An Investigation of the Barriers and Drivers for Implementing Green Supply Chain in Malaysian Food and Beverage SMEs: A Qualitative Perspective

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Abstract: - The food and beverage (F&B) sector in Malaysia is experiencing rapid growth, largely driven by small and medium-sized enterprises (SMEs). However, many Malaysian F&B companies are encountering challenges when it comes to adopting environmentally friendly practices to enhance their environmental performance. This research aims to pinpoint the obstacles that hinder the implementation of Green Supply Chain Management (GSCM) in the F&B industry and to identify the drivers that influence companies' adoption of GSCM initiatives. Data was gathered through semi-structured interviews with 10 individuals from five different F&B SMEs (Companies A, B, C, D, and E) using a qualitative methodology. The data was analyzed using ATLAS.ti version 10, and themes were identified through coding. The study's findings revealed that a lack of knowledge and information sharing presents the most significant barrier to GSCM implementation, as there is insufficient awareness and dissemination of green concepts and practices among SME employees and consumers. Information sharing is crucial for facilitating green activities and promoting collaboration within the supply chain. Additionally, green manufacturing was identified as the most important driver in encouraging environmentally friendly practices among the top five drivers. SME companies need to find a balance between production performance and meeting sustainability requirements. Understanding the barriers and drivers of Malaysian F&B SMEs will enable practitioners to make well-informed decisions regarding GSCM implementation, ultimately enhancing the performance of the F&B industry and ensuring a sustainable food supply.

Key-Words: - Small and Medium Enterprises (SMEs); Green Supply Chain Management (GSCM); Food and Beverage (F&B); practices; drivers; barriers; information sharing; green manufacturing.

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1 Introduction

Green supply chain (GSC) procedures incorporate sustainability principles into conventional supply chain management (SCM) activities. This helps industries reduce their carbon emissions and waste while increasing profit, [1]. In their study, [2] noted that several manufacturing companies across the world have implemented green practices in their operations to enhance their environmental performance. Furthermore, minimizing the ecological effect of small and medium-sized enterprises (SMEs) in the manufacturing and

service sectors is critical to effectively green the economy, [3]. The Food and Beverage (F&B) sector, designated as a fast-growing business in Malaysia, is dominated by SMEs, [4]. Furthermore, in 2019, Malaysian SMEs provided 38.9% of total GDP, 48.4% of total employment, and 17.9% of total exports, [5]. According to [6], the F&B sector is extremely diverse and includes fishery products, cocoa and chocolate products, food ingredients, beverages, processed fruits and vegetables, cereal, and cereal products, confectionery, herbs and spices, and animal feed. This demonstrates how quickly the Malaysian F&B business is growing. As stated by [7], SMEs must embrace green supply chain management (GSCM) activities to improve the performance of their business processes. Although green practices improve a product's environmental performance, there are many obstacles to its implementation, particularly among Malaysian F&B companies. [8], identified the various obstacles that prevent Malaysian F&B SMEs from adopting GSCM; namely, the companies' perceptions of their impact on the environment as well as technological and organizational limitations. The recently issued Twelfth Malaysia Plan (2021-2025) has covenanted to achieve net-zero carbon emissions by 2050, outpacing even Singapore and Indonesia, [9]. As such, Malaysia urgently needs to develop and become environmentally sustainable to transition to a more ecologically friendly economy.

Many studies have been published in the literature where researchers have adopted GSCM. For example, [10], studied how the implementation of GSCM activities affected the performance of the Malaysian manufacturing industries, concerning the operational and environmental parameters. This included variables, such as the components of green procurement, returns on investment (ROI), eco-friendly designs and packaging, reverse logistics, and consumer cooperation as well as the environmental and operational performance of production. [11], examined the environmental effects of food and agricultural production in terms of climate change, deforestation, greenhouse gas (GHG) and carbon dioxide (CO_2) emissions, irrigation issues, soil degradation, pollutants, and waste production. Meanwhile, [12], examined the development of GSCM in the Malaysian food industry. Their results revealed that the introduction of GSCM would increase the costs associated with the acquisition of raw materials, inventories, production, and training, in addition to the costs that would occur owing to higher production lead times and the maintenance of on-time deliveries. However, businesses that adopt GSCM could significantly benefit from increased profits, ROI, and sales.

In their study, [13], investigated the Iranian food businesses and assessed the implementation of sustainability-linked SCM methodologies and their effect on the business performance. The findings indicated that sustainable SCM methods affect the environmental, economic, and social dimensions of Iranian food businesses in terms of their sustainability. [14], on the other hand, found that the greening of supply chains has become the primary topic of discussion for businesses. Manufacturers are motivated to develop and implement green initiatives as customers, governments, and multinational companies have become increasingly ecologically conscious. Despite the wealth of literature on GSCM implementation, only a handful of empirical studies have attempted to identify the barriers and drivers of GSCM implementation among Malaysian F&B SMEs. Therefore, the objectives of this study were to identify the barriers that hinder the implementation of GSCM in the F&B industry; and to identify the drivers affecting the company's adoption of GSCM initiatives. This study provides a foundation for academics, industry practitioners (especially those in the food and beverage SMEs), policymakers, and lawmakers to implement GSCM practices for a sustainable and safe environment. By incorporating input and views from industry experts gathered through interview sessions, it is hoped that a robust framework can be created in the future to promote the adoption of GSCM practices and help businesses achieve their sustainability goals.

2 Literature Review and Theories

The GSCM technology was established as a framework that integrates sustainability factors and environmental thinking into the upstream and downstream processes along the supply chain in response to the increasing global environmental consciousness, [15]. GSCM is defined as the integration of environmental thinking into SCM, which includes product design, manufacturing techniques, material sourcing and selection, final product distribution to customers, and end-of-life management of the products after their application. Sustainability-related issues are attracting more business interest. Studies from several fields demonstrate that supply chain "greening" has emerged as a prominent trend. In their study, [16] noted that GSCM highlighted the environmental

issues related to SCM in the upstream and downstream business operations. GSCM is a process that uses eco-friendly inputs to generate outputs that can be recovered and reused at the end of their life cycles, [17], which results in a sustainable supply chain (SSC).

In addition, various definitions regarding the green supply chain (GSC) have been presented in the literature. A few of the researchers have stated that GSCM is a closed-loop supply chain, while others define it as an SSC, an ethical supply chain, or an environmental supply chain. [18], assert that GSCM has evolved from SCM. Researchers have even termed these behaviours as 'socially conscious supply chains', [19]. Conventional SCM activities focus primarily on acquiring a final product and do not include the externalities regarding the production or delivery processes, [20]. Several beneficial traditional supply chain systems, such as life-cycle analysis, environmental design, total quality environmental management, and International Organization for Standardization (ISO) 14000 standards play a vital role in deriving competitive advantages, [21]. Thus, greening the supply chain entails taking a systematic approach to select suppliers whose products or services are more sustainable compared to their rivals, as well as whose own green practices are more sustainable. [22], observed how the green supply chain not only incorporates the processes of manufacturing and delivery to customers but also ranges from the time when the product is designed to the time it is discarded.

GSCM was established by incorporating eco-friendly and SCM practices, [23]. The goal of GSCM is to increase the number of positive outputs, such as sales, while decreasing the number of negative inputs and outputs, like raw material consumption, energy consumption, capital investment, and waste. GSCM includes six primary green processes, i.e., sourcing, warehousing, processing, packaging, distribution, and transportation, [24].

The adoption of GSCM practices has evolved into a critical component for enterprises, and GSCM has emerged to be a key and necessary driver for organizations. The important components of GSCM activities include reuse, recycling, remanufacturing, and reverse logistics, [18]. Several studies have been conducted to investigate the greening of supply chains in different circumstances, such as process design, product design, manufacturing practices, procurement, and an extensive combination of these factors, [25]. The widespread use of pesticides, food processing, packing, and the transportation of imported products are the primary contributors to the non-sustainable food production process, i.e., along the entire food chain, [26]. As a result, turning green enhances profitability, benefits the environment, lowers production and operation costs, and boosts brand awareness and consumer loyalty. Recent developments in F&B production have negatively affected the environment due to excessive resource use, pollution, and waste generation. Today, most businesses must incorporate or at least evaluate eco-friendly energy practices and resources in their manufacturing operations, [27].

However, GSCM implementation necessitates total integration and participation of all stakeholders across the product life cycle. The traditional supply chain can be classified into five sections: raw materials, distribution, industry, consumer, and waste. Each step in the supply chain can cause pollution, waste, and other environmental problems. Organisations, however, can exert pressure on their suppliers to use greener products and methods, [28]. GSCM refers to conventional SCM practices that incorporate environmental criteria or considerations into organizational procurement choices and long-term supplier relationships. A GSC tries to preserve the wastes within the industrial system to save energy and prevent the release of hazardous pollutants into the environment.

2.1 Green Supply Chain Management (GSCM) practices by Small- and Medium-sized Enterprises (SMEs)

Malaysia's F&B industry has been characterized as a rapidly expanding market and a major contributor to the national economy. This industry is dominated by SMEs, [6]. However, food production is regarded as an important worldwide environmental issue, as it has resulted in climate change, eutrophication, acid rain, and decreased biodiversity. Food production depletes other resources such as nutrients, land area, energy, and water, [29]. According to [30], food production can significantly contribute to GHG emissions within the food system owing to related refrigeration procedures, major energy usage, food distribution, and unsustainable agriculture processes. The manufacturing sector is a significant generator of GHGs and has been under intense pressure to reduce its environmental effects. GHG emissions from the manufacturing sector emphasize resource exploitation, waste, excessive energy and water usage, and pollution.

GSCM activities are regarded as a vital component of company policy and are a major strategic feature that can improve business organizations. [31], stated that GSCM has garnered a lot of interest among academicians and businesses in the past few years. Several researchers have highlighted the importance of developing GSCM strategies, drivers, and practices from an organizational standpoint. For example, [20], observed that GSCM strategies improved the operational performance in the Indian manufacturing industry by categorizing them into four dimensions; non-members of the supply chain, upstream supply chain members, downstream supply chain members, and supply chain organizational members. [32], investigated GSCM methodologies for selecting business functions and activities in Taiwan's electronics industry. Furthermore, [33], investigated green activities linked to GSCM practices among computer component producers in Thailand, including assessing GSCM performance and investigating GSCM pressures or drivers.

[34], examined GSCM adoption by SMEs in the wood furniture industry and discovered that three regions in the Central Jaya Province of Indonesia had moderate levels of adoption. According to [35], external and internal obstacles affect the implementation of reverse logistics by companies in the Malaysian food industry. Furthermore, many studies have examined the practices, effects, and impacts of GSCM in F&B companies; namely a New Zealand study by [36], a Kenyan study by [37], as well as [38] and a British study by [39].

[40], developed a conceptual framework for successfully implementing GSCM activities in construction organizations. This included five strategies for improving GSCM practices in such businesses, including top management commitment, changes in existing policies and technologies, increased awareness of environmental issues, training and education, adoption of efficient materials, and waste management systems. The key goals of GSCM are to reduce environmental contamination from upstream to downstream processes while acquiring raw materials, producing, distributing, and selling products, and managing product depreciation, [41]. Not all food manufacturers have effectively implemented GSCM practices due to the different obstacles hindering the implementation process. Therefore, the authors of this study believed that it was necessary to identify the drivers and challenges of GSCM practices in SMEs to steer the adoption of such practices, particularly in Malaysia. [17], assert that numerous obstacles make it difficult to adopt and apply green business practices. Therefore, this study focused on SMEs due to their key role in the economic expansion and development of Malaysia.

3 Research Design

A qualitative method was used to collect the data required for this present study. Two respondents were selected from each of the five F&B-related companies to understand and explore their current extent of GSCM adoption (Table 1).

Table 1. Interview respondents

Company	Type of company	Respondent's designation	Respondent's work experience (Years)
A	Cooking oil packaging and distribution	P1 Operations Manager	10
		P2 Senior Executive	8
B	Chicken, fish, and beef floss (*serunding*) production	P3 Production Manager	11
		P4 Assistant Manager	8
C	Instant flour mill for cakes and cookies	P5 Production Manager	13
		P6 Assistant Manager	8
D	Processed and canned food production, e.g. canned sardines	P7 Managing Director	15
		P8 Assistant Manager	10
E	Fresh noodle production, e.g. yellow and rice noodles	P9 Managing Director	14
		P10 Logistics Manager	8

Based on the results of the questionnaire, in-depth interviews were then conducted with two respondents, who were either in senior management positions or in charge of F&B production, at each of these five companies. The selected respondents worked for diverse F&B companies in Malaysia; namely, cooking oil packaging and distribution; an instant flour mill for cakes and cookies; chicken, fish, and beef floss (*serunding*) production; processed and canned food production; and fresh noodle production. The types of F&B SME

companies were randomly selected from the Malaysian states of Kelantan and Terengganu. This study used a semi-structured interview format, wherein the general direction of questioning was predetermined, but the interviewer was free to ask additional questions to gather detailed information about a specific answer or to investigate new but pertinent issues arising from a particular answer, [42].

Table 2. Every step of the thematic analysis process

Step	Description
1. Data familiarisation	The data is transcribed then read and re-read with initial thoughts noted.
2. Preliminary code generation	The notable features of the data are coded before data connected to the codes is collated.
3. Pattern or theme identification	The potential themes may yield codes, which are collected and examined to determine if the themes effectively correlate to the coded extracts and generate a thematic analysis map.
4. Theme review	The themes are examined, and a thematic map is generated.
5. Theme defining and naming	The specifics of each theme and the predominant message of the study are continuously analyzed and refined. The basic meanings and names of all the themes are established.
6. Reports/manuscript production	A final analysis is conducted to produce an academic report.

Source: [43]

Even though the researchers developed a list of topics and questions that would be addressed in the interviews, they changed from one interview to the other. The sequence of the questions was determined by the flow of the conversation and topics discussed, which differed from interview to interview. The following questions were generated for the interviews:

1. Which GSCM practices have you adopted?
2. What are the major barriers faced during GSCM implementation?
3. What are the main drivers of GSCM adoption in your company?

The purpose of a thematic analysis is to identify themes and patterns in interview data. As seen in Table 2, this involves six steps, [43]. A thematic analysis was conducted to examine the transcripts using ATLAS. ti version 10.

4 Findings and Discussions

The interviews took place between June 2022 and May 2023. Thematic analysis was used to examine the GSCM practices implemented by F&B SMEs. The next step was to determine the key obstacles to GSCM implementation, and the last step was to determine the primary factors influencing GSCM practices based on feedback from respondents or subject-matter experts.

This section provides the results of in-depth interviews of the five F&B SMEs participating in this present study in terms of the three research questions.

Company A

Company A is a packager and distributor of cooking oil, sugar, and flour that has been operating for 15 years and has 70 employees. It also produces its brand of packaging and distributes it to retailers and consumers around Kelantan. The company does not produce its cooking oil but obtains it from a main cooking oil factory and then rebrands it as its own before packaging it and distributing it to retailers, wholesalers, and customers.

Respondent *P1* stated that Company A does not have a system or guideline to implement green practices among their employees nor is there a shared vision or mission to transition to environmentally friendly practices. However, the company does adopt common environmentally friendly practices, such as recycling used paper boxes. Based on respondent *P2*, the paper boxes used to package the cooking oil packs are reused to eliminate waste while damaged boxes are sent to a recycling center. It also ensures that the least amount of cooking oil is spilled during the tank-to-plastic oil pack transfer, with approximately only five percent of cooking oil wasted while setting the transfer machine. According to respondent *P1*, Company A trucks use the shortest routes to deliver their goods to decrease air pollution and save fuel. Respondent *P1* also opined that a vehicle with a high-powered engine, such as a truck; is necessary to load and transport their goods. Therefore, stakeholders, such as the government and other

relevant agencies; must provide alternative vehicles that can yield a commensurate amount of loading and transportation power as trucks to replace diesel fuel vehicles and overcome air pollution. These vehicles may be powered by renewable energy, such as solar energy, which is environmentally friendly and more effective.

Manufacturing is one of the sectors that can benefit significantly from solar energy. It has been suggested that businesses of all sizes and in almost every sector need to take tangible steps to install solar systems to reduce their energy costs. Respondent *P2* believed that large businesses are more likely to use solar systems. [44], stated that some of the most well-known manufacturers that use solar energy include General Motors, L'Oreal, and Johnson & Johnson. In Malaysia, the national automobile manufacturer, Proton Holdings Bhd, launched a solar power initiative at its Tanjung Malim refinery plant, which could potentially decrease its electricity bill by RM4.39 million a year. The initiative will also help the national train manufacturer, Malayan Railways Limited (KTMB), decrease their annual CO_2 emissions by 11536 tons, [45]. Apart from that, Goodyear Malaysia is the first in the Asia Pacific region to install 6680 solar panels at its production plant, to decrease its annual CO_2 emissions in line with its global mission of protecting the environment, [46].

As per respondent *P2*, the government encourages all companies to embrace green practices. However, this information is primarily targeted at large companies and does not sufficiently reach SMEs. Many SMEs cannot afford to invest in solar systems and, as a result, may not benefit from cost savings on electricity, leading to high electricity bills. For instance, if Company A does not transition to solar power, its electricity bills will remain high. Moreover, government incentives do not adequately support SMEs if substantial capital is needed to retrofit a building for solar equipment.

Although respondent *P1* acknowledged that solar systems yield long-term electricity savings, solar systems only have a 15-year lifespan, after which they become less efficient and effective. Therefore, stakeholders, especially the government, need to play a more pivotal role as renewable energy can save electricity and emit little to no GHGs, and this needs to be strengthened at all levels of a company.

Respondent *P1* stated that the government needs to incentivize not only large companies but small companies as well. Employers should also send their employees to government-backed green programs, seminars, and workshops. At present, there is a lack of green workshops for SMEs. Such workshops would encourage employers to send their employees to learn about green practices.

Company A does not have an ISO certificate but is recognized under the "Industrial Responsibility Safe Food Certification Scheme (MeSTI). It can be challenging for people to adopt green practices because our current way of living has become a habit, and plastics are widely used in everyday products. In addition, implementing green practices can be costly. Moreover, there are only a few recycling centers, and most of them are in remote areas. At times, it's even difficult to sell damaged paper boxes (respondent *P1*). Therefore, the government needs to create a clear standard operating procedure on how and where to distribute or dispose of recyclable items. For example, will a representative of the recycling center come and collect the recyclable items from the company or does the company have to deliver the recyclable items to the center? Another challenge is the lack of information shared with communities to practice recycling from the early stages. This includes providing them with a basic understanding to adopt more environmentally friendly practices (respondent *P2*). Malaysia needs to set Japan's development of green technologies as the benchmark, [47]. Lastly, the government should strengthen policies for SMEs and explore better methods to incentivize the community to cooperate with the industry.

Company B

Company B has 15 employees and produces different of flavors of meat floss made of local and imported beef, fish, and chicken. Founded in 1985, it is one of the most famous meat floss companies in Kampung Laut, Kelantan. Its products are distributed throughout Malaysia as well as shipped to overseas customers. In its 40 years of operations, it has developed a loyal customer base.

Company B produces a significant amount of meat floss daily. Demand is exceptionally high during festive seasons as meat floss is commonly served during these periods. Respondent *P4* mentioned that demand for meat floss increases according to the season, for example, during school holidays. Company B also prioritises the quality and authentic taste of its meat floss. It uses fresh raw materials every day and does not carry old stock. Respondent *P3* states that Company B requires 300 kilograms (kg) of beef, 70 kg of fish, and 48 kg of chicken daily to meet customer demands. As the meat floss that it produces is high

quality, it expires only 6 to 12 months after it is manufactured. This makes it ideal for customers who travel abroad. The meat floss should also be stored at room temperature as refrigeration will change its taste.

Respondent *P3* viewed that, Company B uses a gas stove instead of a wood stove, which is the traditional method of cooking floss. The transition from a wood to a gas stove has significantly altered the types of air pollutants that the company releases. For example, a gas stove produces significantly less smoke during combustion. Natural gas stoves, on the other hand, can emit carbon monoxide (CO), formaldehyde (CH_2 O), and other dangerous chemicals into the air, which might be toxic to humans and pets. The meat floss is cooked from 6.30 am to 1.00 pm daily as the special spicing process that is used to produce a more durable product is time-consuming. Although Company B does not have an ISO quality management certificate, it is monitored by the MoH under its MeSTI certification scheme. The MeSTI accreditation replaces the 1-Malaysia Food Safety Scheme (SK1M). The Food Safety Assurance Programme (PJKM) will be developed and implemented by food manufacturing facilities with the help of MeSTI certification before recognition is granted. Respondent *P4* mentioned that the standard does not relate to the packaging used but the transition from a wood to a gas stove, which produces less smoke. It also prioritizes the cleanliness of the toilets, floors, food storage areas, and drains as well as the use of exhaust fans and appropriate clothing in the processing area, the separation of the kitchen from the customer service and sales areas, and examining the methods used to handle goods and loads.

Respondent *P4* states that Company B uses plastic packaging as it is very difficult to avoid using it. Paper boxes are not only more expensive but ill-suited for this type of product as it is greasy while food-grade plastic is also expensive. Therefore, it is difficult to adopt green practices in terms of packaging as there are no effective alternatives to plastic and existing alternatives are costly. There are several challenges in terms of adopting green practices; namely cost and knowledge. Company B is unsure where or when to start implementing green practices. It is also difficult to encourage the community to accept green practices, such as using less plastic.

Respondent *P3* observed that plastic packaging produces a lot of waste as it cannot be recycled. Even paper boxes containing food must be wrapped in plastic and vacuum-sealed to prevent air from entering. As such, many SMEs use plastics to save on packaging costs and the environment. Hopefully, in the future, there will be other, more effective alternatives to plastic. Small and medium-sized enterprises (SMEs) value government recommendations, but face challenges in meeting the associated resource and guideline requirements.

As most SMEs lack knowledge of green packaging, if the government conducts green workshops, SMEs will possess more knowledge about material management and the types of environmentally friendly packaging. Respondent *P4* states that there is a lack of information about the packaging materials that other companies in the industry use, indicating a lack of knowledge transfer. "A small company like ours does not have standardized materials for packaging, so we must find it ourselves. Overall, it can be concluded that information about green packaging has not yet fully reached SMEs, especially small enterprises" (respondent *P3*).

Online businesses, typically, deliver their products by post or customers can visit the physical store to pick up their products. This decreases the movement of company-owned vehicles. Company B also reuses the boxes that it uses to package its goods to avoid waste. They posit that the government needs to play an important role and work with the industry to further improve green practices. Employees at SMEs also need to possess knowledge and awareness about green practices. Therefore, employers should send their employees to reasonably priced green programs that are organized by the relevant agencies.

Company C

With 40 employees, Company C is a factory that has been producing and supplying its instant premix flours for cakes, biscuits, desserts, and toppings as well as instant decoration materials to wholesalers and retailers since 2010. It also produces and sells its own, retail, and wholesale cakes, cookies, bread, pastries, desserts, frozen foods, western foods, snacks, and chips.

Respondent *P5* mentioned that most of their customers are in the Kelantanese districts of Bachok and Kota Bharu but the business has started to expand elsewhere by going online. Company C does not have a specific mission or vision to introduce green or environmental values to its employees. Therefore, most of its production and shop floor employees are unaware of the company's green practices. However, Company C indirectly has green practices as it sells its boxes, which are made of raw materials or original wheat; to agents

for use by other parties to decrease the amount of waste that it produces. Company C acknowledges that green practices are very important, however, the starting costs are high. At present, it is required to comply with the MeSTI standards, which only require it to manage boxes and plastic products that it throws away or recycles.

Company C has not yet focused on sustainable packaging as their wheat supplier uses plastic packaging that is discarded as waste. Other than that, their power consumption is not high, and their workers manually sieve the flour before packaging it in food-grade plastic. The company does not have the facilities required to handle this plastic waste. As mentioned by respondent P6, Company C finds it challenging to adopt green practices and comply with MeSTI standards due to the influence of customer preferences. For instance, in 2013, the company switched from plastic bottles to glass. However, this change was met with dissatisfaction from customers and was financially burdensome for the company. Company C has not yet developed a plan to collect and reuse the glass bottles due to the time-consuming nature of washing them, and suppliers do not buy back the used bottles. Consequently, the company reverted to using regular plastic bottles and has not invested in biodegradable plastic due to its high cost. Biologically synthesized plastics, also known as bioplastics or biobased plastics, are defined as plastic materials that are derived from natural sources, such as plants, animals, or microbes.

Respondent *P5* believes that the government has not yet offered an alternative to plastic. Respondent *P6* also suggests that the government should increase the use of biodegradable plastics to make them more cost-effective. The current study found that the main issue at SMEs is the use of plastic packaging, particularly in the food industry. Even though Company C aims to enhance its packaging, it lacks knowledge of eco-friendly practices.

Respondent *P5* stated that the Ministry of Health (MoH) only visits its premises to inspect its hygiene, particularly regarding the separation of its flour and cake-making processes. The kitchen sink must be thoroughly clean, including the bottom of the sink. Therefore, they need to make regular improvements and clean it daily. In addition, they need to switch from glass light bulbs to plastic ones to comply with MeSTI standards. Company C has also installed an exhaust fan to manage flour dust and uses separate rooms for each process. The government has yet to provide SMEs with green management workshops and programs nor have they fully enforced green practices. According to respondent *P6*, "The advice of a green practice expert is needed in terms of packaging. The top management also plays an important role in encouraging employees to adopt green practices."

Company D

Company D is a major canned food manufacturer on the Malaysian east coast. Company D has proven to be the highest-quality canned food producer since its inception in 1972. Company D, which operates on its premises, has sufficient equipment to produce a wide range of quality canned food products like chicken curry, sardine fish in tomato sauce, sambal bilis, beef curry, goat curry, catfish, etc. For nearly 20 years, the Malaysian government has designated Company D as the sole supplier of sardines to all government agencies in Peninsular Malaysia. Company D is registered with the Islamic Development Department of Malaysia and Moody International, which received the Halal, HACCP (Hazard analysis and critical control points), and ISO 9001:2015 certifications, as a measure of quality assurance. Company D employs 70 workers, including management and operations personnel.

This company's mission and vision are to be the market leader in the manufacturing of packaged halal food products in Malaysia; to produce a variety of high-quality packaged food products that fulfill international standards and are profitable; to establish a global market, to diversify the market segments; and to provide strong teamwork in the fields of quality control, production, research, and development (R&D), and marketing. Although it does not specifically state that its mission is to implement green practices among its employees, it indirectly implements green practices to minimize the amount of waste that it produces by adopting recycling. Respondent *P7* stated that Company D's use of metal cans and plastic for food packaging does not fully encourage green practices. Metal cans are easily dented by falls or impacts, most of which occur in the early and final stages of production, resulting in an estimated five percent of waste. These metal cans are sold to recycling agents.

Company D's top management intends to switch to renewable solar energy to become more environmentally friendly and save electricity. The government subsidises half the cost of solar construction while the company pays the rest. According to respondent *P8*, although solar constructions cost upwards of hundreds of thousands, it is a worthwhile 3- to 5-year

investment if a building is strategically located and has a large roof. Therefore, one of the first major obstacles to overcome is the location of the building, which requires major, and often costly, renovations to improve existing buildings. The frozen fish that Company D receives pre-cut fish from its supplier, comes in 7 to 8-cm and 9 to 11-cm sizes to avoid the use of human hands. They ensure that nothing goes to waste during the production of tinned sardines, as any excess fish is crushed to make laksa sauce, which is then sold to customers at a more affordable price. However, the company does not treat the effluent used for cleaning their machines and for steaming, which leads to waste.

Company E

Company E was established in 1986 and has 20 employees. As it is the only noodle-based food manufacturer and receives good feedback from various parties, its business is growing. Company E started as a small noodle business and grew by diversifying its products to include chili paste, vermicelli, fine salt, coarse salt, and fish balls.

Respondent *P9* mentioned that Company E does not have a specific policy mission and vision for its employees. However, the company prioritizes cleanliness to ensure that its noodles and other products last a long time. Its noodle products are produced without any chemical preservatives. Respondent *P10* stated, "The amount of waste produced largely depends on the packaging machine. If the machine malfunctions, it either leaks or does not stick during the packaging process, and the noodles fall on another machine. When this happens, approximately 3kg of noodles per day are considered waste and given to chicken farmers. We do not produce much plastic waste, only around 100 pieces per month, while our used boxes are sent to a recycling center." However, the company's plastic waste is discarded as it usually cannot be recycled or reused. Noodle production requires a large volume of clean water every day. This effluent is dumped into a ditch before it eventually flows into a river. The company does not have a wastewater treatment process to enhance water security, sustainability, and resilience" (respondent *P9*).

Respondent *P10* believed that the company plans to switch to solar energy in the future. Although solar construction is expensive, the government provides incentives for solar construction. For example, if the solar construction costs RM200,000 the company need only pay half of the cost while the rest is paid for by the government. However, solar construction requires a larger area. Company E's building cannot be renovated now as this would require production to stop. The company also plans to switch to gas instead of diesel to emit cleaner emissions. Respondent *P9* stated that its stakeholders require alternatives to replace the current plastic packages that they use with safer materials. The obstacle to adopting green practices is the high cost. If SMEs receive government incentives, it will decrease their financial burden. Furthermore, not all SMEs are given knowledge about green practices, such as government incentives and green programs. Most SMEs are only informed of MeSTI's standards, which only pertain to hygiene (respondent *P10*).

5 Barriers to Implementing GSCM in F&B SMEs

A GSC includes practices, policies, and tools which can be implemented by the organization in the context of a sustainable environment, [48]. Environmental issues have become a global concern as the environment has declined, [49]. This section provides the outcome of these interview sessions, which have been analyzed through thematic analysis regarding the barriers to GSCM implementation from a Malaysian view. Then, the drivers or strategies have been outlined in the next section (Table 4). The results were presented by the percentage of responses for each question supported by quotes from respective participants.

The findings of this present study found the main barriers to implementing green practices are as follows; green technologies, knowledge and information sharing, cost and financial assistance, managerial engagement and leadership, and involvement and support (Table 3). In the context of barriers, this study also determines the extent to which green practices have been implemented in F&B SMEs.

Green technologies encompass a wide range of innovative methods aimed at making everyday life more environmentally friendly and preserving the world's natural resources. Approximately 80 percent of the respondents (*P1, P2, P4, P5, P8, P9, P10*) agreed that green technologies have become important in food production as they significantly reduce environmental impacts. Biofuels, eco-forestry, renewables, and solid waste management are examples of the diverse fields in which green technologies can be employed, [50]. According to

[51], the Malaysian government has allocated a budget to finance green technology schemes for both entrepreneurs and industrial companies to enhance innovation and green forms of technology. Respondents *P2, P5, P8,* and *P9* agree that, although the government encourages green practices, it is not widely practiced by SMEs as only mega industries can afford to adopt solar energy. Respondents *P8* and *P10* supported that, solar systems provide long-term savings as they significantly decrease electricity consumption.

Table 3. Summarises the barriers of GSCM.

	Barriers	Number of respondents who agree with this statement	Percentage (%)
1.	Green technologies (e.g; solar energy)	8/10 x 100	80
2.	Knowledge and information sharing	10/10 x 100	100
3.	Cost and financial assistance	8/10 x 100	90
4.	Managerial engagement and leadership	7/10 x 100	70
5.	Involvement and support	8/10 x 100	80

Therefore, the government needs to play a more active role. [52], similarly, asserts that GSCM implementation is often hindered by a lack of technological processes, applications, resources, and expertise as well as a fear of failure as GSCM practices are complex to design. Furthermore, failure on the part of companies to keep abreast with the latest GSCM technologies can cause them to lose their competitive advantage as green practices have dramatically risen in importance, [8]. Given the rapid rate of technological advancement, this obstacle is only likely to become more significant over time, [53].

Knowledge and information sharing were also found to be an important factor in the implementation of GSCM at SMEs (agreed by 100 percent of the respondents). [54], examined Ukrainian manufacturing companies, and found that a lack of knowledge and experience was the 7th of 16 barriers to GSCM implementation, with cost being the leading barrier. [55], similarly, found that a lack of knowledge and information was a significant obstacle in the implementation of GSCM at F&B manufacturing companies. Respondent *P1* viewed that, it was difficult to sell their recycled boxes as not all recycling centers accept such recycled items. Therefore, it is very important to centralize the locations for reverse logistics, especially in Kelantan. Apart from that, SMEs do not fully understand the standard operating procedures or flow of information regarding the recycling of materials. According to respondents *P1, P3, P5, P7,* and *P10*, the company did not receive all the necessary information about how or where to channel their goods for recycling and no specialised companies came to collect these goods from their factory. Therefore, there is no clear information on how to manage these items.

Furthermore, information and knowledge on green practices have not fully reached many stakeholders, including the community, making it very difficult for F&B SMEs to implement green practices from the beginning. A lack of information sharing among senior managers has been shown to decrease company confidence in implementing green initiatives, [56]. According to respondent *P6*, the company's current level of green knowledge or information is insufficient to decrease its environmental impacts. The respondent *P5* also expressed difficulty in obtaining accurate information on green initiatives and GSCM practices. Although this information can easily be found online, the internet also contains a lot of fake information, which decreases organisational confidence in implementing green practices, [57]. The lack of information sharing among firms and suppliers is also a significant barrier, [58].

Apart from green technologies, knowledge, and information sharing**; cost and financial assistance** are other important factors in the implementation of GSCM at F&B SMEs. 90 percent of the respondents viewed financial assistance as significant barrier for companies to implement GSCM.

Many SMEs believe that grants, loans, and tax concessions would encourage them to implement green practices, [59]. In recent years, finance companies, government agencies such as the Malaysian Green Technology Corporation (MGTC), and other stakeholders have collaborated to invest in GSCM and other green innovations. [59] also demonstrated that implementation cost is one of the biggest challenges of implementing GSCM in the leather product industry. The Malaysian government aims to decrease the

country's carbon emissions by 45 percent by 2030. As such, it has encouraged investing in green technology industries as well as the implementation of green technologies in the private sector by providing various incentives. Monetary assistance from governmental and financial institutions has been a key measure in the growth of green technology. For example, as part of its Economic Transformation Programme, the Malaysian government developed GreenTech Malaysia which provides new green projects with a financing mechanism and the support of participating financial institutions. The Green Technology Financing Scheme (GTFS), which was launched in 2018, was extended to 2022 with an additional RM5 billion allocated to its second phase, GTFS 2.0, [60]. However, based on respondents *P1, P3, P6, P8,* and *P10,* the information and offers of government incentives were not disseminated to all SMEs. Furthermore, these policies are not yet robust and need to focus on SMEs, especially in the food production sector. Respondents *P8* and *P10* reported that the government offered to subsidize 50 percent of the cost of constructing a solar system for his company. However, the company needed to pay the remaining 50 percent and the building would need to be renovated to install the solar system, which would incur additional costs. Therefore, the government and/or stakeholders should review the overall situation of such cases, particularly those involving SMEs.

Managerial engagement and leadership (agreed by 70 percent of the respondents) can influence the efficacy of adopting GSCM practices, [8]. Engaging leadership involves behaviors that support, strengthen, connect, and motivate employees to enhance their work engagement. Organisational barriers can take on several forms, ranging from physical barriers to individual and group attitudes, [61]. Respondents *P5* and *P8* mentioned that a lack of resources limited their companies' ability to implement GSCM. Furthermore, most F&B SMEs do not have corporate social responsibility for green practices and the environment. This present study found a general lack of concern about recycling and sustainability in the manufacturing industry. Thus, managerial engagement would encourage the adoption of green initiatives and GSCM, [58]. Respondent *P4* expressed hope that the government and stakeholders would be open to organizing workshops, programs, or seminars on green practices. It is believed that management teams would strongly support such programs as they lack specific knowledge of GSCM, which is still lacking among F&B SMEs.

Lastly, the present study has found that **involvement and support** are also significant barriers to the implementation of GSCM, as agreed upon by 80 percent of the respondents. Respondents *P2, P3,* and *P5* indicated that a lack of senior managerial involvement in GSCM practices results in a lack of exposure to these practices among employees. Therefore, the commitment, guidance, and support of the top management are crucial for GSCM to succeed as a company [16], [58]. It is well known that the resistance of a company's culture to change is a prominent hindrance to environmental advancement, [55]. If the senior managers fail to actively motivate their employees to implement green practices, the latter will not be encouraged to effectively implement them. According to respondent *P6*, one factor in the successful implementation of green practices is employee understanding and awareness of green issues. As many companies lack the resources to educate their employees, the government and/or stakeholders must encourage F&B SMEs to transition towards green practices. Hence, by understanding the barriers faced by Malaysian F&B SMEs, practitioners can make effective decisions about implementing GSCM. This, in turn, can enhance the performance of the F&B industry and ensure the sustainability of the food supply. Additionally, this study also offers GSCM drivers for environmental sustainability in F&B SMEs.

6 Drivers to Implementing GSCM in F&B SMEs

Based on interview analysis, this section discusses the main drivers for implementing green practices. These include the selection and collaboration of green suppliers, green manufacturing, sustainable transportation, sustainable packaging, and the role of organizations and governments in encouraging reverse logistics (Table 4).

The calculation of the response rate was based on the response given by each respondent for each question and will be summarized as follows:

Table 4. Summarises the drivers of GSCM in F&B SMEs.

	Drivers	Number of respondents who agree with this statement	Percentage (%)
1.	Selection and collaboration of green suppliers	8/10 x 100	80
2.	Green Manufacturing	10/10 x 100	100
3.	Sustainable transportation	8/10 x 100	80
4.	Sustainable packaging	7/10 x 100	70
5.	Food manufacturers and government roles to encourage reverse logistics	8/10 x 100	70

Selection and collaboration of green suppliers

About 80 percent of the respondents agreed that selecting and collaborating with green suppliers is crucial for sustainable food products. The company's performance depends on supplier cooperation in environmental efforts (respondent *P5*). Furthermore, [62], mentioned that the supplier selection procedure needs to be used to select suppliers who aim to protect the environment and concentrate on sustainability-related concerns. The selection of green suppliers can improve the performance of firms by providing a competitive edge in addition to traditional economic benefits [63]. [64], confirmed that some of the green indicators for supplier evaluation were frequently associated with the level of wastewater release, solid waste reuse, CO_2 emissions, and usage of hazardous materials. [65], viewed that green procurement is the practice of collaborating with suppliers to generate ecologically sustainable products. The green supplier selection criteria (GSSC) were evolved owing to the organization's desire to address the existing trends in the environmental problems related to business management and procedures, [66]. [62], mentioned that the supplier selection procedure needs to be used to select suppliers who aim to protect the environment and concentrate on sustainability-related concerns. As stated by [63], the selection of green suppliers can improve the performance of firms by providing a competitive edge in addition to traditional economic benefits.

Respondents *P2, P3, P5, P7,* and *P10* claimed that most of manufacturers do not collaborate with their suppliers for sustainable sourcing. They also lack exposure to green suppliers or know how to evaluate and select green suppliers. For example, Company B only deals directly with its suppliers to obtain raw beef, chicken, and fish, while Company D only obtains frozen fish to produce tinned sardines from its suppliers. Company A, similarly, only obtains final products, such as oil, sugar, and wheat flour; from its suppliers in bulk and packages them before distributing them to customers. It does not examine the raw materials used in the production of these final products. Therefore, selecting green suppliers would offer several benefits to SMEs and large corporations, such as waste generation, decreasing harmful emissions, and the use of natural resources, which could further improve the air and water quality, and prevent pollution by energy or water-saving non-toxic products, supplying or decreasing carbon emissions, and generating recycled products. Therefore, in the future, companies should be given full disclosure of the procurement processes of green suppliers.

Green Manufacturing

Green manufacturing refers to creative production processes that strive to reduce negative environmental consequences through waste recycling, waste reduction, better use of natural resources, and other linked techniques, [67]**.** It was noted that using a life cycle strategy for design and production is critical for avoiding social, environmental, and economic consequences, [48]. Food processing, according to [68], includes one or more operations such as sorting, cleaning, washing, peeling, and freezing. Food processing can lead to food wastage, environmental issues, nutrient loss, and a decrease in the concentration of active chemicals. Therefore, about 100 percent of the respondents agreed that green manufacturing is a vital driver of the green supply chain since nearly 90 percent of product waste is generated before the actual product reaches the consumer.

Company D, which produces fish-based products, successfully decreases the amount of waste that it produces by using its excess raw materials to produce other fish-based products. Therefore, Company D practices green manufacturing to some extent (respondent *P8*). Company A also produces minimal waste, which only occurs when setting the machine to repackage cooking oil. It also returns damaged sugar products to the supplier or manufacturer for reprocessing. Meanwhile, Company B produces its products based on customer demand. As such, it does not

produce any waste or excess products during production (respondent *P3*).

Based on the results of this study, Companies A to E do not recycle or reuse water, since they believe that used water is not appropriate for reuse and requires expensive water treatment. - Owing to the significant increase in demand for water, those in the food business must consider a more logical and sustainable use of this scarce natural resource, [69]. As a result of climate change and environmental deterioration, future normal practices in the food sector that are currently taken for granted may be severely impacted by increased water scarcity. This is because a significant quantity of water is needed for cleaning and sanitation operations implemented for daily personal or food processing activities. Respondents *P4* and *P6* supported that, many operational practices in the food sector require the usage of water. For instance, staff members must maintain high standards of personal hygiene, such as sanitation, hand washing, showering, laundering, and disinfecting shoes. At the end of a production batch, all equipment and facilities must be cleaned and sanitized. Many of the practices would necessitate the use of water. However, it is imperative to establish practices that consider alternative food processing techniques that advocate the reuse and recycling of water. To encourage water recycling and reuse, industries, policymakers, and consumers need to collaborate (respondents *P1, P3,* and *P7*).

Concerning energy usage, most businesses continue to use non-renewable forms of energy and emit significant carbon levels into the environment, which can lead to pollution and affect public health. For instance, Company B still employs gas stoves to heat or cook food, where gas burners are placed in the bottom half of the cavity (respondent *P3*). The heat generated from burning petrol enables the chemical reaction between nitrogen (N) and oxygen (O_2) molecules to yield nitric oxide (NO) and nitrogen dioxide (NO_2), known collectively as NOx, which could affect the lungs. Cooking with gas may also generate CO_2, particulates, and CH_2 O. All these chemicals negatively affect human health and harm the cardiovascular and respiratory systems, [70]. Furthermore, the gas stoves also emit methane (CH_4), which is a significant GHG that can lead to climate change, [71].

Respondents *P2, P7,* and *P9* affirmed that if electric energy were replaced using solar energy, it could help save significant levels of energy. The cooking and chilling phases associated with food preparation consume a lot of energy, [72]. However, the dairy and food processing industries rely heavily on conventional or non-renewable energy resources, resulting in pollution, GHG emissions, and global warming, [73]. To address this issue, renewable energy resources, particularly solar energy, may be regarded as the appropriate alternative as they can be used in many applications related to dairy and food processing operations such as steam generation, heating, lighting, cooling, transportation, drying, etc. It can be concluded that utilizing natural resources in green manufacturing can minimize the environmental impact of production processes.

Sustainable transportation

Green or sustainable transportation refers to meeting the transportation needs of today's society without harming the environment or hindering the mobility of future generations [74]. Approximately 80 percent of the respondents emphasized green transport as a driving force for environmental sustainability in F&B SMEs. Several nations and regions have designed tools, strategies, and action plans that focus on the decision-making process related to transportation issues to promote transportation sustainability [75]. [76], conducted many conversations regarding the implementation of eco-friendly logistical activities in supply chains and noted that goods transportation was a very prominent issue. "Green" transport refers to the use of practices and technology that try to reduce the negative environmental impacts of transport. Transport consumes the most energy; approximately 40 percent based on the European Union's annual statistics for the last two years; which is dominated by road transport, more than 80 percent, [48].

In terms of sustainable transportation, Company A delivers goods by trucks, using the lowest number of routes and reducing redundant distances covered by trucks to avoid congestion while also lowering the overall transportation costs, fuel expenses, and GHG emissions (respondents *P1* and *P2*). Respondents *P3* and *P5* agreed that the use of route optimization software such as Waze, GPS (Global Positioning System) technology, and telecommunication applications can contribute significantly to finding the shortest, fastest, or most efficient route.

Company B engages in e-commerce, sometimes known as online shopping (respondent *P3*). E-commerce is described as the sale or purchase of products or services over computer networks using methods specifically developed for

accepting or placing orders, while the delivery or payment of goods or services does not need to be done online, [77]. When compared to in-person buying, online shopping generates up to 2.9 times lower GHG emissions. This reduction is because e-commerce requires less land usage compared to traditional retail. E-commerce significantly reduces the need for parking lots, storage, and consumer automobile traffic, [78]. In terms of transportation, Companies A to E regularly use conventional fuel-based vehicles to deliver their products. Even if a company adopts green practices by choosing the shortest delivery route, carbon emissions still occur and pollute the environment if fuel-, petrol-, or diesel-based trucks are used (respondents *P5, P8,* and *P10*).

To minimize the negative impacts of business transportation and achieve environmental sustainability, one key factor would be the use of alternative fuel vehicles, also known as Electric Vehicles or EVs, [79]. Respondent *P10* supported the idea that electric vehicles can help businesses reduce their environmental impact while lowering operational expenses. Therefore, SMEs need to implement more green practices in terms of transportation.

Sustainable packaging

In the food industry, products require extra protection to prevent contamination and tampering and to extend their shelf life. Approximately 70 percent of the respondents (*P1, P2, P3, P5, P8, P9,* and *P10*) agreed that sustainable packaging is essential for reducing waste, conserving resources, protecting the environment, reducing emissions, supporting ethical responsibility, and enhancing brand value. Respondent *P2* viewed that, plastic is commonly used in food packaging due to its lightweight, resistance to physical and chemical effects, and inexpensive production costs.

Furthermore, one of the benefits of food packaging (plastics) is that it informs consumers about the shelf life, contents, and storage conditions of the food product, [80]. Food packaging also preserves food safety, increases the shelf life of food, and reduces food loss and waste, [81], [82], [83]. Despite these advantages, there are still concerns about the long-term effects of food packing on the environment (respondent *P9*). Extraction of raw packaging materials depletes natural resources and discharges additional GHG into the atmosphere. Plastics are most employed in the manufacture of packaging materials composed of polyethene terephthalate, polypropylene, polyethene, and polystyrene, [84]. These materials are derived from fossil fuels and are employed in food packaging, [85]. The degradation processes are affected by polymer chain length, additives or resulting radicals, temperature, and environmental composition.

Studies have shown that food packaging materials are responsible for many environmental problems, such as trash pollution both in the ocean and on land, overflowing landfills, and GHG emissions. The environmental issues regarding food packaging and its effects on the atmosphere are mostly focused on its disposal (respondents *P2* and *P7*). Plastics are versatile and affordable, which makes them a good choice for packaging. Nevertheless, most plastics are single-use, which, when paired with their low recycling or reuse ratios, significantly adds to environmental contamination, [86]. Plastics can interact negatively with the environment and human body because it is not biochemically inert. Some solutions were offered by [87] to address the worldwide concerns regarding food and plastic waste reduction, and end-of-life challenges of persistent materials. Production of microbial biodegradable polymers from agro-food waste residues appears to be a promising route to creating an inventive, resilient, and productive waste-based food packaging economy by separating the food packaging industry from fossil feedstocks and facilitating the return of nutrients to the soil.

This study demonstrates that SMEs have not completely overcome the waste issue associated with the use of plastic materials for food packaging among SMEs. As a result, initiatives to decrease plastic waste, such as recycling, are critical (respondents *P5* and *P8*). However, recycling plastic food packaging material is expensive and shows a higher carbon footprint since it requires pre-processing to get rid of food residues before recycling. It has been shown that virgin plastic is less expensive and can be easily acquired, [88]. Therefore, there is a need to find a novel alternative to replacing plastic food packaging material. Malaysia should strive for a closed-loop plastic waste recycling system centered around a circular economy model, wherein plastics are never discarded. This must be accompanied by financial investments to construct a green supply chain and develop a consistent waste management strategy, which involves the standardization of plastic production and recycling operations, [89].

Food manufacturers and government roles to encourage reverse logistics

Reverse logistics is the process of returning, exchanging, refurbishing, reselling, and disposing of goods. Customers return products for a variety of reasons, including end-of-life, expiration, product damage, product recall, poor quality, and non-halal products, [35].

The food industry has a significant environmental impact due to food waste and packaging material. Another major problem noted in the food industry is food packaging waste that is generated, which must be addressed by the producer to fulfill his societal and environmental responsibilities. As stated by [90], food waste sources can be broadly divided into three categories: food losses, which refer to food materials lost during the preparation, processing, and production stages of the food supply chain; unavoidable food waste, which refers to inedible food materials that are lost during the consumption phase (fruit core, pineapple peel, etc.); and avoidable food waste, which refers to edible food materials lost during consumption phase (surplus and wastage).

Every day, Malaysia discards more than 30,000 tonnes of municipal solid waste, which indicates 1.17 kg of waste per person. Municipal solid waste is primarily composed of food waste, with smaller amounts of plastic, mixed organic materials, paper, wood, etc. The current recycling rate in Malaysia is 31 percent, which is lower than that displayed by its neighboring countries such as Korea, Singapore, Taiwan, and Thailand. Malaysia's Federal Government has established an objective of a 40 percent recycling rate by 2025, [91]. The solid wastes that are generated by the F&B industries include packaging and organic waste. Thus, solid waste management can be challenging to the local authorities as the local governments spend a lot of time, money, and effort on the collection and disposal of solid waste. The role of the government and food manufacturers is crucial to promote reverse logistics for sustainable development as agreed by 80 percent of respondents.

[35], asserted that the effective incorporation of reverse logistics in the food and beverage sectors is impacted by various factors. Initially, companies should initiate efforts to educate and enlighten their workforce. This will enable employees to comprehend the extent of sophistication involved in reverse logistics operations. Moreover, companies should furnish clear directives and standardized procedures for both their employees and clients to adhere to when engaging in reverse logistics practices. Additionally, food producers must establish a well-structured system for handling product recalls, returned items, product wastage, and packaging materials. This is essential as businesses are now mandated to manage waste materials in an environmentally responsible manner, in response to growing environmental consciousness and regulations.

In addition, the effectiveness of reverse logistics practices is impacted by government agreements and regulations. Respondents *P1* and *P3* also advocated for the notion that the initiation of a reverse logistics program should be spearheaded by the government. Thus, the involvement of the government is essential in establishing an environment conducive to sustainable development. Ultimately, governments must devise strategies for sustainable development that integrate social, economic, and environmental considerations in their planning and management efforts to achieve sustainability.

7 Implications and Conclusions

The adoption of green logistics within the food industry is crucial and demands the involvement of all employees, from the frontline workforce to top management. Recognizing the primary factors influencing the successful implementation of green logistics is vital due to its significant advantages for both organizational performance and the environment. A recent study has pinpointed five key barriers obstructing the integration of sustainable practices among SMEs, including green technology, knowledge and information sharing, cost and financial assistance, management and leadership involvement, and support. It is widely agreed among all participants that the sharing of knowledge and information is essential. This is because there is still a need for wider dissemination of green concepts and practices among employees and consumers of SMEs. In this context, the sharing of information helps to promote green initiatives among different parties and encourages collaboration within the supply chain, [92].

This study also identified the top five drivers important for the implementation of green logistics in F&B SMEs. These drivers include the selection and collaboration of green suppliers, green manufacturing, sustainable transportation, sustainable packaging, and the role of organizations and governments in encouraging reverse logistics. The promotion of environmentally friendly practices through green manufacturing has been recognized as a crucial factor. The ongoing

industrialization and economic expansion have led to biodiversity loss and harm to the earth's ecological system. Consequently, green manufacturing offers organizations a practical means to harmonize social, ecological, and economic sustainability aspects, [93]. By comprehending the obstacles and motivators for Malaysian F&B SMEs, practitioners can make informed decisions about implementing green supply chain management, thereby enhancing the performance of the F&B industry and securing a sustainable food supply.

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Declaration of Generative AI and AI-assisted Technologies in the Writing Process
During the preparation of this work the authors used GRAMMARLY GENERATIVE AI in order to improve our sentence structure. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

- Rosmaizura Mohd Zain was responsible for collecting data, analyzing it, and drafting the original article.
- Ainon Ramli conducted the literature review and devised the research design.
- Mohd Zaimmudin Mohd Zain was responsible for editing the article.
- Liafisu Sina Yekini reviewed, revised, and corrected the article.
- Azizah Musa conducted data collection and interview sessions.
- Mohammad Nizamuddin Abdul Rahim collaborated with industry (SMEs).
- Ali Nur Dirie revised and corrected the article.
- Noor Inani Che Aziz conducted data collection.

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