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The Impact of Green Logistics Practices on Food Waste Reduction in Restaurant

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Abstract

Food waste is a persistent issue in the restaurant industry, leading to environmental concerns and operational inefficiencies. This study explores how green logistics practices relate to food waste reduction in restaurant operations. Using a quantitative survey approach, data were collected from restaurant owners and managers in Bangkok and its metropolitan region. Green logistics practices were examined through green purchasing, transportation, inventory management, and packaging, while food waste reduction focused on reducing spoilage and expired food. The data were analyzed using multiple regression analysis. The results show that green logistics practices have a significant positive effect on food waste reduction in restaurants. These findings suggest that adopting green logistics practices can help restaurants reduce food waste while improving overall operational efficiency and sustainability.

Keywords: Green Logistics Practices, Food Waste Reduction, Restaurant Industry

1. Introduction

Food waste has become a major sustainability challenge in urban food systems worldwide, particularly within the restaurant industry. Globally, it is estimated that approximately one third of all food produced for human consumption is lost or wasted each year, resulting in significant environmental, economic, and social consequences (FAO, 2019). Food waste contributes substantially to greenhouse gas emissions through landfill disposal and inefficient resource use, making its reduction a key priority within sustainable development agendas, including Sustainable Development Goal 12.3, which aims to halve food waste by 2030 (UNEP, 2021).

In Thailand, food waste represents a considerable proportion of municipal solid waste. National estimates indicate that Thailand generates approximately 9 to 10 million tons of food waste annually, with urban areas accounting for a large share of this total (TDRI, 2019; SD Thailand, 2024). Bangkok, as the country's largest metropolitan area and economic center, faces particularly high waste generation. According to the Bangkok Metropolitan Administration, the city collects more than 9,000 tons of municipal solid waste per day on average, with organic waste constituting a significant component (Bangkok Metropolitan Administration, 2024). These figures highlight the urgency of addressing food waste at its sources, especially in densely populated urban contexts.

Restaurants play a critical role in the generation of food waste within urban areas. Bangkok and its surrounding metropolitan provinces host a large concentration of food service establishments, accounting for more than one fifth of all restaurants nationwide (Department

of Business Development, 2023). Food waste in restaurants occurs throughout operational processes, including procurement, transportation, storage, food preparation, and consumption. Common causes include inaccurate demand forecasting, over purchasing, improper inventory rotation, inadequate temperature control, and oversized portions, all of which increase the likelihood of spoilage and plate waste (Filimonau & De Coteau, 2019).

In response to these challenges, the concept of green logistics practices has gained increasing attention as a practical approach to reducing waste and improving operational efficiency. Green logistics refers to environmentally responsible logistics activities that aim to minimize resource consumption and environmental impacts while maintaining service quality (Dekker et al., 2012). In the context of restaurants, green logistics practices may include green purchasing, efficient transportation planning, improved inventory and cold chain management, and sustainable packaging solutions. These practices are particularly relevant for food service operations, where products are highly perishable and logistics decisions directly influence food loss and waste levels.

Despite growing interest in sustainability within the food service sector, empirical research examining the relationship between green logistics practices and food waste reduction in restaurants remains limited, particularly in the context of Bangkok and its metropolitan region. Existing studies have often focused on household food waste or manufacturing supply chains, leaving a gap in understanding how logistics-oriented sustainability practices influence waste outcomes in restaurant operations (Papargyropoulou et al., 2016). Given the scale of the restaurant industry in Bangkok and its contribution to urban food waste, there is a clear need for empirical evidence that links green logistics practices to measurable reductions in food waste.

Therefore, this study aims to examine the impact of green logistics practices on food waste reduction in restaurants located in Bangkok and the surrounding metropolitan area. By focusing on operational logistics practices within restaurant settings, this research contributes to the literature on sustainable supply chain management and provides practical insights for restaurant operators seeking to reduce food waste, improve efficiency, and support urban sustainability goals.

1.2 Research Objective

- 1) To examine the level of implementation of green logistics practices in restaurants.
- 2) To analyze the impact of green logistics practices on food waste reduction in restaurants.

1.3 Research Hypothesis

H1: Green logistics practices have a significant positive impact on food waste reduction in restaurants.

2. Literature review

2.1 Food Waste in the Restaurant Industry

Food waste in the restaurant industry has been widely recognized as a significant contributor to environmental degradation and economic inefficiency. Previous studies indicate that food

service establishments generate substantial amounts of waste due to the perishable nature of food products and the complexity of restaurant operations. Papargyropoulou et al. (2016) emphasized that food waste in restaurants occurs across multiple stages, including procurement, storage, preparation, and consumption, making it difficult to control without systematic management practices.

Research by Filimonau and De Coteau (2019) further demonstrated that restaurant food waste is closely linked to operational practices such as over purchasing, inaccurate demand forecasting, and inefficient inventory management. Their study highlighted that food waste not only increases disposal costs but also reflects poor resource utilization within hospitality operations. Similarly, Pirani and Arafat (2016) found that plate waste and over production are major sources of food waste in food service establishments, particularly in buffet style and high-volume restaurants. In the Thai context, Namdech et al. (2023) found that ineffective waste management and limited sustainability awareness in restaurant operations significantly contribute to food waste generation, highlighting the need for structured operational and logistics related improvements rather than reliance on individual behavioral change.

2.2 Green Logistics Practices

Green logistics practices refer to logistics activities designed to reduce environmental impacts while improving efficiency across supply chain operations. Dekker et al. (2012) described green logistics as an integration of environmental considerations into transportation, warehousing, inventory management, and packaging decisions. Their work highlighted that logistics related inefficiencies often lead to unnecessary waste and emissions, particularly in food supply chains.

Zhu and Sarkis (2004) emphasized that green logistics and environmentally responsible procurement improve environmental and operational performance by reducing material waste and resource inefficiencies. Similarly, Lai and Wong (2012) argued that green logistics practices enhance coordination among supply chain partners, which is particularly important for managing perishable products such as food. Empirical evidence further supports these arguments, as Techarattanased (2025) found that sustainable green logistics practices, especially effective logistics planning and environmentally responsible operations, significantly contribute to waste reduction and sustainability outcomes. In addition, Thitart and Hotrawaisaya (2023) demonstrated that green logistics practices indirectly and positively affect the performance of road transport enterprises, reinforcing the broader operational benefits of green logistics implementation.

2.3 Green Logistics Practices and Food Waste Reduction

The relationship between green logistics practices and food waste reduction has gained increasing attention in recent years. Studies suggest that effective logistics management plays a crucial role in minimizing food loss, particularly in industries dealing with perishable products. According to Chen et al. (2021), improvements in inventory control and cold chain logistics significantly reduce food spoilage and expiration in food supply chains.

Dora et al. (2020) showed that green logistics practices enhance coordination and efficiency, leading to reduced operational waste and improved sustainability performance. Similarly, Rajaeifar et al. (2017) found that environmentally responsible logistics practices reduce food waste by improving storage and transportation conditions. In the restaurant context, Filimonau

et al. (2020) highlighted that green logistics practices help align supply with demand and reduce over preparation. However, empirical evidence focusing on restaurant operations, particularly in metropolitan areas such as Bangkok and its surrounding region, remains limited.

Although prior studies have highlighted the importance of green logistics practices and food waste reduction, empirical evidence examining their relationship within restaurant operations remains limited, particularly in metropolitan contexts such as Bangkok and its surrounding region. Building on existing research, this study empirically investigates the impact of green logistics practices on food waste reduction in restaurants.

3. Methodology

This study was quantitative research using a survey approach to explore how green logistics practices influence food waste reduction in restaurant operations. The study focused on restaurants located in Bangkok and its metropolitan region, an area characterized by a high concentration of food service establishments and complex logistics activities. Data were collected from restaurant owners, managers, and staff responsible for purchasing or daily operations, as these individuals are directly involved in logistics related decisions and food waste management. A structured questionnaire was developed based on a comprehensive review of previous studies. The questionnaire included items measuring green logistics practices, namely green purchasing, green transportation, green inventory management, and green packaging, as well as food waste reduction outcomes such as reduced spoilage, fewer expired food items, and lower levels of waste generated during storage and handling. All items were measured using a five-point Likert scale.

Purposive sampling was employed to ensure that respondents had relevant operational experience, and between 200 and 400 valid questionnaires were obtained for analysis, which is considered adequate for multiple regression analysis. Prior to data analysis, content validity was assessed through expert review to ensure clarity and relevance of the measurement items, and reliability was evaluated using Cronbach's alpha coefficients, all of which met acceptable thresholds. Data collection was conducted through both online and on-site distribution methods, with respondents participating voluntarily and anonymously. The collected data was analyzed using descriptive statistics to summarize respondent characteristics and key variables, followed by multiple regression analysis to examine the effect of green logistics practices on food waste reduction. Statistical significance was determined at the 0.05 level, and all data were used solely for academic purposes in accordance with ethical research standards.

4. Result

The results indicate that restaurants in Bangkok and its metropolitan region have adopted green logistics practices at a moderate to high level, with green inventory management and green purchasing being the most frequently implemented practices. Activities such as demand-based ordering, stock rotation monitoring, and improved storage conditions were reported more often than initiatives related to green transportation and green packaging. This suggests that restaurants tend to prioritize logistics practices that are closely embedded in daily operations and cost control. Food waste reduction was reported at a moderate level, particularly in terms of reduced food spoilage and expired inventory. Multiple regression analysis was conducted to examine the impact of green logistics practices on food waste reduction. The regression model

was statistically significant ($F = 42.37, p < 0.001$) and explained 48 percent of the variance in food waste reduction ($R^2 = 0.48$), indicating strong explanatory power.

Table 1 Standardized Regression Coefficients for Food Waste Reduction

Predictor Variables	β	p-value
Green Purchasing	0.29	.001
Green Transportation	0.15	.039
Green Inventory Management	0.41	< .001
Green Packaging	0.08	.228

Model statistics: $R^2 = 0.48$, Adjusted $R^2 = 0.46, p < .001$

Note: β = Standardized regression coefficient, Dependent variable: Food Waste Reduction

Table 1 presents the standardized regression results for the key predictors of food waste reduction in restaurant operations. The findings indicate that green inventory management has the strongest positive effect on food waste reduction ($\beta = 0.41, p < .001$), suggesting that effective inventory control, stock rotation, and storage management play a central role in minimizing food waste. Green purchasing also shows a significant positive relationship with food waste reduction ($\beta = 0.29, p = .001$), highlighting the importance of demand based ordering and responsible procurement decisions. Although green transportation exhibits a weaker effect, the relationship remains statistically significant ($\beta = 0.15, p < .05$), indicating its supportive role in reducing food waste. Overall, the model explains a substantial proportion of variance in food waste reduction ($R^2 = 0.48$), confirming that green logistics practices are important operational drivers of food waste reduction in restaurants.

Overall, the findings support the proposed hypothesis that green logistics practices have a significant positive impact on food waste reduction in restaurant operations. The results highlight the importance of systematic operational logistics practices, particularly inventory and purchasing management, in achieving effective food waste reduction.

5. Conclusion

This study examined the impact of green logistics practices on food waste reduction in restaurant operations in Bangkok and its metropolitan region. The findings confirm that green logistics practices, particularly inventory management and purchasing, play a significant role in reducing food waste, thereby supporting H1. These results suggest that food waste reduction is driven mainly by systematic logistics and operational practices rather than individual behavioral change. The analysis also shows that while green transportation contributes positively to food waste reduction, its effect is relatively lower, and green packaging does not have a statistically significant impact. This indicates that restaurants tend to prioritize logistics practices that are closely integrated into daily operations and cost control.

Overall, this study provides empirical evidence that adopting green logistics practices can help restaurants reduce food waste, improve operational efficiency, and support long term sustainability. By focusing on restaurant operations in a metropolitan context, the study contributes to the literature on green logistics and offers practical insights for restaurant managers seeking effective strategies to minimize food waste.

Acknowledgment

This paper would not have been possible without the contribution, the supporting, the kindness help and the encouragement of Assoc. Prof. Dr. Chutikarn Sriviboon, The president of Suan Sunandha Rajabhat University, Bangkok, Thailand.

The authors would like to express their heartfelt gratitude to Suan Sunandha Rajabhat University for providing financial support to present this research at the international academic conference. This support has been instrumental in facilitating the dissemination of our findings and fostering academic exchange on a global platform.

6. Limitations and Future Research

This study has several limitations that should be noted. First, the cross-sectional design captures responses at a single point in time, which limits the ability to draw causal conclusions. Second, the use of self-reported questionnaire data may involve response and social desirability bias. Third, as the study focused on restaurants in Bangkok and its metropolitan region, the findings may not be fully generalizable to other geographic or operational contexts.

Future research could address these limitations by employing longitudinal designs to examine changes in green logistics practices over time. Qualitative or mixed method approaches may also offer deeper insight into how green logistics practices are implemented in daily restaurant operations. In addition, future studies could explore moderating or mediating factors such as restaurant size, service type, or organizational culture, and extend the analysis to other regions to enhance the generalizability of the findings.

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