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INTEGRATED LOGISTICS AND FOOD SAFETY: ENHANCING SUPPLY CHAIN EFFICIENCY IN MALAYSIA'S FOOD SERVICE INDUSTRY

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Abstract:

This study examines the relationship between logistic effectiveness, food safety compliance, and the performance of food service businesses in Malaysia. Utilizing a quantitative research approach, data was collected through structured questionnaires completed by 50 managers and decision-makers in the food service industry. The findings, analysed using Structural Equation Modeling (SEM) with SMARTPLS, reveal that logistic effectiveness has a positive but moderate direct impact on business performance. However, food safety compliance plays a significant mediating role, enhancing the influence of logistics on performance outcomes. The study emphasizes how crucial it is to combine strict food safety regulations with effective logistics to increase operational effectiveness and consumer satisfaction. The main recommendations center on closing gaps via supplier cooperation, cutting-edge technologies, and environmentally friendly procedures. This study advances our knowledge of how to optimize safety and logistics procedures to boost company success in an increasingly competitive marketplace.

Keywords:

Business Performance, Food Safety Compliance, Logistic Effectiveness, Structural Equation Modeling, Food Service Sector

Introduction

As a major contributor to GDP, employment, and consumer satisfaction, Malaysia's food service sector is a pillar of the country's economy (Alam & Sayuti, 2011; Ting et al., 2017). However, maintaining food safety, managing intricate supply chains, and attaining sustainable

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corporate performance present the industry with increasing problems. Intricate logistical processes and the rapid globalization of supply chains have led to vulnerabilities that could jeopardize the safety and quality of food (Ramanathan et al., 2011). These difficulties show how important it is for food service companies to create efficient logistics plans that may improve supply chain efficiency and guarantee adherence to food safety regulations.

By guaranteeing effective transportation, storage, and distribution of food goods, logistics plays a crucial role in the food supply chain, protecting the safety and quality of the food (Christopher, 2016). Reliable logistics techniques must be included in supply chain management to reduce risks, maximize efficiency, and enhance company results. Despite its crucial significance, little research has looked at how the efficiency of logistics in the food supply chain affects both overall business performance and adherence to food safety regulations. This study fills this knowledge gap by examining how well logistics ensure food safety and how it affects the success of Malaysian food service companies.

To achieve this objective, the study is guided by three key research questions. First, it seeks to determine the extent to which the effectiveness of logistics in the food supply chain influences the performance of food service businesses. Second, it examines the extent to which the effectiveness of logistics impacts food safety compliance within these businesses. Lastly, the study explores how food safety compliance mediates the relationship between logistics effectiveness in the food supply chain and the overall performance of food service businesses.

This research seeks to contribute to the academic discourse by providing empirical insights into the intersection of logistics, food safety, and business performance. Moreover, the findings will offer actionable recommendations for food service operators and supply chain managers, equipping them with tools to navigate logistical complexities while prioritizing food safety and enhancing organizational success.

Literature Review

Food Safety and Quality in the Food Supply Chain

Foodborne illnesses, arising from contamination at various stages such as production, processing, packaging, and distribution, remain significant challenges to public health and consumer confidence (Onyeaka et al., 2024). These illnesses range from mild discomfort to severe health crises, sometimes resulting in fatalities. Food safety encompasses activities to meet established standards, enhance public health, and prevent foodborne diseases, while food security ensures individuals have consistent access to sufficient, safe, and nutritious food for an active lifestyle (Tsoukas et al., 2022). One in ten people worldwide still suffer from nutritional inadequacies despite attempts to ensure food security.

Food safety and security problems are worsened by obstacles like food fraud and insufficient traceability. Food fraud gives inadequate label information, mislabelling, and fabricating food origins (Tsoukas et al., 2022). Reorganizing and optimizing the food supply chain is necessary for effective traceability systems to avoid scandals such as the Chinese milk scandal (2008) or the horse meat scandal (2013) (Nilsson et al., 2024). These issues erode customer confidence and emphasize the necessity of strict food safety regulations throughout the food supply chain.

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Poor sanitation, a lack of training, and a lack of knowledge about proper hygiene measures pose serious food safety risks for street food sellers, increasing the likelihood of contracting foodborne illnesses (Adaku et al., 2024; Islam et al., 2024). Additional public health issues are raised by the quality of street food, which is frequently high in unhealthy fats and sugars. For the food service industry to ensure food safety, technological advancements, employee training, and regulatory compliance are essential. For example, companies can fulfil changing customer demands by using technologies like blockchain for traceability and adhering to HACCP requirements (Radu et al., 2023; Sansome et al., 2024).

Food Supply Chain Management and Logistics

To guarantee that food reaches consumers on schedule, the food supply chain is a complicated system that includes production, storage, transportation, and retail (Haessner et al., 2024). From farmers generating raw agricultural products to processing, distribution, and retail, every stage of this chain depends on both natural and human resources. For food safety and quality to be maintained, these interrelated processes must be managed effectively. Food wastage and uneven quality because of varying demand are made worse by the supply chain's intrinsic complexity, especially for perishable goods (Von Berlepsch et al., 2024). The necessity for effective logistics is highlighted by the fact that over two-thirds of the world's food loss happens during the harvesting, shipping, and storage phases (Goodwin, 2023).

Throughout the supply chain, logistics are essential to guaranteeing the quality and safety of food. To preserve food items' physical, sensory, and chemical qualities, food logistics entails packing, shipping, handling, and storing them in suitable circumstances, such as regulated temperature and humidity (Bai et al., 2023). From locating raw materials to delivering the finished product to customers, these operations encompass the full distribution process. Food goods must be transported and stored hygienically due to their perishability, which emphasizes the significance of specialized logistics systems that are different from those used in other industries (Pakdel et al., 2023).

Integrated Logistics and Supply Chain Management

The food supply chain plays a pivotal role in ensuring food safety, quality, and sustainability. Prior studies have emphasized the importance of logistics in enhancing food distribution efficiency (Aramyan et al., 2007; Aung & Chang, 2014). However, a growing body of literature has begun to focus on the integration of logistics processes as a critical determinant of food quality, especially in highly perishable supply chains (Zhang et al., 2022; Lee et al., 2021). Integrated logistics involves coordinated management of transportation, warehousing, inventory, and information flow to minimize delays and quality degradation.

Despite this growing interest, there remains a significant gap in research exploring the direct link between logistics integration and food quality outcomes, particularly in developing countries. Most existing studies focus on logistics cost efficiency or traceability rather than examining how coordinated logistics efforts impact sensory and nutritional aspects of food (Raut et al., 2023; Yunis et al., 2020). Moreover, in the Malaysian food service industry, limited empirical evidence exists on how businesses strategically implement integrated logistics to manage food quality throughout the supply chain.

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Additionally, recent disruptions due to COVID-19 and rising consumer demand for safe, high-quality food have underscored the need for agile and integrated logistics systems (Fan & Stewart, 2021). Yet, few studies have evaluated the post-pandemic implications on logistics integration and food quality assurance mechanisms in Southeast Asia. This highlights a critical need to explore context-specific strategies and frameworks for integrated logistics that contribute to maintaining food quality and safety under uncertainty.

Therefore, this study aims to bridge these gaps by investigating the role of integrated logistics in enhancing food quality within the Malaysian food supply chain context, providing insights into how logistics coordination can support quality assurance and business resilience.

Challenges and Future Directions

Lack of technological adoption, the cost of regulatory compliance, and coordination among various stakeholders are some of the obstacles to the integration of food logistics with supply chain management (MacCarthy et al., 2022). Due to budget limitations, many small and medium-sized businesses (SMEs) find it difficult to implement advanced technologies, even with developments. Governments and industry partners must work together to address these problems by offering SMEs infrastructure support, subsidies, and training. Adopting stakeholder theory also offers a useful framework for dealing with these issues. Businesses can promote trust, responsibility, and long-term sustainability by considering the interests of all parties involved, including farmers, suppliers, distributors, and customers (Harrison et al., 2015).

New developments like blockchain technology and IoT-enabled traceability present viable ways to improve the food supply chain's efficiency and transparency. By enabling real-time monitoring, these technologies lower the risk of contamination and guarantee adherence to food safety regulations. Additionally, as businesses look to strike a balance between financial performance and environmental responsibility, sustainable practices—like cutting down on food waste and making the best use of resources—are becoming more and more popular (Shah & Bookbinder, 2022).

In conclusion, maintaining food safety and quality depends on efficient logistics and supply chain management. Adopting sustainable practices, encouraging collaboration, and incorporating cutting-edge technologies are all necessary to address the supply chain's complexity. By highlighting how supply chain management, logistics, and food safety are intertwined, stakeholders may create robust systems that improve public health and customer confidence.

Methodology

To fulfill the research objectives and provide answers to the questions posed, this study uses a quantitative research approach. Structured questionnaires are used to collect data from 50 managers and decision-makers in Malaysian food service enterprises. These people were chosen because they play crucial roles in managing logistics, guaranteeing food safety procedures, and assessing the overall success of the business. Managers and decision-makers are included to guarantee that the data gathered represents a knowledgeable viewpoint on the strategic and operational dynamics of the food service sector.

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The questionnaires were created by combining adapted and adopted approaches. Multiple-item constructs were used to evaluate the variable items, which are listed in the table below. The five-point Likert scale used to rate each item ranged from "strongly disagree" to "strongly agree."

Table 1: List Of Construct Items and Codes

Items	Codes
Delivery and storage techniques	LG1
Safety precautions	LG2
Monitoring and disposal during transit	LG3
Supplier involvement in safety practices	LG4
Compliance with operational control standards	LG5
Coordination with food suppliers	LG6
Integrated logistics benefits	LG7
Dependable transportation activities	LG8
Role of food safety regulations	FSC1
Adherence to regulations	FSC2
Management support	FSC3
Encouragement to report non-compliance	FSC4
Customer volume satisfaction	BP1
Customer feedback satisfaction	BP2
Food safety and quality satisfaction	BP3
Management practices satisfaction	BP4

The data is analyzed in the study using Structural Equation Modeling (SEM) with SmartPLS. SEM was selected because of its strong statistical capabilities for evaluating intricate interactions between variables, including mediating effects. Since studies involving managerial insights and organizational practices frequently involve lower sample numbers, non-normal data distributions, and complex model structures, SmartPLS is especially well-suited for this type of research. The study uses SEM to assess how logistics effectiveness affects business performance through food safety compliance, both directly and indirectly.

SEM is consistent with the research's objective of offering a thorough grasp of how food safety compliance and logistical efficiency interact to affect business outcomes in the Malaysian food service sector as shown in Figure 1. The analysis's findings will have useful ramifications for boosting organizational performance and supply chain operations in the food service industry.

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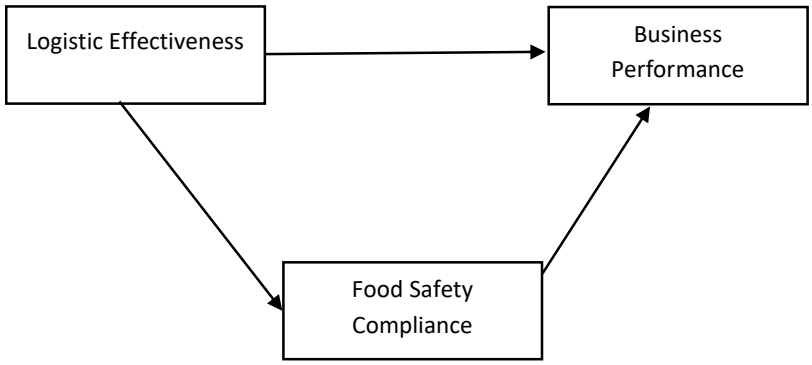

Figure 1: Conceptual Framework: Logistics, Food Safety Compliance and Business Performance

Findings

The analysis's findings offer a thorough comprehension of the connections between business performance (BP), food safety compliance (FSC), and logistic effectiveness (LG). The validity and reliability of the measurement model are confirmed by the loadings for every indicator across all constructs exceeding the 0.6 threshold. To illustrate the robustness of the questionnaire items in capturing the intended dimensions of the constructs, indicators like LG5 (loading = 0.892) and FSC4 (loading = 0.790) show particularly substantial contributions to their respective constructs.

The model's capacity for explanation is further demonstrated by the R-squared values. 31.7% of the variance is explained by food safety compliance (R^2 = 0.317), indicating that logistic efficacy has a considerable impact on it. Additionally, business performance has an R-squared value of 0.280, which indicates that the combined effects of food safety compliance and logistic effectiveness account for 28% of its variance. These R-square values show that the model has moderate to significant predictive power, which is consistent with the goals of the study.

Crucially, the analysis also emphasizes how food safety compliance acts as a mediator. Despite having a negligible direct influence on business success (path coefficient = 0.082), logistic effectiveness has a significantly larger indirect impact through food safety compliance (path coefficient = 0.479). Effective logistics procedures, like appropriate transportation and storage, greatly improve adherence to food safety regulations, as shown by the path from logistic effectiveness to food safety compliance (path coefficient = 0.563). This compliance in turn has a significant impact on business performance, highlighting the fact that following food safety procedures converts logistical effectiveness into observable business results.

In conclusion, by highlighting the significance of incorporating food safety procedures into logistical operations, the analysis supports the research framework. The influence of logistic effectiveness on business performance is amplified by the mediating role of food safety compliance, demonstrating its crucial role in guaranteeing not only operational excellence but also consumer happiness and commercial success. These results highlight the necessity for food service companies to give logistical and safety concerns top priority to maximize performance results.

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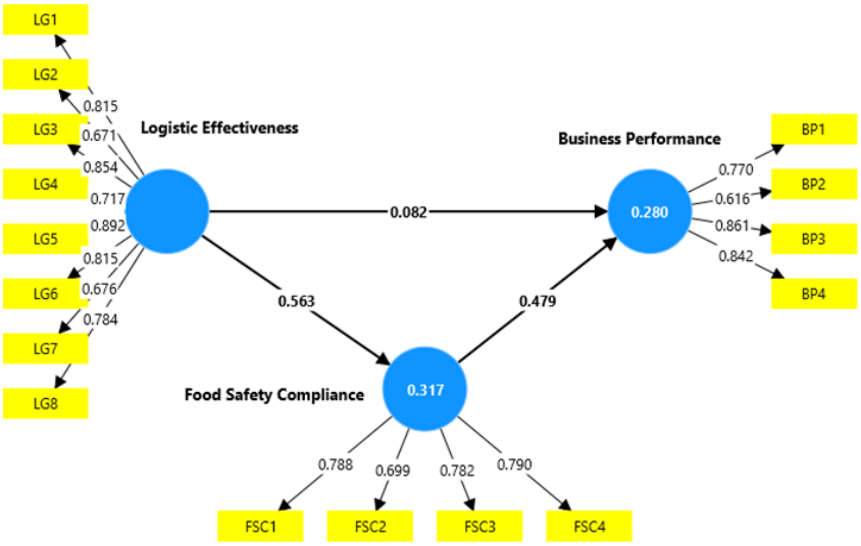

Figure 2: Research Framework

Recommendations

This study indicates the need for focused improvements in this area by highlighting the comparatively little influence of logistic effectiveness on business performance. Food service businesses are urged to use cutting-edge technologies like predictive analytics and automated tracking systems to improve their logistical operations. By increasing the effectiveness and dependability of inventory management, storage, and transportation, these tools help minimize interruptions and optimize the supply chain. Additionally, developing closer ties with suppliers can guarantee greater coordination in logistics procedures, which will ultimately enhance food safety and business results.

Businesses should give priority to training programs that teach employees about regulatory requirements and best practices in food handling and logistics to address the role of food safety compliance. Frequent assessments and audits help strengthen standard compliance, fostering an environment of responsibility and ongoing development. Support from management is essential for encouraging staff to follow food safety regulations and for promoting candid dialogue to proactively address possible hazards. By establishing these procedures, the gap between logistics and company performance can be closed and the mediating effect of food safety compliance further strengthened.

Future research could examine other factors like cost control, operational flexibility, and customer satisfaction that affect business success in the food service industry to fill in the gaps that have been found. Increasing the sample size and including a range of geographical areas may also offer a more comprehensive view of the potential problems in the food supply chain. Researchers can learn more about the subtleties of logistic efficacy and how it interacts with food safety procedures by incorporating qualitative methods like case studies or interviews.

Ultimately, a complete strategy is needed to improve the link between logistics, food safety, and business performance. Businesses can improve their operational efficiency and provide clients with more value by implementing these suggestions, which will increase their competitiveness in the ever-changing food service sector.

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Conclusion

This study emphasizes how crucial logistical efficiency and adherence to food safety regulations are in affecting the success of food service enterprises. The results show that although business performance is directly impacted by logistical effectiveness, this effect is amplified when strong food safety procedures are in place. These findings highlight how crucial it is to combine effective logistical processes with rigorous adherence to food safety regulations to satisfy both regulatory and consumer demands. Even while logistical effectiveness has no direct effect on performance, food safety compliance plays a crucial mediating function in closing this gap. The report offers insightful information that helps food service companies prioritize strategic enhancements to their supplier partnerships, logistical procedures, and food safety protocols. Businesses can improve overall performance, customer satisfaction, and operational efficiency by filling up the gaps found and using cutting-edge technologies and sustainable practices. This will open the door for long-term success in the competitive food service sector.

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