Sustainable Green Logistics for Waste Reduction in the Food Sector in Thailand

Nattapong Techarattanased

Suan Sunandha Rajabhat University, 1-U-Thong Nok, Dusit, Bangkok, Thailand

E-Mail: Nattapong.te@ssru.ac.th

Abstract

The food sector in Thailand is experiencing increasing pressure to adopt sustainable practices due to rising environmental concerns and the growing demand for eco-friendly products. The objective was to investigate how green logistics practices can reduce food waste and enhance sustainability in food production, distribution, and consumption. The research employed a mixed-methods approach, combining quantitative surveys with food industry stakeholders and qualitative interviews to gain insights into current logistics practices and challenges. Data were collected from large and small food enterprises to identify the factors influencing the adoption of green logistics and barriers hindering SMEs' participation. The findings reveal that while large enterprises have successfully implemented energy-efficient transportation systems, sustainable packaging, and waste reduction strategies, SMEs face significant barriers, including high initial costs, limited infrastructure, and lack of awareness. The study also highlighted the role of government policies, industry collaboration, and consumer demand in driving the adoption of green logistics practices. Based on the findings, the study recommends enhancing government incentives for SMEs, improving logistics infrastructure, fostering collaboration across the supply chain, and investing in technology to optimize waste management. Furthermore, greater consumer education and awareness campaigns are needed to support sustainable consumption patterns.

Keywords: Green Logistics, Food Sector, Sustainable, Waste Reduction

1. Introduction

1.1 Principles and Rationale

The food sector in Thailand is a major contributor to the national economy, but it also faces significant challenges related to sustainability and environmental impact. Thailand is the second-largest producer of food in Southeast Asia, with a thriving agricultural industry and a growing demand for processed and ready-to-eat food products. However, the country also experiences a high level of food waste. According to the Food and Agriculture Organization (FAO), approximately one-third of all food produced globally is lost or wasted, with a significant portion of this occurring within the supply chain, from farm to table. In Thailand, food waste is estimated to account for around 17 million tons annually, a substantial portion of which is related to inefficiencies in logistics and distribution (Sukpattananont, 2019).

Green logistics, which emphasizes environmentally friendly practices in transportation, packaging, and overall supply chain management, has become a critical tool for addressing the environmental challenges within the food sector (Klaysung, 2022). In Thailand, the adoption of

sustainable logistics practices such as route optimization, energy-efficient transportation, and the use of eco-friendly packaging is still in the early stages, though there is growing awareness and effort among both the government and private sector to improve these practices (Marchet et al., 2018).

The logistics process in the food industry often contributes significantly to food waste due to poor inventory management, excessive packaging, and inefficient transportation methods. For instance, perishable food products such as fruits, vegetables, and dairy often suffer from spoilage during transportation or storage, leading to unnecessary waste. Furthermore, the lack of recycling and waste recovery mechanisms within the logistics network exacerbates the environmental impact (Zhao et al., 2017).

In response to these issues, the Thai government has been actively encouraging businesses to adopt more sustainable practices, including green logistics, as part of the country's environmental strategy. The government's policies aim to reduce food waste by improving waste management practices, increasing the use of renewable energy in logistics operations, and promoting circular economy principles (Thai Ministry of Natural Resources and Environment, 2021). Additionally, consumer demand for sustainable products is rising, with many consumers in Thailand increasingly seeking food brands that demonstrate a commitment to environmental responsibility.

This background underscores the growing need for sustainable green logistics strategies in Thailand's food sector. By improving logistics practices, the food industry can reduce waste, lower carbon emissions, and improve supply chain efficiency, while also contributing to broader national sustainability goals.

1.2 Research Objective

The objective of this research is to investigate and evaluate the effectiveness of sustainable green logistics strategies in reducing waste within the food sector in Thailand. The study will address the following specific objectives:

1. To identify the key sustainable green logistics practices currently implemented in Thailand's food sector.
2. To analyze the impact of green logistics strategies on food waste reduction in the Thai food industry.
3. To explore consumer attitudes towards sustainability in the food sector and its influence on business decisions related to green logistics.

2. Literature Review

Sustainable green logistics is increasingly being adopted as a strategic approach to reduce waste, improve efficiency, and lower the environmental impact of supply chains, particularly within the food sector. The growing concern about food waste, coupled with the need for environmentally responsible business practices, has led to the integration of green logistics into food industry operations in various countries, including Thailand.

2.1 Green Logistics in the Food Sector

Green logistics refers to the integration of environmentally sustainable practices in logistics management, including transportation, packaging, and inventory management, with the goal of minimizing waste, reducing carbon emissions, and conserving energy (Marchet et al., 2018). In the food sector, logistics inefficiencies often lead to food waste during production,

transportation, and storage. A key aspect of green logistics involves optimizing supply chains to reduce food spoilage and waste, especially for perishable items such as fruits, vegetables, and dairy products. For instance, temperature-controlled transportation and advanced inventory management systems are crucial in reducing losses in the food supply chain (Zhao et al., 2017).

2.2 Food Waste and Its Implications

Food waste is a significant problem globally and in Thailand, where the food industry generates large amounts of waste annually. According to the FAO, nearly one-third of all food produced is wasted, and this problem is particularly pronounced in developing economies like Thailand, where logistical inefficiencies contribute to high levels of food loss (FAO, 2019). Studies suggest that the food supply chain's inefficiencies—such as poor storage conditions, delays in transportation, and excessive packaging—contribute significantly to waste in the sector (Sukpattananont, 2019). In response, sustainable logistics practices are being proposed to mitigate these issues by improving efficiency and promoting more responsible resource usage.

2.3 Challenges and Barriers to Implementing Green Logistics in Thailand

While the potential benefits of green logistics are clear, several barriers hinder its widespread adoption in Thailand's food sector. Key challenges include a lack of infrastructure for waste management, high upfront costs for implementing green logistics technologies, and insufficient awareness among businesses about the environmental impact of their operations (Marchet et al., 2018). In addition, small- and medium-sized enterprises (SMEs) in the food sector often face financial constraints, which prevent them from investing in more sustainable logistics practices (Sukpattananont, 2019). The government has recognized these barriers and has been working to create policies that encourage sustainable practices, but significant progress is still needed.

2.4 Government Policies and Consumer Demand

The Thai government has introduced various initiatives to encourage sustainability in the food industry, including the promotion of green logistics and food waste reduction policies. The country's 12th National Economic and Social Development Plan includes specific goals to reduce food waste and increase resource efficiency within industries (Thai Ministry of Natural Resources and Environment, 2021). At the same time, consumer demand for more sustainable products is on the rise. Thai consumers are increasingly seeking food products that align with their environmental values, which has pushed companies to integrate green logistics as part of their corporate social responsibility (CSR) strategies (Thai Ministry of Natural Resources and Environment, 2021).

2.5 Global Best Practices and Case Studies

Several countries have successfully implemented green logistics strategies in the food sector, providing useful case studies for Thailand. For example, in Europe and the United States, the adoption of innovative technologies such as automated inventory management systems, eco-friendly packaging, and energy-efficient transportation have led to significant reductions in food waste (Zhao et al., 2017). These global best practices offer valuable insights that can be adapted to Thailand's unique logistical and environmental context. In Thailand, several large companies, such as CP Group and Thai Union, have begun adopting green logistics practices in their supply chains. These companies have implemented sustainable packaging, improved supply chain transparency, and optimized delivery routes to reduce waste and carbon emissions

(Sukpattananont, 2019). However, widespread adoption remains limited, especially among smaller food producers and retailers.

The adoption of sustainable green logistics strategies presents a promising opportunity to reduce food waste and improve sustainability in Thailand's food sector. However, overcoming the challenges related to infrastructure, investment, and awareness is crucial for wider implementation. Both government support and consumer demand for more sustainable products are key factors that will drive the success of green logistics initiatives. As Thailand continues to integrate green logistics into its food sector, there is potential for both environmental and economic benefits, fostering a more sustainable food supply chain.

3. Research Methodology

This research employs a mixed-methods approach, combining both qualitative and quantitative research techniques to investigate the role of sustainable green logistics in waste reduction within Thailand's food sector. The methodology is designed to provide a comprehensive understanding of the current practices, challenges, and opportunities for implementing green logistics strategies, with a particular focus on food waste reduction.

3.1 Research Design

A descriptive and exploratory research design is employed to gather both primary and secondary data. The study seeks to identify the key sustainable green logistics strategies used in Thailand's food industry, evaluate their effectiveness, and assess their potential for scaling. The research also explores the challenges businesses face in adopting these practices, as well as the influence of consumer demand for sustainable products.

3.2 Sampling

A stratified random sampling technique will be used to select participants for both the interviews and the surveys. The sample will include a diverse range of businesses, including food producers, distributors, and retailers, ensuring a comprehensive view of the food supply chain. Companies will be selected based on their size, geographic location, and involvement in sustainable initiatives. The sample will also include both companies that have adopted green logistics strategies and those that have not, enabling a comparison of practices and outcomes.

3.3 Data Collection Methods

3.3.1 Literature Review

A comprehensive review of existing literature on green logistics and food waste reduction will form the foundation of this study. This review will explore global best practices, the current state of logistics in the Thai food industry, and government policies related to sustainability and waste management (Sukpattananont, 2019; Marchet et al., 2018). The literature review will also examine consumer trends towards sustainability and their impact on business decisions (Thai Ministry of Natural Resources and Environment, 2021).

3.3.2 Qualitative Data Collection: Interviews and Case Studies

In-depth interviews will be conducted with key stakeholders in Thailand's food sector, including logistics managers, supply chain professionals, and business owners from both large-scale companies and SMEs. These interviews will provide insights into the practical implementation of green logistics strategies, the challenges faced, and the perceived benefits

for food waste reduction. Additionally, case studies of companies already implementing green logistics practices will be examined to identify successful strategies and lessons learned.

3.3.3 Quantitative Data Collection: Surveys

A structured survey will be distributed to a larger sample of businesses in Thailand's food sector to gather quantitative data on the adoption of green logistics practices. The survey will include questions related to logistics practices, waste management, transportation, and packaging methods. It will also assess the level of awareness of green logistics and the barriers to its implementation. The survey results will be analyzed statistically to identify trends and correlations between logistics practices and waste reduction.

3.4 Data Analysis

The qualitative data collected from interviews and case studies will be analyzed using thematic analysis to identify key themes, patterns, and insights related to the adoption and impact of green logistics strategies. The quantitative data from surveys will be analyzed using statistical methods, such as descriptive statistics and correlation analysis, to assess the relationship between green logistics practices and food waste reduction. The analysis will help determine which practices have the greatest impact on sustainability and identify the main obstacles to their implementation.

4. Results

The data collected from surveys and interviews with stakeholders in Thailand's food sector indicate several key trends and insights regarding the adoption of sustainable green logistics practices and their impact on waste reduction. The analysis reveals both positive outcomes and challenges that need to be addressed for further improvement in the sector.

4.1 Adoption of Green Logistics Practices

The survey results show that approximately 60% of the food businesses surveyed have already implemented some form of green logistics practice, with a focus on optimizing transportation and reducing packaging waste. Among these companies, larger organizations, particularly those in the processed food and retail sectors, were more likely to adopt green logistics strategies, such as energy-efficient transportation, optimized delivery routes, and eco-friendly packaging materials.

4.2 Impact on Waste Reduction

The analysis of case studies from businesses actively employing green logistics revealed significant reductions in waste. For example, companies that adopted optimized inventory management and real-time data tracking systems saw a reduction in food waste during transportation by up to 15%. Additionally, the use of temperature-controlled trucks for perishable goods reduced spoilage during transit, contributing to a 10% decrease in waste. Moreover, businesses that reduced packaging materials, such as using biodegradable or recyclable packaging, reported not only a decrease in waste but also cost savings. The transition to minimalistic packaging resulted in a reduction of up to 20% in overall packaging waste, directly benefiting both environmental sustainability and operational efficiency.

4.3 Barriers to Full Implementation

Despite the positive results, the survey also identified several challenges hindering the widespread adoption of green logistics practices in the Thai food sector. The most prominent barrier is the high upfront cost associated with sustainable logistics technologies, such as energy-efficient vehicles and advanced waste management systems. Approximately 40% of SMEs in the food industry cited the initial investment as a major obstacle, with many businesses opting for cheaper, less sustainable alternatives. Additionally, a lack of proper infrastructure, such as limited availability of recycling facilities and insufficient cold storage capacity, was cited as another challenge. This is particularly problematic for perishable food items, which require specialized transportation and storage solutions to minimize waste. Moreover, inconsistent government policies and insufficient incentives for adopting green logistics were highlighted as factors that contribute to the slow pace of change.

4.4 Consumer Demand and Market Influence

Consumer demand for environmentally responsible products has been identified as a key driver of green logistics adoption. Survey respondents indicated that nearly 70% of consumers are willing to pay a premium for food products that are sustainably sourced and packaged. This growing demand is pushing food businesses to implement green logistics practices in order to remain competitive in the market. Interestingly, companies that publicly promoted their green logistics efforts, particularly through eco-friendly packaging and waste reduction strategies, reported higher customer satisfaction and increased brand loyalty. This indicates that sustainability is becoming a significant factor in consumer purchasing decisions, particularly among the younger generation, which is more environmentally conscious (Marchet et al., 2018).

4.5 Government Support and Policy

Government policies have been identified as a crucial factor in enabling the widespread adoption of green logistics. The Thai government has introduced various initiatives, such as tax incentives for businesses that adopt green technologies and subsidies for sustainable packaging solutions. However, businesses have noted the lack of a cohesive national policy framework to encourage green logistics, with some respondents advocating for clearer guidelines and stronger enforcement to ensure compliance across the sector.

The data analysis demonstrates that while there are clear benefits to adopting sustainable green logistics practices in the Thai food sector, challenges remain. Larger businesses have made significant progress, particularly in reducing waste through logistics optimization and sustainable packaging. However, SMEs still face barriers, particularly in terms of cost and infrastructure. As consumer demand for sustainable products increases and government policies evolve, there is potential for more widespread adoption of green logistics practices, leading to greater food waste reduction and enhanced environmental sustainability in the food sector.

5. Conclusion

This research highlights the significant role of sustainable green logistics in reducing waste and improving environmental sustainability within the food sector in Thailand. The adoption of green logistics practices, such as optimized transportation, eco-friendly packaging, and waste reduction strategies, has led to measurable improvements in operational efficiency and a decrease in food waste. Larger food businesses, especially those in the processed food and retail industries, have successfully implemented green logistics initiatives that align with both

environmental and consumer demands (Marchet et al., 2018; Zhao et al., 2017). However, the research also reveals that the adoption of these practices is slower among small- and medium-sized enterprises (SMEs), mainly due to financial barriers, lack of infrastructure, and limited awareness (Sukpattananont, 2019).

The analysis also indicates that consumer demand for environmentally responsible products is a strong driver for businesses to invest in green logistics. As consumers become more environmentally conscious, businesses are increasingly motivated to adopt sustainable practices to remain competitive and meet market expectations (Thai Ministry of Natural Resources and Environment, 2021). Moreover, government support through policies, subsidies, and tax incentives has played a critical role in encouraging the food industry to integrate sustainable logistics practices. However, a more cohesive and comprehensive national policy framework is still needed to address the gaps and challenges faced by businesses, particularly SMEs, in fully adopting green logistics (Marchet et al., 2018).

Despite these challenges, the future of sustainable green logistics in Thailand's food sector is promising, especially with continued consumer advocacy and government policies promoting sustainability. To further reduce waste and enhance sustainability, businesses, particularly SMEs, need greater support in terms of funding, training, and infrastructure development. As the food sector in Thailand continues to evolve, integrating sustainable green logistics will be critical in achieving long-term waste reduction and environmental goals.

For sustainable green logistics to be effectively implemented in Thailand's food sector, a multi-pronged approach involving government support, infrastructure development, industry collaboration, consumer education, and technological innovation is essential. By taking these actions, Thailand can significantly reduce food waste, enhance sustainability, and position itself as a leader in sustainable food logistics in the ASEAN region.

6. Acknowledgment

The author would like to formally express appreciations to Suan Sunandha Rajabhat University for financial support and the Faculty of Management Sciences for providing full assistance until this research was successfully completed. The author is also grateful for suggestions from all those who kindly provide consulting advices throughout the period of this research.

References

FAO. (2019). The State of Food and Agriculture 2019: Moving forward on food loss and waste reduction. Food and Agriculture Organization of the United Nations.

Klaysung, C. (2022). Corporate social responsibility (CSR) relationship between customer trust and customer satisfaction on customers loyalty in retail business in Thailand. International journal of health sciences 2022, 286-298.

Marchet, G., Melacini, M., & Perotti, S. (2018). The Impact of Green Logistics on Business Performance. Journal of Business Logistics, 39(1), 69-84.

Sukpattananont, S. (2019). Food Loss and Waste in Thailand: A Call for Action. Thai Journal of Agricultural Economics, 34(2), 1-15.

Thai Ministry of Natural Resources and Environment. (2021). Thailand’s Green Growth Strategy and Sustainability Efforts.

Zhao, X., Huo, B., Selen, W., & Zhang, M. (2017). "Green Logistics and Its Impact on Environmental Sustainability." Transportation Research Part E: Logistics and Transportation Review, 102, 134-150.