport (PEK): For premium fruits targeting high-income consumers in northern regions.

(3) Shenzhen Bao'an International Airport (SZX): A major

gateway for fruit imports in the Greater Bay Area, handling time-sensitive shipments.

(4) Shanghai Pudong International Airport (PVG): Key hub for fruits distributed across Eastern China.

(5) Chengdu Shuangliu International Airport (CTU): Serves Western China, connecting to fast-growing markets in Sichuan and Chongqing.

2.4.3.3 Flight Logistics and Routing

Figure 2.11 Logistics of Thai Fruits: Direct Flights, Transshipment and Charter Flights

Source: Baidu, 2024c

(1) Direct Flights: Thai Airways and other international carriers operate direct cargo flights to major Chinese cities. Direct routes are typically used for fast delivery of premium-grade fruits.

(2) Hub-and-Spoke Model: Some shipments transit via regional hubs like Hong Kong International Airport (HKG) or Singapore Changi Airport (SIN) before reaching secondary airports in China.

(3) Chartered Flights: During peak seasons (e.g., durian season), exporters may arrange chartered cargo flights directly from Thailand to China to meet demand.

2.4.3.4 Key Features of Air Transport

Figure 2.12 Container for Pharma (Brand: Envirotainer)

Source: Baidu, 2024a

(1) Cargo Handling: Fruits are packed in temperature-controlled containers to preserve freshness and prevent spoilage.

(2) Transit Time: Flights typically take 3–6 hours, depending on the destination city.

(3) Cost: Air freight is significantly more expensive than sea or land transport, limiting its use to high-value or time-sensitive shipments.

(4) Customs Clearance: Special handling and expedited customs procedures at both departure and destination airports to minimize delays.

2.4.4 Comparative Analysis of Transportation Modes

To provide a comprehensive understanding of the transportation modes used for Thailand's fruit exports to China, Based on the above literature, webpage knowledge, and other information, the following table is created,a comparative analysis is presented below:

Table 2.1 Comparative Analysis of Transportation Modes

Transportation Mode	Advantages	Disadvantages	Typical Transit Time	Cost	Environmental Impact
Sea	- Lower costs - High volume capacity - Suitable for non-perishable goods	- Longer transit times - Potential quality degradation - Higher environmental impact	4-10 days	Low	High (due to fuel consumption)
Land	- Shorter transit times - Better control over cargo handling - Suitable for regional exports	- Border delays - Infrastructure limitations - Political risks	2-7 days	Moderate	Moderate (depending on fuel efficiency)
Air	- Fastest transit times - Preserves freshness of perishable goods - Suitable for high-value goods	- High costs - Limited capacity - Environmental impact due to fuel consumption	3-6 hours	High	High (due to fuel consumption)

Source: Summary by Researcher

2.4.5 Future Trends and Recommendations Future Trends

Figure 2.13 Logistics' New Future: Technological Empowerment and Green-driven Development

Source: Baidu, 2024b

1) Technological Advancements: The integration of advanced technologies such as IoT, AI, and blockchain can enhance logistics efficiency and transparency.

2) Sustainability: Increasing emphasis on sustainable logistics practices, including the use of electric vehicles and renewable energy sources.

3) Policy and Infrastructure Development: Continued investment in infrastructure and policy reforms to facilitate smoother cross-border trade.

Recommendations

1) Optimize Transportation Mix: Develop a balanced transportation strategy that leverages the strengths of each mode while mitigating their weaknesses.

2) Invest in Technology: Utilize advanced analytics and machine learning to optimize logistics decisions and improve efficiency.

3) Enhance Infrastructure: Invest in modern refrigeration technology and improve border checkpoint facilities to reduce transit times and maintain fruit quality.

4) Promote Sustainability: Implement stricter emission standards and promote eco-friendly transportation modes to reduce environmental impact.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Population and Samples

3.1.1 Definition of Population

The population for this study includes Thai fruit exporters involved in shipping tropical fruits such as durian, mango, and mangosteen to the Chinese market. According to reaching, there are approximately 1,496 Thai companies (www.doa.go.th) which exporting fruits to China and 500 Chinese importing durian companies (1688.com, www.11467.com) which importing durian from Thailand including the big trade companies, distribution companies, E-commerce platform etc. These fruits are integral to Thailand's agricultural exports, and efficient transportation is key to maintaining freshness and competitiveness. The population also includes stakeholders from companies that handle logistics, customs, and trade operations involved in the fruit export process.

3.1.2 Sampling Technique (Narrow Down/Scoping)

A purposive sampling technique will be used to select participants directly involved in fruit exports to China. The sample will include:

Exporters of Thai fruits to China. Select 3 companies from 1,496 companies that have transportation, packaging, and cold storage activities.

Importers of Thai fruits to China. Select 3 companies from 500 companies that have transportation, port and customs clearance activities.

Thai governors (such as Custom Clearance) with knowledge of logistics and transportation of this business. Select 1 person.

Key companies to be included in the study are:

1) According to the query analysis report from the Gladtrust website, relevant data for the research paper can be obtained from the following companies.

1.1) USTH Trading (www.usth.co.th): USTH Trading is one of Thailand's largest fruit suppliers, offering a wide range of products including fresh fruits, canned fruits, and preserved fruits. Their products are provided by internationally certified vendors, ensuring high-quality and safe fruit services for their customers.

1.2) Richfield Fresh Fruit Co., Ltd (www.richfield-food.com): Richfield Fresh Fruit Co., Ltd is one of the biggest fruit exporting companies. This company , which has long term corporation with a big Chinese's importing company named Baiguoyuan, took part in a lot of exporting project which offer a lot of fruit such as durian, cocona, banana, pomelo etc.to Chinese's marketing.

1.3) Urban Fruit (www.urbanfruit.in.th): Urban Fruit is one of Thailand's most renowned fruit suppliers, offering fresh fruits, canned fruits, and frozen fruits with a well-established domestic and international supply chain. They provide safe and convenient purchasing services, selling over 300 types of fruits weekly, and are recognized by both domestic and international users.

2) According to the query analysis report from the Baidu website, relevant data for the research paper can be obtained from the following companies.

2.1) Joyviogroup (www.joyvio.com): A modern agricultural company controlled by Lenovo Group primarily engages in investments and operations in the modern agriculture and food sectors. The company owns large-scale fruit plantations, seedling breeding centers, engineering technology centers, sorting and processing centers, cold chain logistics platforms, and brand marketing networks. Its fresh fruits, dried fruits, fruit juices, fruit wines, and nuts have gained widespread consumer acclaim.

2.2) Hjfruit Company (www.hjfruit.com): Founded in 2002, the company specializes in the full industry chain operations of premium imported fruits and high-quality domestic fruits. As one of the largest distributors of durians, dragon fruits, mangosteens, and longans in China, it has grown into a nationally leading, fast-growing multi-brand fresh fruit group.

2.3) Yogo Farming (www.yogofruit.cn):A well-known fruit import and export service provider in China, integrating research and development, cultivation, packaging, product processing, supply chain distribution, global trade, and domestic and international agricultural investments. The company is dedicated to providing consumers with fresh and nutritious fruit products.

Additionally, the study will target participants from:

1) Supply Chain Manager

Reason: The supply chain manager has a comprehensive understanding of various transportation modes and cost control within the company. They are the main decision-makers in choosing transport modes, making them key to the research on transportation modes.

2) Logistics Manager

Reason: The logistics manager oversees the overall transportation planning, implementation, and management of the company. They can provide insights into the practical operations and cost benefits related to transportation modes.

3) International Sales Manager

Reason: The international sales manager has in-depth knowledge of the company's transportation needs in overseas markets. They can provide feedback on transportation satisfaction and customer experience.

4) Officials from Thai government departments

Reason: These officials are responsible for formulating and implementing policies related to transportation and trade, such as the Department of International Trade Promotion (DITP), Ministry of Transport, and Department of Agriculture in Thailand. They can offer information on government policies, infrastructure investments, and future policy directions.

5) Importing fruit companies in China

Reason: They can provide firsthand information about the sales channels, consumer preferences, and logistics costs for Thai fruits in the Chinese market and still can offer some information such as port selection for imported fruit, transportation, and customs clearance etc. Interviewing these companies helps

understand the market demand and competitiveness of Thai fruits, as well as their transportation and supply chain management.

The study aims to interview 6 companies to provide a wide range of insights and ensure the statistical significance of the findings. The sample will consist of both large-scale exporters and large-scale importers to reflect different business scales and their transportation decision-making processes.

3.1.3 Justification for Sample Selection

The purposive sampling method is crucial for this study as it focuses on those who are most knowledgeable about the transportation of Thai fruits to China. By selecting participants from key sectors, including exporters, logistics companies, and government bodies, importers. the research will ensure a comprehensive understanding of the transportation challenges and opportunities within the industry. Moreover, including stakeholders from different business sizes allows for a more nuanced perspective on the transportation mode selection process and its impact on competitiveness in the Chinese market.

3.2 Research Instruments

3.2.1 Development of Interview

The interview will be designed to collect quantitative data from the selected participants. interview will focus on:

1) The cost-effectiveness of different transportation modes (air, sea, and land).

2) Transit times and logistical efficiency.

3) The impact of each mode on fruit quality during transit.

4) Satisfaction levels with current transportation methods.

Participants will be asked to rate their satisfaction on a Likert scale (e.g., 1 to 5), as well as to provide qualitative insights on the challenges and advantages of each transportation mode.

3.2.2 Design of Interview Guide

A semi-structured interview guide will be created to gather qualitative insights from key decision-makers, including:

1) Supply Chain Manager from Thailand exporting companies and Chinese importing compines.

2) Logistics Managerrom Thailand exporting companies and Chinese importing compines.

3) International Sales Managerrom Thailand exporting companies and Chinese importing compines.

4) Official from Thai government departments.

The guide will explore:

1) The advantages and disadvantages of different transportation modes for fruit exports from Thailand to China.

2) The cost efficiency and satisfaction of the current logistics modes used for fruit exports from Thailand to China be analyzed.

3) The macro and micro factors affect transportation decisions, including seasonal fruit variations, logistics infrastructure, and service fees.

4) For competitive is Thailand's export market in China, the opportunities and challenges exist for future improvement.

Interviews will last 30-60 minutes and will be recorded (with consent) for transcription and thematic analysis.

3.3 Data Analysis

Interview data will be analyzed using Thematic Analysis and Content Analysis:

1) Thematic Analysis will identify, analyze, and report recurring themes within the interview responses. This method involves coding and categorizing qualitative data to uncover patterns and key themes, such as transportation mode selection, operational challenges, and market competitiveness. Thematic analysis helps to explore deeper insights into the experiences and perceptions of stakeholders involved in transportation and logistics.

2) Content Analysis will systematically analyze the frequency and context of specific terms, phrases, or concepts within the literature and related secondary data. This approach helps to identify the dominant narratives and issues in existing literature regarding transportation choices, logistical challenges, and market dynamics. By comparing these findings with primary data from interviews, the study can triangulate the findings to validate the themes identified, ensuring a comprehensive understanding of the research questions.

CHAPTER 4

RESEARCH RESULTS

This chapter presents a comprehensive analysis of the six interviews conducted with Thai fruit exporters and Chinese importers. The study examines the selection of transportation modes, cost efficiency, logistics challenges, and the impact of government policies on Thailand's fruit exports to China. The findings provide deeper insights into the advantages and disadvantages of different transport options and offer strategic recommendations for improving logistics efficiency.

4.1 Result 1: Key Factors in Transportation Mode Selection

Summary of Interview Findings

The study identifies three main transportation modes—sea, land, and air—each with distinct advantages and disadvantages. Across all six interviews, respondents highlighted several key factors influencing their transportation mode selection, including cost considerations, transit time, fruit perishability, and destination market requirements.

Similarities Across Interviews:

1) Cost and Time Efficiency as Primary Considerations

1.1) All respondents emphasized that cost and time efficiency are the most critical factors when selecting a transportation mode.

1.2) Sea transport is the most cost-effective but has the longest transit time.

1.3) Land transport offers a balance between cost and speed, making it ideal for perishable fruits.

1.4) Air transport is the fastest but also the most expensive.

Example from Interviews:

1.1) The logistics manager of Baiguoyuan stated that their company primarily relies on land transport for durians due to its shorter transit time compared to sea freight, ensuring better freshness upon arrival in the Chinese market.

1.2) The export director of USTH Trading emphasized that for long-distance shipments to China's northern cities, bananas and frozen fruits are shipped via sea freight, while premium fresh durians are sent by air freight to high-end retailers in Shanghai and Beijing.

2) Fruit Type and Market Demand Influence Mode Selection

2.1) Perishable fruits such as durians, mangosteens, and dragon fruits require faster transportation (land or air) to maintain freshness.

2.2) Durable fruits like bananas and pomelos can tolerate longer transit times, making sea transport more suitable.

2.3) Some exporters use a combination of transport modes to optimize cost and freshness.

Example from Interviews:

2.1) The import manager at Joyvio Group highlighted that air freight is mainly used for high-end fruit brands, while sea and land transport are preferred for bulk distribution to wholesale markets.

3) Market Destination Determines Transport Mode

3.1) Fruits exported to major cities such as Shanghai, Beijing, and Guangzhou are more likely to be transported by air freight due to consumer demand for premium freshness.

3.2) Fruits destined for wholesale markets in second-tier cities tend to be shipped via land or sea transport to reduce costs.

Example from Interviews:

3.1) The supply chain manager at UrbanFruit confirmed that their company relies on air freight for specialty fruits sold in high-end supermarkets but faces challenges due to high costs.

Differences in Responses:

3.1) Some companies prioritize stability and reliability, preferring land transport over air freight despite higher costs.

3.2) Others prioritize cost reduction, even at the expense of longer transit times, favoring sea freight for large-volume shipments.

3.3) Companies targeting premium markets opt for air freight, ensuring maximum freshness but accepting higher logistics costs.

4.2 Result 2: Cost Efficiency and Satisfaction with Logistics Performance

Summary of Interview Findings

Cost efficiency is a major concern for exporters, with land and sea transport being the preferred choices for most businesses. The study identifies cost structures and satisfaction levels across different transport modes.

Similarities Across Interviews:

1) Sea Transport is the Cheapest but Slowest

1.1) Sea transport is widely used for bulk fruit exports due to its low per-unit cost.

1.2) However, long transit times (7-14 days) increase the risk of quality deterioration and market price fluctuations.

Example from Interviews:

1.1) The head of exports at Richfield Fresh Fruit Co., Ltd stated that they rely on sea freight for large-scale banana exports to China but struggle with quality loss due to extended transit times.

2) Land Transport is Faster but More Expensive than Sea Transport

2.1) Land transport ensures quicker delivery (2-4 days), making it ideal for perishable fruits.

2.2) However, customs fees, fuel costs, and road congestion increase overall costs.

Example from Interviews:

1.1) The operations director at Hjfruit Company mentioned that due to high demand for fresh longans, they often opt for land transport, even though costs are higher than sea shipping.

4.3 Result 3: Challenges in Logistics and Transportation Infrastructure

Summary of Interview Findings

Logistics challenges affect all transportation modes, particularly in terms of border delays, customs clearance, and cold chain management.

Similarities Across Interviews:

1) Customs Clearance is a Major Bottleneck

1.1) Many companies reported that border delays increase transit time, particularly for land transport.

Example from Interviews:

1.1) The logistics head at Yogo Farming noted that their shipments via Thailand-Laos-China corridors often experience long clearance delays at customs.

2) Cold Chain Limitations Affect Fruit Quality

2.1) Inadequate cold storage at ports and distribution centers leads to increased spoilage rates.

Example from Interviews:

2.1) The CEO of USTH Trading stressed that their biggest challenge is the lack of temperature-controlled storage at border checkpoints, which affects fruit freshness.

4.4 Result 4: The Role of Government Policies and Infrastructure Development

Similarities Across Interviews:

1) Policy Changes Affect Costs and Efficiency

1.1) Changes in tariffs, customs regulations, and trade agreements directly impact logistics costs.

Example from Interviews:

1.1) The compliance officer at Joyvio Group, highlighted that

recent tax reductions on imported fruits have improved cost efficiency, but bureaucratic delays remain a challenge.

4.5 Result 5: Future Trends and Logistics Innovations

Similarities Across Interviews:

1) Technology Will Improve Logistics

1.1) Companies plan to invest in IoT tracking, AI-driven logistics planning, and automated customs clearance.

Example from Interviews: The head of digital operations at Hjfruit Company, stated that AI-driven route optimization is helping them cut transport time by 15-20%.

Table 4.1 Comparative Analysis of Transportation and Logistics Strategies in Thai Fruit Exports to China Insights from Industry Experts

Number	Question	Director of USTH Trading	Head of Exports at Richfield Fresh Fruit Co., Ltd	Logistics Manager of Baiguoyuan	Import Manager at Joyvio Group	Operations Director at Hjfruit Company	Supply Chain Manager at UrbanFruit	Logistics Head at Yogo Farming
Comparing the advantages and disadvantages of different transportation modes								
1	Which transportation mode (sea, land, or air) does your company primarily use for fruit exports to China? Why did you choose this mode?	Land and sea: Perishable fruits by land (2-4 days), bulk shipments by sea (7-14 days)	Land (durian), sea (pomelo, bananas)	Land (high-value fruits), sea (bulk fruits)	Combination of land, sea, and air	Combination of land, sea, and air	Combination of land, sea, and air	Combination of land, sea, and air
2	Which transportation mode is most likely to affect fruit quality during transit?	Sea transport; using reefer containers and cold chain management	Sea and land; using smart cold chain and pre-cooling	Sea and land; high-standard cold chain and monitoring	Sea and land; full cold chain and monitoring	Sea and land; full cold chain and monitoring	Sea and land; high-standard cold chain and monitoring	Sea and land; full cold chain and monitoring

Table 4.1 Comparative Analysis of Transportation and Logistics Strategies in Thai Fruit Exports to China Insights from Industry Experts (Cont.)

Number	Question	Director of USTH Trading	Head of Exports at Richfield Fresh Fruit Co., Ltd	Logistics Manager of Baiguoyuan	Import Manager at Joyvio Group	Operations Director at Hjfruit Company	Supply Chain Manager at UrbanFruit	Logistics Head at Yogo Farming
	How does your company address this issue?							
Analyzing cost efficiency and satisfaction								
3	What are the main cost components of different transportation modes? How does your company control these costs?	• Main cost components: Fuel and Freight Charges, Cold Chain Logistics, Customs and Tariffs, Handling and Packaging, Infrastructure and Warehousing.	• Main cost components: Fuel, cold chain, customs, packaging, loss; bulk transport to reduce unit cost. • Control measures: Long-term contracts with cold chain	• Main cost components: Fuel, cold chain, customs, packaging, loss; bulk transport to spread out cost. • Control measures: Long-term contracts with logistics	• Main cost components: Fuel, cold chain, customs, packaging, loss; bulk transport to spread out cost. • Control measures: Long-term contracts with logistics	• Main cost components: Fuel, cold chain, customs, packaging, loss. • Control measures: Optimize transportation planning,	• Main cost components: Fuel, cold chain, customs, packaging, loss; bulk transport to reduce unit cost. • Control measures:	• Main cost components: Sea freight, cold chain management fees, port fees, customs clearance fees. • Control measures: Optimize

Table 4.1 Comparative Analysis of Transportation and Logistics Strategies in Thai Fruit Exports to China Insights from Industry Experts (Cont.)

Number	Question	Director of USTH Trading	Head of Exports at Richfield Fresh Fruit Co., Ltd	Logistics Manager of Baiguoyuan	Import Manager at Joyvio Group	Operations Director at Hjfruit Company	Supply Chain Manager at UrbanFruit	Logistics Head at Yogo Farming
		• Control measures: Optimize transportation planning, negotiate bulk shipping rates, invest in efficient packaging, and utilize real-time logistics tracking to reduce delays and spoilage.	logistics companies for better rates, optimize packaging design to reduce losses, improve fruit transportability.	companies to lock in low-cost freight rates, automated warehouse management to reduce labor costs and increase efficiency.	companies to lock in low-cost freight rates, automated warehouse management to reduce labor costs and increase efficiency.	negotiate bulk shipping rates, invest in efficient packaging, and utilize real-time logistics tracking.	Long-term contracts with logistics companies for better rates, optimize packaging design to minimize losses and improve fruit durability during transport.	transport modes, choose the most cost-effective routes, and manage inventory effectively to reduce spoilage and improve turnover rates.

Table 4.1 Comparative Analysis of Transportation and Logistics Strategies in Thai Fruit Exports to China Insights from Industry Experts (Cont.)

Number	Question	Director of USTH Trading	Head of Exports at Richfield Fresh Fruit Co., Ltd	Logistics Manager of Baiguoyuan	Import Manager at Joyvio Group	Operations Director at Hjfruit Company	Supply Chain Manager at UrbanFruit	Logistics Head at Yogo Farming
4	Is your company satisfied with the current transportation mode? If not, what are the main issues?	Overall, we are satisfied with our transportation modes, but some challenges remain: logistics congestion during peak seasons affecting delivery times; cold chain limitations that can sometimes impact fruit	• We are generally satisfied with our current transportation modes, but there are still some challenges: insufficient capacity during peak seasons leading to delivery delays; inconsistent cold chain management levels among	We are generally satisfied with our transportation modes, but there are several challenges: unstable customs clearance times, sometimes strict customs inspections leading to delays; tight	We are basically satisfied with our current transportation modes, but still face some challenges: cost increases during peak seasons, especially for durian and mangosteen seasons when air freight rates surge; complex customs	We are generally satisfied with our current transportation modes, but still face some challenges: cost increases during peak seasons, especially for durian and mangosteen seasons when air freight rates	We are generally satisfied with our transportation modes, but there are still several challenges: unstable customs clearance times, sometimes strict customs inspections	We are generally satisfied overall, but still face the following challenges: peak season freight rate increases, especially during the durian and cherry seasons when transportation

Table 4.1 Comparative Analysis of Transportation and Logistics Strategies in Thai Fruit Exports to China Insights from Industry Experts (Cont.)

Number	Question	Director of USTH Trading	Head of Exports at Richfield Fresh Fruit Co., Ltd	Logistics Manager of Baiguoyuan	Import Manager at Joyvio Group	Operations Director at Hjfruit Company	Supply Chain Manager at UrbanFruit	Logistics Head at Yogo Farming
		quality; and customs clearance delays due to changing regulations in China.	some logistics companies that may affect fruit quality; and unstable customs clearance times due to adjustments in Chinese customs policies.	capacity during peak seasons, especially during the durian season, leading to significant increases in freight costs; high cold chain management requirements, with varying service levels among some suppliers that	procedures with higher quarantine standards for some fruits affecting delivery times; high cold chain management requirements with inconsistent service quality from some third-party	soar; complex customs procedures with higher quarantine standards for some fruits affecting delivery times; high cold chain management requirements with inconsistent service quality from some	leading to delays; tight capacity during peak seasons, especially during the durian season, leading to significant increases in freight costs; high cold chain management requirements with varying service levels	costs are high; complex customs procedures, with high quarantine requirements for some fruits affecting customs clearance efficiency; cold chain transportation standards are not unified,

Table 4.1 Comparative Analysis of Transportation and Logistics Strategies in Thai Fruit Exports to China Insights from Industry Experts (Cont.)

Number	Question	Director of USTH Trading	Head of Exports at Richfield Fresh Fruit Co., Ltd	Logistics Manager of Baiguoyuan	Import Manager at Joyvio Group	Operations Director at Hjfruit Company	Supply Chain Manager at UrbanFruit	Logistics Head at Yogo Farming
				may affect fruit quality.	logistics providers.	third-party logistics providers.	among some suppliers that may affect fruit quality.	and the cold chain management capabilities of some partners still need improvement.
Evaluating macro and micro factors affecting transportation decisions								
5	Does your company adjust transportation modes based on seasonal variations? Why or why not?	Yes, we adjust transportation modes based on harvest seasons and demand spikes. During peak fruit seasons	Yes, we adjust transportation modes according to the fruit season and demand peaks. For instance, during the durian season	Yes, we prioritize land and air transport during the peak season (March to August) to ensure rapid entry into the	Yes, we adjust based on the fruit season and market demand. For example, during the peak season for blueberries,	Yes, we adjust based on the fruit season and market demand. For instance, during the durian season	Yes, we adjust transportation modes according to seasonal changes. During the peak season	Yes, we adjust based on the fruit season and market demand. For example, during the peak season for

Table 4.1 Comparative Analysis of Transportation and Logistics Strategies in Thai Fruit Exports to China Insights from Industry Experts (Cont.)

Number	Question	Director of USTH Trading	Head of Exports at Richfield Fresh Fruit Co., Ltd	Logistics Manager of Baiguoyuan	Import Manager at Joyvio Group	Operations Director at Hjfruit Company	Supply Chain Manager at UrbanFruit	Logistics Head at Yogo Farming
		(March–August), we prioritize land transport for faster deliveries. In off-peak seasons, we increase sea shipments to balance costs.	(March to August), we prioritize land transport to quickly enter the market.	market. For bananas and pomelos (year-round stable supply): sea transport is mainly used to reduce costs. During consumption peaks such as the Spring Festival and Mid-Autumn Festival: increase the	cherries, and kiwis (October to March): air and land transport are used to ensure rapid market entry. During the peak seasons for durians and mangosteens (March to August): land and sea transport are used to ensure	(March to August): land and air transport are used to ensure rapid entry into the market. During the cherry season (December to February): a combination of air and sea transport is used to ensure sufficient	(March to August): prioritize land transport for rapid entry into the market. Off-season: increase the proportion of sea transport to reduce costs.	durians (March to August): increase the combination of land and sea transport, reducing reliance on expensive air transport. These responses directly reflect whether each company adjusts their

Table 4.1 Comparative Analysis of Transportation and Logistics Strategies in Thai Fruit Exports to China Insights from Industry Experts (Cont.)

Number	Question	Director of USTH Trading	Head of Exports at Richfield Fresh Fruit Co., Ltd	Logistics Manager of Baiguoyuan	Import Manager at Joyvio Group	Operations Director at Hjfruit Company	Supply Chain Manager at UrbanFruit	Logistics Head at Yogo Farming
				proportion of air transport to capture market share.	large-scale supply.	supply for the Spring Festival market.		transportation modes according to seasonal variations and the reasons for doing so, as mentioned in the six interviews.

Table 4.1 Comparative Analysis of Transportation and Logistics Strategies in Thai Fruit Exports to China Insights from Industry Experts (Cont.)

Number	Question	Director of USTH Trading	Head of Exports at Richfield Fresh Fruit Co., Ltd	Logistics Manager of Baiguoyuan	Import Manager at Joyvio Group	Operations Director at Hjfruit Company	Supply Chain Manager at UrbanFruit	Logistics Head at Yogo Farming
6	How do factors such as customs clearance, weather, and infrastructure impact your company's transportation process?	Customs delays, weather interference, and infrastructure improvements.	Customs delays, weather interference, and infrastructure improvements.	Customs delays, weather interference, and infrastructure improvements.	Customs delays, weather interference, and infrastructure improvements.	Customs delays, weather interference, and infrastructure improvements.	Customs delays, weather interference, and infrastructure improvements.	Customs delays, weather interference, and infrastructure improvements.
7	Do government logistics policies (such as tariffs, cold chain support) influence your company's	Yes, government policies significantly impact our logistics strategy.	Yes, we need to adapt to policy changes such as China's quota management and upgraded inspection	Yes, China requires imported fruits to comply with cold chain tracking standards,	Yes, tariff policy: changes in import duties directly affect costs, and we need to adjust our pricing	Yes, tariff policy: changes in import duties directly affect costs, and we need to adjust our	Yes, tariff policy: changes in import duties directly affect costs, and we need to adjust our	Yes, changes in import duties directly affect costs, and the company needs to adjust

Table 4.1 Comparative Analysis of Transportation and Logistics Strategies in Thai Fruit Exports to China Insights from Industry Experts (Cont.)

Number	Question	Director of USTH Trading	Head of Exports at Richfield Fresh Fruit Co., Ltd	Logistics Manager of Baiguoyuan	Import Manager at Joyvio Group	Operations Director at Hjfruit Company	Supply Chain Manager at UrbanFruit	Logistics Head at Yogo Farming
	transportation decisions? How does it affect and why?		standards for imported fruits.	prompting us to upgrade our blockchain logistics systems to ensure traceability.	strategy accordingly.	pricing strategy accordingly.	pricing strategy accordingly.	pricing strategies in a timely manner.
Exploring Thailand's export competitiveness in the Chinese market								
8	Has the demand for Thai fruit in the Chinese market changed in recent years? How has this affected your company's	Yes, demand has grown significantly, especially for durian, longan, and mangosteen due to increased consumer	The demand for durian has seen a substantial increase, particularly in second-tier and third-tier cities. We have	The growing demand, particularly for high-value fruits like durian, has prompted us to adjust our transportation	There has been a notable increase in demand for Thai fruits like durian, which has led to an increase in both	The rising demand for premium Thai fruits has driven an increase in land and air transport to	The increased demand for exotic fruits has influenced our decision to use a combination of land, sea, and	The continuous growth in demand, especially for durian, has led to an increase in the use of land and sea

Table 4.1 Comparative Analysis of Transportation and Logistics Strategies in Thai Fruit Exports to China Insights from Industry Experts (Cont.)

Number	Question	Director of USTH Trading	Head of Exports at Richfield Fresh Fruit Co., Ltd	Logistics Manager of Baiguoyuan	Import Manager at Joyvio Group	Operations Director at Hjfruit Company	Supply Chain Manager at UrbanFruit	Logistics Head at Yogo Farming
	choice of transportation mode?	preference for exotic fruits. This has led us to expand our land transportation capacity for quicker delivery, while also securing more reefer container slots for sea shipments to manage high-volume exports.	responded by increasing our land transportation channels to reduce transit times and ensure freshness.	strategies. We have increased land transport during peak seasons to ensure faster delivery to the market.	land and sea transport to accommodate the higher volume.	ensure the freshest possible produce reaches the market quickly.	air transport to ensure we meet the market's need for freshness and quality.	transport combinations to balance cost and delivery speed.

Table 4.1 Comparative Analysis of Transportation and Logistics Strategies in Thai Fruit Exports to China Insights from Industry Experts (Cont.)

Number	Question	Director of USTH Trading	Head of Exports at Richfield Fresh Fruit Co., Ltd	Logistics Manager of Baiguoyuan	Import Manager at Joyvio Group	Operations Director at Hjfruit Company	Supply Chain Manager at UrbanFruit	Logistics Head at Yogo Farming
9	In an increasingly competitive market, what strategies has your company implemented to optimize logistics?	We focus on: Cold Chain Upgrades, Smart Logistics Planning, Diversification.	Strengthen cold chain management: use IoT to monitor temperature, prevent cargo damage. Expand transport routes: try the China-Laos railway as a new transport method to reduce customs pressure. Optimize inventory management:	Smart cold chain management: real-time monitoring of temperature and humidity to ensure fruit quality. Expand transport methods: explore railway transport to reduce customs pressure. Optimize	Smart cold chain technology to ensure constant temperature throughout the journey. Expand transportation methods: explore railway transport to reduce customs pressure and improve transport efficiency.	Smart cold chain logistics to ensure temperature control throughout the transport process, reducing losses. Multi-channel transport combinations to flexibly adjust transport methods to	Smart cold chain management: real-time monitoring of temperature and humidity to ensure fruit quality. Expand transport methods: explore railway transport to reduce customs pressure.	Smart cold chain management: real-time monitoring of temperature and humidity to ensure fruit quality. Flexible transport modes, adjust sea, land, and air combinations according to

Table 4.1 Comparative Analysis of Transportation and Logistics Strategies in Thai Fruit Exports to China Insights from Industry Experts (Cont.)

Number	Question	Director of USTH Trading	Head of Exports at Richfield Fresh Fruit Co., Ltd	Logistics Manager of Baiguoyuan	Import Manager at Joyvio Group	Operations Director at Hjfruit Company	Supply Chain Manager at UrbanFruit	Logistics Head at Yogo Farming
			forecast market demand and pre-allocate stocks to cold storage near ports.	inventory management: predict market demand and pre-allocate stocks to warehouses near ports.	Optimize inventory management: predict market demand and pre-position goods in warehouses close to ports.	cope with market fluctuations. Strengthen supply chain integration by deeply cooperating with upstream growers and logistics providers to ensure stable supply.	Optimize inventory management: predict market demand and pre-allocate stocks to warehouses near ports.	different fruit needs. Supply chain integration, deeply cooperate with global farms, traders, and logistics companies to ensure stable supply.

Table 4.1 Comparative Analysis of Transportation and Logistics Strategies in Thai Fruit Exports to China Insights from Industry Experts (Cont.)

Number	Question	Director of USTH Trading	Head of Exports at Richfield Fresh Fruit Co., Ltd	Logistics Manager of Baiguoyuan	Import Manager at Joyvio Group	Operations Director at Hjfruit Company	Supply Chain Manager at UrbanFruit	Logistics Head at Yogo Farming
10	Does your company plan to adopt new technologies or transportation methods (such as smart cold chain logistics or blockchain logistics)to enhance competitiveness in the future? What challenges does your company	Yes, we are actively exploring: Smart Cold Chain Logistics, Blockchain Logistics, Automated Warehousing. Challenges: High initial investment, staff training, regulatory adaptation. Solution: We	We are testing smart cold chain and blockchain logistics to improve supply chain traceability. Challenges: High technology investment, need to gradually promote. Low industry adaptability, suppliers may not be able to keep up with technology	Planned adoption: Smart cold chain technology: real-time monitoring of fruit status, reducing losses. Blockchain logistics: ensuring supply chain transparency to meet China's traceability requirements. China-Thailand railway transport: reducing land	Planned adoption: Smart cold chain technology: real-time monitoring of fruit status to reduce losses. Blockchain logistics: ensuring supply chain transparency to meet traceability requirements in the Chinese market. China-Thailand railway transport:	Planned adoption: Smart cold chain system to monitor fruit status in real-time, improving quality control capabilities. Blockchain tracking system to enhance supply chain transparency, meeting food safety	Planned adoption: Smart cold chain system to monitor fruit status in real-time, improving quality control capabilities. Blockchain tracking system to enhance supply chain transparency, meeting food safety	Planned adoption: Intelligent temperature control system to improve the stability of cold chain transportation. Blockchain traceability to enhance supply chain transparency, meeting market food safety

Table 4.1 Comparative Analysis of Transportation and Logistics Strategies in Thai Fruit Exports to China Insights from Industry Experts (Cont.)

Number	Question	Director of USTH Trading	Head of Exports at Richfield Fresh Fruit Co., Ltd	Logistics Manager of Baiguoyuan	Import Manager at Joyvio Group	Operations Director at Hjfruit Company	Supply Chain Manager at UrbanFruit	Logistics Head at Yogo Farming
	anticipate in adoptitnh new transportation technologies or modes, and how do you plan to adress them?	plan to gradually implement these technologies in pilot programs before full-scale adoption.	updates quickly. Changing regulatory requirements, need to work closely with Chinese customs to ensure compliance with import standards. Solution: We plan to implement new technologies in phases, first test in high-value fruit transportation	transport costs, improving customs efficiency. Possible challenges: High technology investment, need to be gradually promoted. Different adaptation degrees of cooperation partners, some logistics	reducing transportation costs and improving efficiency. Possible challenges: High technology investment, need to be gradually implemented. Different adaptation degrees of cooperation partners, some	requirements in the Chinese market. China-Thailand railway transport to reduce transportation costs and improve efficiency. Possible challenges: High technology investment costs, need to be implemented in	requirements in the Chinese market. China-Thailand railway transport to reduce transportation costs and improve efficiency. Possible challenges: High technology investment costs, need to be implemented in	requirements. China-Thailand railway transport to reduce transportation costs and improve efficiency. Challenges: High technology investment, need to be gradually promoted. Supply chain coordination difficulty, need

Table 4.1 Comparative Analysis of Transportation and Logistics Strategies in Thai Fruit Exports to China Insights from Industry Experts (Cont.)

Number	Question	Director of USTH Trading	Head of Exports at Richfield Fresh Fruit Co., Ltd	Logistics Manager of Baiguoyuan	Import Manager at Joyvio Group	Operations Director at Hjfruit Company	Supply Chain Manager at UrbanFruit	Logistics Head at Yogo Farming
			(such as durians), and gradually promote to other categories.	companies may not be able to keep up with technology upgrades. Uncertainty of policy adjustments, need to work closely with Chinese customs.	logistics companies may not be able to keep up with technology upgrades. Uncertainty in policy adjustments, need to maintain close communication with Chinese customs.	stages. Increased difficulty in supply chain coordination, need all partners to upgrade logistics capabilities simultaneously. Policy uncertainty, need to maintain close communication with relevant departments.	stages. Increased difficulty in supply chain coordination, need all partners to upgrade logistics capabilities simultaneously. Policy uncertainty, need to maintain close communication with relevant departments.	upstream and downstream partners to upgrade logistics capabilities synchronously. Policy uncertainty, need to continue to pay attention and adjust strategies flexibly.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

This chapter presents the conclusions derived from the research findings and provides recommendations for improving the transportation and logistics efficiency of Thailand's fruit exports to China. The analysis integrates insights from interviews with industry professionals, highlighting the key challenges and opportunities in logistics operations.

5.1 Conclusion

Research Objectives

1) To compare the advantages and disadvantages of different transportation modes for fruit exports from Thailand to China.

2) To analyze cost efficiency and satisfaction to assess the current logistics modes used for fruit exports from Thailand to China.

3) To evaluate the macro and micro factors affecting transportation decisions, including seasonal fruit variations, logistics infrastructure, and service fees.

4) To explore Thailand's export competitiveness in the Chinese market and identify opportunities and challenges for future improvement.

The research findings indicate that transportation mode selection, cost efficiency, logistics challenges, and government policies play a significant role in shaping Thailand's fruit export industry. Based on the six interviews conducted with Thai exporters and Chinese importers, the following conclusions have been drawn:

5.1.1 Cost and Time Efficiency Drive Transportation Mode Selection

1) Exporters prioritize cost-effectiveness and delivery speed when choosing between sea, land, and air transport.

2) Interview Findings: All respondents emphasized the importance of balancing cost and transit time. For example, USTH Trading and Baiguoyuan highlighted that land transport is preferred for high-value and perishable fruits like durians and mangosteens to maintain freshness, while sea transport is used for bulk shipments of less perishable fruits like bananas and pomelos. This aligns with the findings from Joyvio Group and UrbanFruit, which also stressed the need for a multimodal strategy.

3) Sea transport remains the most cost-effective option for bulk shipments, while land transport balances cost and efficiency for perishable fruits.

4) Interview Findings: The export director of USTH Trading and the logistics manager of Baiguoyuan both noted that land transport is crucial for maintaining the quality of perishable fruits. Additionally, Richfield Fresh Fruit Co., Ltd, highlighted that sea transport is preferred for bulk shipments of bananas and pomelos due to its cost-effectiveness.

5) Air transport, though the fastest, is only used for premium fruits due to its high cost.

6) Interview Findings: The import manager at Joyvio Group and the supply chain manager at UrbanFruit both highlighted that air transport is used for premium fruits like durians to ensure maximum freshness for high-end markets in major cities like Shanghai and Beijing.

7) Companies such as Baiguoyuan and Joyvio Group emphasized that land transport is preferred for durians and mangosteens to maintain freshness.

8) Interview Findings: Both Baiguoyuan and Joyvio Group mentioned that land transport is crucial for maintaining the quality of perishable fruits like durians and mangosteens, as it offers faster transit times compared to sea freight.

5.1.2 Cold Chain and Customs Clearance Remain Key Challenges

1) Cold storage limitations at ports and border checkpoints increase the risk of fruit spoilage during transportation.

2) Interview Findings: The CEO of USTH Trading and the logistics head at Yogo Farming both stressed that inadequate cold storage facilities at border checkpoints and ports lead to higher spoilage rates, especially for perishable fruits.

3) Customs clearance delays, particularly along the Thailand-Laos-China corridors, significantly increase transit time for land transport.

4) Interview Findings: The logistics head at Yogo Farming and the head of exports at Richfield Fresh Fruit Co., Ltd, reported that unpredictable customs procedures and long clearance delays are major bottlenecks for land transport.

5) Yogo Farming and USTH Trading highlighted that delays in customs inspections and limited temperature-controlled storage pose major threats to fruit quality and profitability.

6) Interview Findings: Both companies noted that delays in customs inspections and the lack of temperature-controlled storage facilities at border checkpoints significantly impact fruit quality and overall profitability.

5.1.3 Government Policies and Infrastructure Investments Are Essential

1) Recent tariff reductions on fruit imports in China have improved cost efficiency, but bureaucratic inefficiencies remain a challenge.

2) Interview Findings: The compliance officer at Joyvio Group noted that recent tax reductions on imported fruits have improved cost efficiency, but bureaucratic delays at customs still pose challenges.

3) The China-Laos Railway has provided an alternative to traditional road transport, but its full potential has yet to be realized.

4) Interview Findings: Several interviewees, including the logistics manager of Baiguoyuan and the operations director at Hjfruit Company, mentioned that the China-Laos Railway offers a promising alternative to traditional road transport, but

further investment and optimization are needed to fully realize its potential.

5) Joyvio Group's compliance officer noted that regulatory improvements have helped reduce logistics costs, but further enhancements in customs processing are still needed.

6) Interview Findings: The compliance officer at Joyvio Group highlighted that while regulatory improvements have reduced logistics costs, further streamlining of customs procedures is essential to enhance overall efficiency.

5.1.4 Technological Innovation and Multimodal Transport Are the Future

1) Exporters and importers plan to integrate AI-driven logistics planning, IoT tracking, and automated customs clearance to enhance efficiency.

2) Interview Findings: The head of digital operations at Hjfruit Company and the supply chain manager at UrbanFruit both emphasized the importance of adopting AI-driven logistics planning and IoT tracking to improve supply chain visibility and reduce transit times.

3) Hjfruit Company's head of digital operations stated that AI-driven route optimization has already reduced transit times by 15-20%, showing the potential of technology in improving logistics performance.

4) Interview Findings: The head of digital operations at Hjfruit Company shared that AI-driven route optimization has significantly reduced transit times by 15-20%, demonstrating the potential of technology to enhance logistics efficiency.

In summary, while Thailand's fruit export logistics face significant challenges in cost management, infrastructure, and policy implementation, advancements in cold chain technology, digital logistics solutions, and multimodal transport offer promising opportunities for improvement.

5.2 Recommendations

This section critically examines the research design, contextualizes the findings within existing literature, and highlights the study's contributions and limitations.

5.2.1 Research Details

The study employed a mixed-methods approach to evaluate transportation mode selection for Thailand's fruit exports to China. **Primary data** were collected through semi-structured interviews with six key stakeholders, including Thai exporters (e.g., USTH Trading, Richfield Fresh Fruit Co., Ltd.) and Chinese importers (e.g., Joyvio Group, Hjfruit Company), selected via purposive sampling to ensure representation of diverse logistics roles. **Secondary data** from Thai Ministry of Commerce reports, customs records, and industry databases (e.g., World Agrochemical Network, Xinhua News Agency) supplemented the analysis.

The research framework (Figure 1.3) integrated four dimensions:

1) Advantages and disadvantages of air, sea, and land transport.
2) Cost efficiency and satisfactionwith logistics performance.
3) Macro-micro factors(e.g., seasonal demand, infrastructure, tariffs).
4) Competitiveness in China's market.

Data were analyzed using thematic analysis (for qualitative interviews) and comparative cost-time metrics (for secondary data). This dual approach ensured triangulation of findings, enhancing reliability.

5.2.2 Research Findings and Significance

The study revealed three critical insights with theoretical and practical implications:

1) Trade-offs Between Cost and Freshness
    1.1) Sea transport dominated exports (51%) due to low costs

(USD 0.12–0.18/kg), but prolonged transit times (4–10 days) led to 15–20% quality loss for perishables like durians.

1.2) Land transport (48%) balanced cost (USD 0.25–0.35/kg) and speed (2–4 days), yet customs delays at the Thailand-Laos-China corridor increased lead times by 30–40%.

1.3) Air transport (0.54%) preserved freshness (transit <6 hours) but incurred prohibitive costs (USD 1.2–1.8/kg), limiting its use to premium markets.

2) Infrastructure and Policy Gaps

2.1) Inadequate cold chain facilities at border checkpoints (e.g., Mohan, Ruili) resulted in 12–15% spoilage rates.

2.2) Customs digitization initiatives (e.g., China's "Single Window" system) reduced clearance times by 20%, yet bureaucratic inefficiencies persisted, particularly during peak seasons.

3) Technological Opportunities

3.1) Early adopters of IoT-enabled cold chain tracking (e.g., Hjfruit Company) reduced spoilage by 18%, while AI-driven route optimization (e.g., UrbanFruit) cut transit times by 15%.

3.2) Significance: These findings provide a decision-making framework for exporters to align transportation choices with product perishability, market demand, and cost constraints. Policymakers can leverage the evidence to prioritize cold chain investments and streamline cross-border procedures.

5.2.3 Comparison with Existing Studies

The study both aligns with and diverges from prior literature:

Table 5.1 This Study vs. Exsting Literature by Key Themes

Aspect	This Study	Existing Literature
Cost-Time Trade-offs	Quantified sea transport's 15–20% quality loss, a gap overlooked by Izadi, Nabipour, and Titidezh (2019)	Focused on generalized logistics costs, neglecting perishable-specific degradation (Izadi et al., 2019; Meixell & Norbis, 2008).
Cold Chain Management	Highlighted 12–15% spoilage due to infrastructure gaps, corroborating Han (2017)	Emphasized technical solutions (e.g., smart containers) without addressing policy barriers (Li et al., 2019; Patil et al., 2023).
Customs Efficiency	Identified 30–40% delays in land transport, aligning with Warr et al. (2009).	Analyzed tariffs but underestimated procedural bottlenecks (Timilsina & Dulal, 2010).

This study advances the field by integrating perishability metrics into transportation models and offering region-specific solutions (e.g., China-Laos Railway utilization), bridging gaps in generalized logistics frameworks.

5.2.4 Research Limitations

While comprehensive, the study has limitations:

1) Sample Scope: Interviews focused on six companies, potentially underrepresenting small-scale exporters. Future studies should expand to rural SMEs.

2) Geographic Focus: Analysis centered on Thailand-China routes; findings may not generalize to other ASEAN corridors (e.g., Vietnam-Cambodia).

3) Data Currency: Secondary data from 2022–2023 may not reflect post-2024 policy shifts (e.g., China's revised fruit import quotas).

4) Technological Assumptions: IoT/AI benefits were extrapolated from early adopters; broader implementation challenges (e.g., cost, training) require deeper exploration.

These limitations highlight opportunities for longitudinal and comparative research to validate the proposed framework.

5.3 Final Remarks

The findings of this research highlight the complex interplay between cost, efficiency, infrastructure, and policy in shaping Thailand's fruit export logistics. While exporters face significant challenges in cold chain management, customs procedures, and transport costs, emerging technological solutions and multimodal logistics strategies provide a pathway for overcoming these obstacles.

By implementing the recommended improvements in transportation selection, cold chain investment, customs procedures, and technology adoption, Thailand's fruit export industry can enhance its competitiveness, reduce costs, and improve the overall efficiency of fruit shipments to China.

Future Research Directions:

1) Investigating the impact of rail freight (China-Laos Railway) on reducing logistics costs for fruit exports.

2) Assessing the potential benefits of blockchain-based tracking systems for transparency in fruit supply chains.

3) Exploring alternative trade routes and Free Trade Agreements (FTAs) to enhance cost-effectiveness in exports.

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