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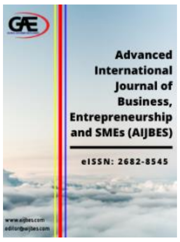

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ENVIRONMENTAL MANAGEMENT STRATEGY: THE IMPACT OF GREEN LOGISTIC PRACTICES AND GREEN SUPPLY CHAIN MANAGEMENT ON ENVIRONMENTAL AND ECONOMIC PERFORMANCE

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Abstract:

The globalisation of businesses and increased competitive pressures have prompted many firms to develop green logistics and supply chain management. They align with rising demands for third-party logistics amid growth in the service and manufacturing sectors, leading to transforming traditional business models in logistics. The study investigates how environmental management strategies impact both environmental and economic performance, focusing on the role of green logistics (LO) and supply chain management practices (SP) in Malaysian manufacturing companies certified under ISO 14900. Using SPSS and Partial Least Squares (PLS) for data analyses, and the study found significant relationships between EM, GL, and GSCM. However, there is no relationship between EM and EO. The results showed a positive relationship between EM, EN, GL, and EO. Moreover, no relationships are found between GSCM and GL, EN, and EO performance. These research findings provide valuable insights for policymakers, local authorities, and organisations keen to

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promote green sustainability practices for competitive advantage in the long run.

Keywords:

Environmental Management Strategy, Green Supply Chain Practices, Green Logistics Practices, Environmental Performance, Economic Performance

Introduction

Green supply chain management and logistics provide the foundation of the entire physical distribution process, from the transportation of green materials and products/services to the point of consumption (Kaira, 2020). According to Sarkis et al. (2011), progressive companies that embrace green ideas would gradually incorporate green practices into their supply chain activities. In addition to encouraging environmental friendliness, green concepts boost a company's profitability and sound business practices (Zhu & Geng, 2013). In order to gain market share, companies must recognise that a green strategy is used for cooperatively integrating operations with the environment; as such, it must be expanded to include the entire supply chain function (Mutingi, 2013).

Since 1995, environmental issues in the logistics sector have primarily focused on reverse logistics and purchasing-related issues (Karia, 2020). Nonetheless, there is a rising awareness that supply chain management procedures and logistical operations harm sustainability and the environment. Chin et al.(2015). Khan et al.(2020), Karia and Asaari (2016), and Gruner and Power (2017) emphasised that elements such as greenhouse gases (GHG), CO2 emissions, and hazardous and toxic chemicals, and international trade-related freight transport account for 7% of CO2 global emissions as highlighted in the International Transport Forum (ITF) in 2015. Businesses also lack awareness of the advantages of green logistics, making it challenging to recognise green practices as a necessary component of business practices, even though it has received attention from shareholders, regulators, and customers.

The business theme of today is not the same as it was in the past. Profit was the primary cause of most company disputes in the past. In this sense, the drivers of economic performance were a focus of most research studies. However, this is a cause for concern. Organisations should also prioritise environmental performance (EN) and economic success. In addition, the growing need for goods mobility in the logistics services sector also makes environmental issues and challenges more important. Environmental sustainability has become an increasingly crucial selection criterion for businesses in the logistics services sector (Centobelli et al., 2017).

Businesses can formalise structure and procedures by adopting an environmental management strategy (EM) approach. This study examines the benefits of environmental management strategy in delivering environmental and economic performance through green logistics practices (LO) and supply chain management practices (SP) in ISO14900 manufacturing Malaysian companies. There is research on the implementation of green logistics practices. However, studies on the relationship between supply chain management and green logistics regarding environmental and financial performance are lacking. Since sustainability and environmentalism have emerged as significant societal and commercial challenges for the logistics sector, this research is crucial for many businesses (da Silva, Frederico, & Garza-Reyes, 2023; Zhu et al., 2008). Additionally, this study would offer a thorough implementation roadmap for environmental management strategies in the third-party logistics (3pl) provider industry.

The research findings will provide solid insights and knowledge for organisational and local authority policymakers regarding implementing green logistics for firm sustainability and performance. This study has five sections. Section one is the introduction, followed by the literature review and hypothesis development in section 2. The research methodology will be discussed in Section 3. Research findings will be shared in Section 4. Lastly, the conclusion and recommendations are presented in Section 5.

Literature Review – Green Supply Chain Management and Triple Bottom Line Performance

Environmental strategy has rapidly become a key focus for organisations that leverage green opportunities within their supply chain strategies (Chen & Chang, 2012). This study proposes an integrated framework based on Green Supply Chain Management (GSCM), incorporating the triple bottom line (TBL) approach to address environmental concerns across the supply chain. SCM covers green procurement, manufacturing, eco-efficient transportation, distribution and sustainable warehousing (Dubey, Gunasekaran, & Papadopoulos, 2017). TBL performance is used to support the framework in supply chain management, widely adopted in many firms' supply chain management processes to support long-term success by enhancing environmental, social, and economic performance, thereby driving sustainability and competitive advantage (Munjal & Shama, 2023; Birasnav, Chaudhary, Dunne, Bienstock & Seaman, 2022; Sarkis, Zhu, Q & Lai, 2011).

Environmental Management Strategy with Environmental and Financial Performance

Environmental issues have been a concern for numerous organisations during the last few decades. The severity of environmental pollution has also increased in tandem with the economy's rapid development. Organisations must balance economic operations and environmental concerns in today's competitive and dynamic climate (Longoni & Cagliano, 2015). According to Pajunen et al. (2016), the operational performance level will not be reflected in the organisation's mission and vision, even though it incorporates the element of sustainability.

To move ahead, the organisation needs to proactively ensure improvements in its business activities, products, or services with consideration of environmental performance (Cheremisinoff et al., 2013). Environmental management is beneficial as it adopts a long-term view and goes above and beyond only fulfilling legal and regulatory requirements

Even though there is an awareness of environmental management, Christmann and Taylor (2006) commented that it is often unregulated, and accreditation is optional (Christmann & Taylor, 2006). Large firms might use an EM more stringently than the certifying authority recommended (Wong et al., 2020). Thus, businesses committed to more excellent environmental performance standards would obtain environmental legitimacy. This is important because, as Bansal (2005) and Kanashiro (2020) pointed out, establishing public legitimacy is critical for businesses operating in highly polluting industries like logistics.

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Although implementing green practices, like using EM, is crucial to achieving sustainability, operationalising EM frequently presents several difficulties because it interacts and collaborates in functional cooperation, organisation strategies and goals for a longer-term standpoint (Longoni & Cagliano, 2015).

Numerous studies have supported the idea that an organisation can attain competitive operational performance through environmental management practices such as using recyclable or reused materials, lowering the number of raw materials utilised, or both (Famiyeh et al., 2018). Additionally, the organisation can improve its total environmental performance by reducing resource consumption and emissions during production through environmental technology in environmental management practice implementation (Famiyeh et al., 2018; Forés, 2019).

Murillo-Luna et al.'s (2011) findings show that firms can make environmental investments through their financial capabilities invested in new technology. Low-cost manufacturing is the top goal for all businesses, and it is sustained by increasing orders (Qi et al., 2009). Kazan et al. (2006) further emphasised that manufacturing companies' primary responsibility is to strengthen and manage low-cost operations through investment that could eventually improve their financial performance and expansion in the future.

However, there is a tendency for the trade-off between investment expenses and firm profitability in the long term. There is no direct relationship between increasing the investment in capital and new resources to achieve environmental goals. Research by Rao and Holt (2005) proved that implementing green initiatives only contributed to the firm's environmental performance and not to any economic benefits for the firm's competitive edge. The finding was supported by Ambec and Lanoie (2008), who stated that green environmental management practices would not contribute to or bring significant financial benefits to an organisation.

Likewise, Lai (2012) also discovered that Chinese manufacturing exporters' adoption of green supply chain methods has no relationship with increases in disposal prices, cost savings from raw materials, or government subsidies. On the other hand, Zhang et al. (2012) found that environmentally friendly actions could boost economic performance and enhance resource usage. Thus, the hypotheses are developed as follows:

H1: Environmental management strategies significantly impact an organisation's environmental performance.

H2: Environmental management strategies significantly impact an organisation’s economic performance.

Environmental Management Strategy with Green Supply Chain Management and Green Logistics

The relationship between environmental management strategy and sustainable supply chain and logistics has become a critical area that needs further assessment. To achieve operational effectiveness and firm sustainability in the environmental aspects, it is emerging that the manufacturing processes in terms of emissions, pollution, and waste reduction management in manufacturing plants must be studied.

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The traditional logistics function has been expected to reduce costs, improve flexibility, ensure timely delivery and increase market coverage (Shyamsunder, Roshani, Soni, Gowda, Aghav, & Abdullah, 2024; Large, Kramer, & Hartmann, 2013; Ahn, Ishii, & Ahn, 2013; Acar, 2012). However, logistics' role in reducing industries' environmental impact has not been proven. The growth and transformation of the manufacturing sector have prompted the demand for logistics service providers to leverage organisational operations management for better systems and procedures to meet compliance requirements by the authorities.

Due to institutional pressure from various parties, such as customers, competitors and regulatory pressures, organisations must demonstrate their commitment to meeting their environmental goals and objectives. Thus, logistics companies must create a sustainable business model to offer better services to their customers (Evangelista, McKinnon & Sweeney, 2013). On top of that, the firm's priority is to build its intra-organisational and integration capabilities as the driver for environmental strategy, using green logistics practices to promote the firm's environmental and economic performance (Darmiono, 2023; Shang & Marlow, 2005).

Companies with effective environmental management strategies will be able to support their green supply chain management practices. There must be support at all levels for its internal management, employees, customers, and suppliers for environmental thinking to be successfully incorporated into its green supply chain practices (Luthra et al., 2016; Sharma et al., 2017). Management support is critical for employee commitment and is considered an essential driver for the long-term sustainability of their green supply chain implementation (Agi & Nishant, 2017; Luthra et al., 2016). The effective adoption of the supply chain may be attributed to two key factors: employee dedication and top-down management sponsorship (Agi & Nishant, 2017; Luthra et al., 2016). Externally, value chain providers and customers must work together to enhance the relationship between the upstream and downstream operations through cooperative efforts toward supply chain sustainability (Sharma et al., 2017). Hence, we hypothesise the following:

H3: Environmental management strategies significantly impact the green supply chain management

H4: Environmental management strategies significantly impact green logistics practices.

Green Logistics Practices and Green Supply Chain Management

Green logistics is a crucial element of supply chain integration. The primary responsibilities of the logistics function are transportation arrangement, managing the reverse logistics flow, warehousing and shipping. In Evangelista's (2014) research, three elements- resources, relations, and synchronisation- affect the efficiency of implementing and controlling green logistics capabilities. Previous research has shown interrelated factors in purchasing, marketing and operation activities, and there is a lack of exploration of the relationship between supply chain management and green logistics practices.

A company's supply chain integration depends heavily on its logistical practices. The primary functions of the logistics division can be broadly classified as shipping, warehousing, transportation, and reverse logistics. When implementing green logistics capabilities, a collection of resources, relationships, and synchronisation that affect and control logistics processes has to be considered (Evangelista, 2014). Studies on the connection between logistics techniques and supply chain management are scarce. Nonetheless, the manufacturing company's purchasing, marketing, operations management, and logistics departments are all interrelated.

Krikke *et al.* (2001) observed that reverse logistics activities can unpollute the distribution of recovered products. This view is supported by Pazirandeh and Jafari (2013), who state that greening transportation is necessary for achieving an organisational sustainability strategy. In summary, reverse logistics and supply chain activities involving transportation transactions, whether downstream or upstream, are crucial in green supply chain management (Dias & Braga Jr., 2016; Beh et al., 2016). For this reason, this study hypothesises that:

H5: Green logistics practices significantly impact green supply chain management

Green Supply Chain with Environmental and Economic Performance

It has been found that SP practices not only improve operational efficiencies and performance and reduce organisational costs (Haifa, Abdessalem & Hatem, 2024; Ruamsook et al., 2009) but also enhance environmental performance in achieving sustainable economic and environmental growth (Aldakhil et al., 2018). Firms can achieve organisational-level achievements after successfully implementing SP practices (Chopra & Meindl, 2004; Sarkis, 2012). However, the performance outcomes of SP practices are not widespread and well-defined (Karia, 2016; Xiao et al., 2015). As green logistics are highly demanded to reduce environmental degradation, it is crucial to effectively study how companies could integrate the economic and environmental urgencies within GSCM (Davis-Sramek et al., 2020; Roy et al., 2020; Wu & Pagell, 2011).

Capability is crucial in coping with environmental changes (De Toni et al., 2016). In an organisation, the capability of the top management to allocate resources efficiently will lead to the firm achieving a competitive advantage and boosting environmental performance (Gonzalez-Benito & Gonzalez-Benito, 2006). The organisation's capability to integrate members from different departments will promote cross-functional collaboration in the supply chain, implementing an environmental strategy to boost organisational performance (Darnall et al., 2008a; Gonzalez et al., 2008). Hence, we hypothesise that:

H6: Green supply chain management significantly impacts environmental performance

Green *et al.* (2012) indicated that several SP practices may increase the costs for the organisations concerned. However, other authors claim that by adopting SP practices, an organisation can achieve better economic performance as the subsequent elimination of waste can offset the upfront cost of implementation. This has been verified through the observation of literature that green supply chain practices are correlated with economic performance (Fang & Zhang, 2018). To support their argument, the researchers performed a meta-analysis of diverse industries (including electronics, logistics, automotive, rubber, and garment) of different sizes. Thus, we hypothesise that:

H7: Green supply chain management significantly impacts economic performance.

Green Logistics Practices with Environmental and Economic Performance

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Green logistics is a new concept growing speedily within the logistics industry. Before the 1980s, companies were not keen on engaging in green environmental initiatives in their business plans and strategies (Choi & Zhang, 2011). With the increase of public concerns relating to environmental problems and the establishment of ISO14001 and ISO26000, which relate to environmental management accreditation and social responsibility guidance, respectively (Lee, 2009), organisations began to participate in environmental efforts and invest in sustainability measures to diminish environmental risks to enhance their competitive advantages (Rao & Holt, 2005; Dey et al., 2011; Porter & van der Linde, 1995; Pazirandeh & Jafari, 2013).

Green logistics combines environmental and social responsibilities into a single concept. It acknowledges that significant social and environmental matters must be considered together to achieve sustainable economic development (Pazirandeh & Jafari, 2013). According to Seuring and Muller (2008), green logistics practices highlight the environmental traits with organisational economic performance. Wong *et al.* (2020) reflected that green logistics implementation is less resource-intensive and is more broadly adopted. Most studies (Khan & Qianli, 2017a; Aldakhil et al., 2018; Simao et al., 2018) indicate that green logistics practices (LO) positively influences environmental performance, but the results were mixed as for its impact on economic performance (Khan & Qianli, 2017b).

Research indicates that green practices grounded on customer satisfaction and operations efficiency can boost economic performance. Besides, research from Sarkis et al. (2010), Khan et al. (2017b) and Acquaye et al. (2014, 2017) found that organisational economic performance mainly relies on the efficiency and viability implementation of LO. Hence, there are insufficient conclusive studies relating LO to organisational economic performance.

Various studies (Petrini & Pozzebon, 2009; Chin et al., 2015; Karia & Asaari, 2016; Gruner & Power, 2017; Khan et al., 2020) underscore that the logistics industry is the key player in economic development and the ultimate leader for environmental degradation. The increasing application of green practices in logistics and SP features the management's acknowledgement of integrating environmental concerns into their business practices (Sarkis et al., 2011) and as part of the strategies to minimise the pressures arising from scarce resources and environmental issues (Green et al., 2012; Brockhaus et al., 2013).

H8: Green logistics practices significantly impact environmental performance

H9: Green logistics practices significantly impact economic performance

Conceptual Framework and Hypotheses

Both Luthra et al. (2016) and Sharma et al. (2017) highlight that having an internal environmental management policy is the most significant fundamental component in applying green practices in an organisation. Fang and Zhang (2018) reaffirm this view in their meta-analysis of 629 peer-reviewed articles, which states that the impact of green supply chain practices is positively associated with internal environmental management.

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A suitable management system with formal structures, processes and procedures can assist the employees in reducing the time, energy and materials consumption in the operations activities, which, in turn, enables the organisations to achieve a positive effect on environmental performance (Forés, 2019).

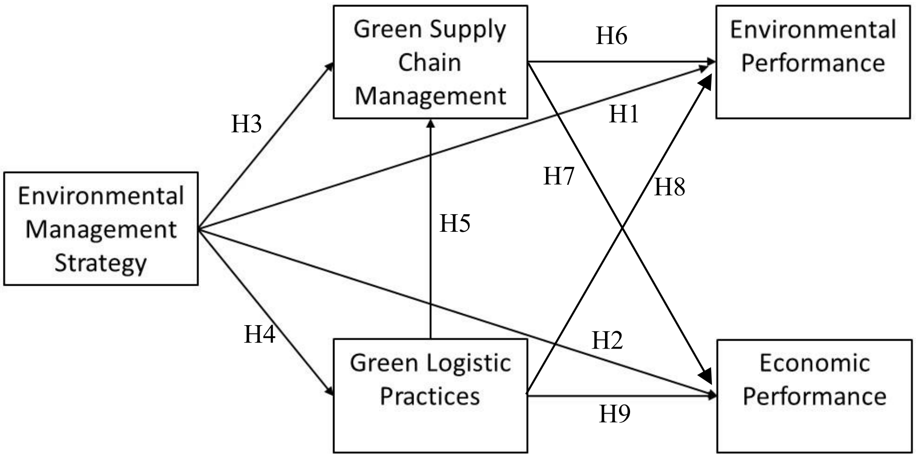

Figure 1: Conceptual Framework

Source: Self-developed

Methodology

Sampling and Data Collection

Data were collected from service providers and ISO 14001-certified manufacturers in Malaysia. The respondents comprised supply chain professionals and those involving in the supply environment strategy. Philips (1981) stated that more reliable information comes from higher-ranking respondents. Thus, the respondents are from SIRIM-certified and FMM (Federation of Malaysian Manufacturers) member companies since these companies have a high level of specifications and guidance for numerous environmental disciplines. Besides, the focus on manufacturing companies with ISO 14001 certification is mainly due to the likelihood that they are adopting and implementing green practices with their suppliers (Darnall *et al.*, 2008; Zhu *et al.*, 2010).

The study used convenience sampling to collect data from the population of interest. Self-administered questionnaires were distributed via email and face-to-face to 350 respondents in the selected companies. One hundred and two responses (i.e., a 29% response rate) were received over three months. The response rate criteria are met since it is above the tolerable ratio of ten-to-one for testing independent variable numbers (Hair et al., 2010).

Questionnaire

Data was collected using structured questionnaires. The research objectives and hypotheses were used to develop the constructs and questions, using a five-point Likert scale of 1 to denote strongly disagree, 2 for disagree, 3 to symbolise neutral, 4 to signify agree, and 5 to stand for strongly agree. The measurements used for the study are shown below.

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Table 1: Measurements

	Green Environmental Management	Loading	Mean
GE1	Obtain environmental management certification, such as the ISO14000 series.	0.81	2.99
GE2	Carry out the audit of environmental performance practice.	0.78	3.16
GE3	Selection of partners or customers in their environmental performance assessment	0.82	2.98
GE4	Establishing an overall company quality environmental management system and strategies.	0.78	2.95
GE5	Carrying out employees' environmental management training and providing incentives to promote environmental performance.	0.81	3.09
GE6	Establishing a related corporate environmental management information system	0.77	3.04
	Green Supply Chain Management		
SP1	Requirements of company shareholders (Customers, government authorities, NGO, employees, suppliers, etc.) on green logistics issues.	0.88	2.85
SP2	Behaviour requirements of the employees on the green supply chain and logistics issues.	0.79	2.64
SP3	Requirements of the internal and external collaboration among supply chain members.	0.77	2.76
	Green Logistics Practices		
LO1	Reasonable arrangements for the layout of warehouse space to optimise warehouse order picking strategies	0.79	3.34
LO2	Reducing transport packaging, recycling containers and other packaging materials in logistics.	0.79	3.12
LO3	Using recyclable packaging materials and logistics containers.	0.72	3.26
LO4	Optimising transport routes, load distribution and vehicle driving mileage.	0.80	3.38
LO5	Setting key performance indicators to optimise logistics performance.	0.83	3.34
	Economic Performance		
EO1	Decreased the cost of material purchases.	0.79	2.85
EO3	Decreased its fees for waste treatment/discharge.	0.81	2.82
EO6	Increased the cost of operating, training, and logistics of environmentally friendly materials and activities.	0.72	2.75
	Environmental Performance		
EN1	Significant reduction in the consumption of hazardous materials and harmful/toxic materials.	0.80	3.15
EN2	A significant increase in the reuse, recycling and recovery of components or parts materials.	0.74	3.17
EN3	Significant reduction in air emissions, water and solid waste.	0.81	3.02

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EN4	Significant decrease in the frequency of environmental accidents.	0.83	3.10
EN5	Significant reduction in energy consumption	0.87	3.13
EN6	Significant improvement in the overall environmental performance of our company.	0.83	3.25

Data Analysis

The descriptive analyses were conducted using SPSS version 21 and the partial least squares structural equation modelling (PLS-SEM) technique to validate the measures developed and test the hypotheses. The two-stage procedure is used to evaluate the measurement model. In stage 1, measures were assessed for both validity and reliability. Validity tests assess how well an instrument measures the concept that it intends to measure (Sekaran & Bougie, 2010). Both convergent and discriminant validity were applied to test the construct validity in the measurement model. Reliability tests assess whether the measures have the consistency and stability to measure the concept they intend to measure (Sekaran, 2003).

Results

Firm Characteristics

Most of the firm's primary business is in food products and beverages (28.4%). This is followed secondly by rubber and plastic products (21.6%) and thirdly by electrical and electronic products (9.8%). Next, chemicals and chemical products, wood products and furniture, textiles, and apparel are at 8.8% each. Few firms deal with basic metals, metal, and machinery (7.8%), while the least in other manufacturing sectors (5.9%).

Table 2: Demographic Characteristics of the Firms

	Number	Percentage
Nature of Business		
Electrical & electronic products	10	9.8
Chemicals & chemical products	9	8.8
Food products & beverages	29	28.4
Basic metals, metal & machinery	8	7.8
Wood products & furniture	9	8.8
Rubber & plastics products	22	21.6
Textiles & wearing apparels	9	8.8
Other manufacturing sectors	6	5.9
Number of Employees		
Less than 20	33	32.4
20 - 49	42	41.2
50 - 250	22	21.6
251 - 500	5	4.9
Length of Operations		
Less than 10 yrs	20	19.6
11 - 20 yrs	36	35.3
21 - 30 yrs	31	30.4

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More than 30 yrs	15	14.7
Ownership Status of the Firm		
Malaysian fully owned	65	63.7
Local and foreign joint venture	21	20.6
Owned by American company	4	3.9
Owned by Japanese company	7	6.9
It is owned by European company	5	4.9

With regards to the workforce, most firms have 20 to 49 employees (41.2%), followed by less than 20 employees (32.4%), 50 to 250 employees (21.6%) and lastly, 251 to 500 (4.9%). As for the length of business operations, most firms have been in business for 11 to 20 years (35.3%), followed by 21 to 30 years (30.4%) and less than ten years (19.6%). Few firms have operated for more than 30 years (14.7%). For the ownership status of the firms, a sizeable majority are wholly owned by Malaysians (63.7%). This is followed by local and foreign joint venture ownership (20.6%), Japanese company ownership (6.9%), European company ownership (4.9%) and American company ownership (3.9%).

Construct Reliability

Greater values of the composite reliability indicate higher reliability which ranges from 0 to 1. Table 3 displays the composite reliability scores ranging from 0.821 to 0.922. As shown, all values exceed the minimum threshold of 0.70. Hence, it indicates the internal consistency and reliability within each construct (Nunnally, 1978).

Table 3: Construct Reliability and Validity

Model Construct	Measurement Item	Loading	CR	AVE
Environmental	EM1	0.813	0.911	0.631
Management Strategy	EM2	0.776		
	EM3	0.815		
	EM4	0.779		
	EM5	0.813		
	EM6	0.770		
Environmental	EN1	0.803	0.922	0.665
Performance	EN2	0.738		
	EN3	0.810		
	EN4	0.828		
	EN5	0.874		
	EN6	0.832		
Economic	EO1	0.794	0.821	0.605
Performance	EO3	0.813		
	EO6	0.724		
Logistics Practice	LO1	0.788	0.889	0.617
	LO2	0.789		
	LO3	0.723		
	LO4	0.798		
	LO5	0.826		
Supply Chain	SP1	0.877	0.854	0.661

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Practice	SP2	0.794
	SP3	0.765
Composite Reliability	CR	
Average Variance Extracted	AVE	

Convergent Validity
Convergent validity refers to how closely the correlations among multiple items measure the same construct. To assess convergent validity (Hair et al., 2010; Gholami et al., 2013), the factor loadings, composite reliability and average variance extracted (AVE) were used. Table 2 displays the results for convergent validity. All items load more than the threshold score 0.7 (Hair et al., 2010). Moreover, all values of composite reliabilities are above 0.7 (ranging from 0.821 to 0.922), and all AVE values are higher than 0.5 (fluctuating from 0.605 to 0.665). Thus, there is convergent validity for all constructs.

Table 4 provides the results of the measurement model. The t-values of all the five constructs are above 1.96 ($p<0.05$), indicating that the measures of environmental management strategy, environmental performance, economic performance, green supply chain management, and green logistics practices are valid (Chow & Chan, 2008).

Table 4: Summary Results of the Model Construct

Model Construct	Measurement Item	Standardised Estimate	t-value
Environmental Management Strategy	EM2	0.813	19.410
	EM3	0.776	17.317
	EM5	0.815	10.925
	SC2	0.779	13.109
	SC4	0.813	20.464
	SC5	0.770	16.829
Environmental Performance	EN1	0.803	19.303
	EN2	0.738	9.323
	EN3	0.810	18.394
	EN4	0.828	26.117
	EN5	0.874	34.640
	EN6	0.832	17.795
Economic Performance	EO1	0.794	7.530
	EO3	0.813	7.180
	EO6	0.724	5.383
Logistics Practice	LO1	0.788	18.143
	LO2	0.789	15.312
	LO3	0.723	9.244
	LO4	0.798	13.791
	LO5	0.826	21.157
Supply Chain	SP1	0.877	22.886

Practice	SP2	0.794	13.851
	SP3	**0.765**	**10.120**

Discriminant Validity

Discriminant validity assesses the degree to which a particular construct does not correlate with all other constructs in the research model. The cross-loadings need to be examined first, and followed by the square root of the AVE for each construct needs to be compared for the correlation with other constructs (Chin, 1998). Based on Hair et al. (2010), the value is considered significant when it is higher than 0.7. Table 5 shows that all the items are loaded greater on their respective intended latent variables than other variables, and the scores confirm discriminant validity between different constructs.

Table 5: Loadings and Cross-loadings

	EM	**EN**	**EO**	**LO**	**SP**
EM1	0.813				
EM2	0.776				
EM3	0.815				
EM4	0.779				
EM5	0.813				
EM6	0.770				
EN1		0.803			
EN2		0.738			
EN3		0.810			
EN4		0.828			
EN5		0.874			
EN6		0.832			
EO1			0.794		
EO3			0.813		
EO6			0.724		
LO1				0.788	
LO2				0.789	
LO3				0.723	
LO4				0.798	
LO5				0.826	
SP1					0.877
SP2					0.794
SP3					0.765

Table 6 indicates that the average variance extracted (AVE) is above 0.5, implying that the constructs constitute more than 50% of the measurement variance. It indicates that each square root of AVE (indicated in bold) is more significant than the inter-construct correlations, which means that the variance explained by the respective construct is greater than the measurement error variance (Fornell & Bookstein, 1982). Hence, the measurement instruments' discriminant validity is formed.

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Table 6: Discriminant Validity of Constructs

	EO	EN	EM	LO	SP
EO	0.778				
EN	0.321	0.815			
EM	0.217	0.620	0.794		
LO	0.352	0.781	0.562	0.785	
SP	0.254	0.366	0.542	0.340	0.813

The heterotrait monotrait ratio (HTMT) must be examined for discriminant validity, as Henseler et al. (2015) suggested. The recommended threshold value is 0.90 (Henseler et al., 2015). Lack of discriminant validity can be shown by a value greater than 0.90. Table 7 displays that all the values are less than 0.90. Thus, it meets the HTMT criterion, which supports discriminant validity between the model constructs.

Table 7: Heterotrait-Monotrait Ratio (HTMT)

	EO	EN	EM	LO
EN	0.413			
EM	0.289	0.688		
LO	0.450	0.894	0.647	
SP	0.366	0.445	0.663	0.430

Reliability Analysis

Constructs' reliability can be measured using Cronbach's alpha and composite reliability. Cronbach's alpha value is suggested to be greater than the threshold of 0.7 (Nunnally & Berstein, 1994). For composite reliability, it ranges from 0 to 1, and high values indicate the high reliability of the constructs. Table 3 indicates that the composite reliability values range from 0.821 to 0.922, and AVE > 0.5. Based on Tables 3 and 8, it can be determined that the constructs have adequate internal consistency reliability. Measures that do not meet requirements are dropped from the analysis.

Table 8: Results of the Reliability Test

Constructs	Measurement Items	Cronbach's alpha	Loading range	Number of items
Environmental Management Strategy	EM2, EM3, EM5, SC2, SC4, SC5	0.883	0.776-0.815	6 (6)
Environmental Performance	EN1, EN2, EN3, EN4, EN5, EN6	0.898	0.738-0.874	6 (6)
Economic Performance	EO1, EO3, EO6	0.678	0.724-0.813	3 (6)
Logistics Practice	LO1, LO2, LO3, LO4, LO5	0.844	0.723-0.826	5 (5)
Supply Chain practice	SP1, SP2, SP3	0.742	0.765-0.877	3 (5)

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Hypotheses Testing

Using the measurement model from the previous section, the next step would be to evaluate or create the structural model and conduct hypothesis tests. To perform this task, the data was then analysed with 5,000 bootstrapped samples for the 102 cases per sample. This study then used a t-test to investigate the path loading between constructs and identify its significant effect. The results can be found in Table 9 and Figure 2.

The variance in environmental performance is measured via the R^2 adjusted value of 0.658, indicating that 65.8% of environmental performance can be explained by environmental management strategy, green supply chain management and green logistics practices. Based on the results, the environmental management strategy (b=0.259, p<0.00) and the green logistics practices (b=0.631, p<0.00) are positively related to environmental performance. Green supply chain management (b=0.011, p=0.866) has no significant relationship with environmental performance. Thus, H1 and H8 are supported, and H6 is not.

The findings show that the R^2 adjusted value for economic performance is 0.146, and that 14.6% of the variance in economic performance can be explained by environmental management strategy, green supply chain management, and logistics practices. Based on the results, the environmental management strategy (b= - 0.062, p=0.696) and the green supply chain management (b=0.177, p=0.159) have no significant relationships to economic performance. Meanwhile, green logistics practices (b=0.327, p<0.00) have a significant relationship with economic performance. Thus, H9 is supported, and H2 and H7 are not.

In addition, 29.6% of the variance in green supply chain management can be explained by environmental management strategy and green logistics practices; the results show that environmental management strategy (b=0.514, p<0.00) has a significant effect on green supply chain management, and the green logistics practices (b=0.051, p=0.721) has no relationship to the supply chain management. Thus, H3 is supported, and H5 is rejected. The result also shows that environmental management strategy can explain 31.6 % of the variance in green logistics practices, with an R^2 adjusted value of 0.316. The results show that environmental management strategy (b=0.562, p<0.00) significantly affects green logistics practices. Thus, H4 is supported.

Table 9: Path Coefficients and Hypothesis Testing

Hypothesis	Relationship	Coefficient	t value	p value	Supported
1	Environmental management strategy -> Environmental performance	0.259	3.048	0.002	YES
2	Environmental management strategy -> Economic performance	-0.062	0.391	0.696	NO
3	Environmental management strategy -> Green supply chain management	0.514	4.301	0.000	YES
4	Environmental management strategy -> Green logistics practices	0.562	8.749	0.000	YES

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5	Green logistics practices -> Green supply chain management	0.051	0.358	0.721	NO
6	Green supply chain management -> Environment performance	0.011	0.169	0.866	NO
7	Green supply chain management -> Economic performance	0.177	1.409	0.159	NO
8	Green logistics practices -> Environment performance	0.631	8.472	0.000	YES
9	Green logistics practices -> Economic performance	0.327	2.345	0.019	YES

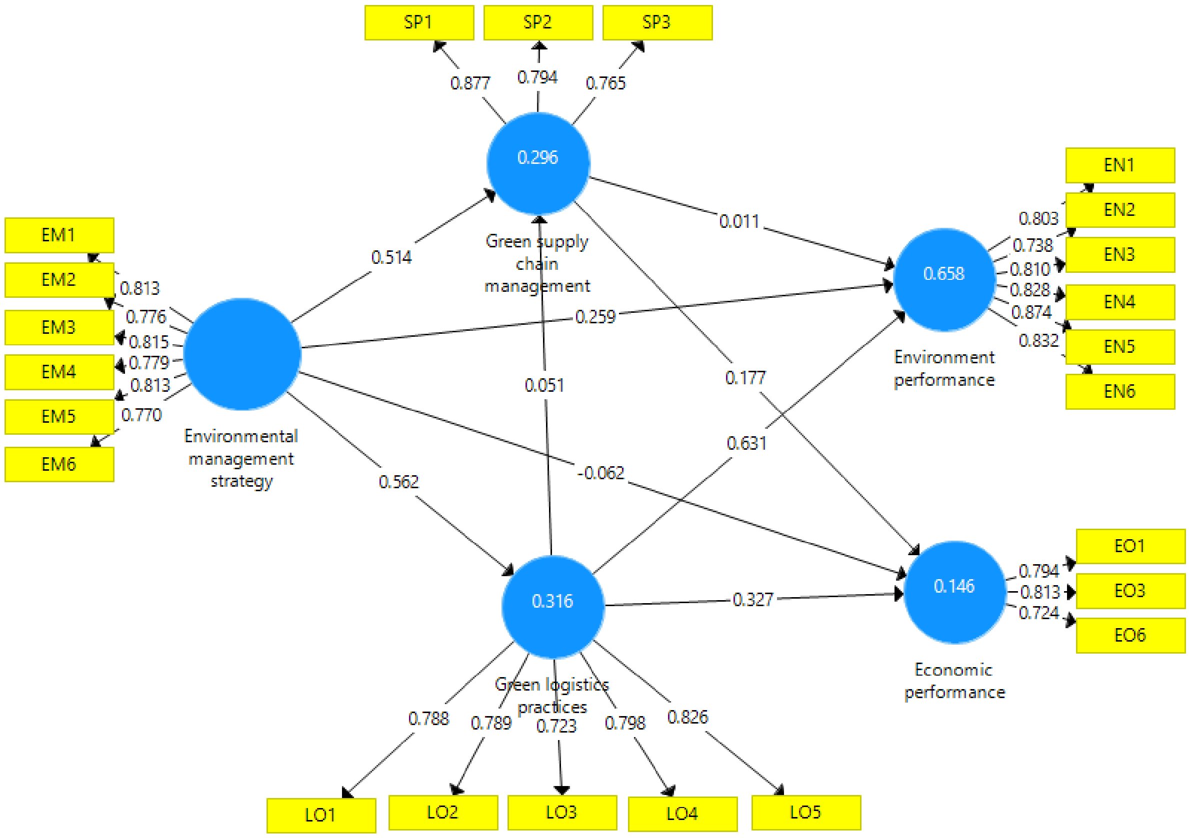

Figure 2: Results of the Path Analysis

Discussions

Environmental management strategy is critical to the achievement of environmental performance (Walls et al., 2012; Abdallah & Al-Ghwayeen, 2020). These researchers proved that implementing green activities and strategies directly impacts the firm's environmental performance. Proactive organisations could reduce emissions, reduce resource use and prevent hazardous materials from being used in production (Famiyeh *et al.*, 2018; Fang & Zhang, 2018). According to studies by Luthra et al. (2016) and Sharma et al. (2017), environmental management strategy plays a central role in supply chain management. Fang and Zhang (2018) conducted a meta-analysis using 629 peer-reviewed articles and commented that environmental management significantly affects the ecological management of the supply chain. This study provided empirical corroboration of this hypothesis through H1 and H3.

However, the research by Rao and Holt (2005) and Ambec and Lanoie (2008) proved a direct relationship between green initiatives and environmental performance without contributing to the firm's economic benefits. This finding contradicts the comments given by Zhang et al. (2012), Sambasivan et al. (2013), and Woo et al. (2016) as these other researchers highlighted that eco-friendly initiatives will lead to resource efficiency and economic performance concurrently. The comments were against the Malaysian scenario, as these studies did not support H2.

Research by Zhu et al. (2008) highlighted that environmental management strategy directly affects marketing, suppliers, intraorganizational processes, and environmental logistics. This statement is supported by Aronsson (2006), who shared that organisations reform their processes and systems through transportation effectiveness and advanced technology performance. These studies support H4, where environment management strategies positively impact environmentally friendly logistical practices (Abboud, As' ad, Bilstein, Costers, Henkens & Verleye, 2021).

In the logistics services sector, environmental sustainability is becoming a critical success factor in reducing costs through financial incentives, energy efficiency or tax relief. At the operational level, recycling, replacing environmentally harmful materials, and reusing or remanufacturing lead to cost savings and environmental performance (Akhtar, M, 2023; Hofer *et al.*, 2012). Managing constant changes in logistics practices will lead to a company's performance in terms of the environment and economy (Shang & Marlow, 2005). In this study, H8 and H9 were supported when green logistics positively impact environmental and economic performance.

The primary function of the supply chain is to cope with and collaborate with an organisation's upstream and downstream partners, controlling reuse, recycling, and emission throughout the entire distribution channel. Thus, integration in logistical practices, supply chain management, reverse logistics, third-party service providers, and transportation is crucial for an organisation (Evangelista, 2014). However, there is no agreement on how the green logistics operation is linked to supply chain activities in the Malaysian context. That way, H5 is not supported.

Researchers, such as Green et al. (2012), Wong et al. (2012), Varsei et al. (2014), Schrettle et al. (2014), Masudin and colleagues (2018) and Petljak et al. (2018) have confirmed the critical role played by supply chain as a mechanism achieving more excellent environmental and operational performance. This view was disagreed with and contradicted by Khan and Qianli (2017b) from Pakistan, where the findings showed the unfavourable impact of firm performance and green supply chain practices. The research by Abdallah and Al-Ghwayeen (2020) studied manufacturing companies in different sectors in Jordan and commented that there is no direct link between green activities and firm economic performance.

Additionally, the study on the food retail enterprises in Croatia by Petljak et al. (2018) pointed out no significant impact on economic performance. In contrast, the view differs from that of Mumtaz et al. (2018), who show that the ecological management of the supply chain significantly affects companies' economic performance by reducing operating costs. Past studies have shown mixed results on the relationship between ecological supply chain management and environmental and economic performance. The findings were that green

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supply chain management does not affect environmental or economic performance. For these reasons, H6 and H7 were not supported.

The underlying reason for these unsupported hypotheses could be that companies operating a green supply chain have high costs, which can lead to a deterioration in profits. Many organisations focus on their short-term gain rather than the long-term benefits that could lead to a competitive advantage. The collaboration between the logistics and supply chain practices will eventually lead to long-term environmental performance.

The study's theoretical implications lie in revealing a knowledge gap by examining the relationship between sustainable environmental management, the green supply chain management framework, and the Triple Bottom Line approach. In addition, this study proposes using logistics and supply chain management as a mediator variable to study the impact on triple bottom line performance implementation. Finally, it proves that the conceptual GSCM framework coupled with the Triple Bottom Line performance (TBL) contributes to the knowledge base and provides a thorough list of future research directions.

The findings of this study will raise awareness and have implications for practitioners. The results enable organisations to examine all aspects of green ecology supply chain management, logistical practices, and environmental and economic performance. Senior management must shift its focus to support green policies and systems on reuse, recycling, reverse logistics and energy conservation through its proactive environmental programs. Furthermore, organisations need to integrate their logistics functions into the ecological supply chain, where both functions are part of the environmental strategy and optimise a company's environmental and economic performance.

Policymakers could identify the processes and procedures and promote their nation's ability as a regional freight hub through advanced infrastructure development and regulations to gain a competitive edge in the long run. Suppose the Malaysian government is serious about growing domestic service providers and distribution hubs and making them accessible to international players. In that case, appropriate related infrastructure investment must be encouraged, and the existing regulatory frameworks must be improved.

Conclusion and Recommendations

Sustainability and environmental concerns are becoming common questions. Tremendous pressure from the general public and stakeholder's forces organisations to incorporate the supply chain and green logistics into their daily operations. Research by Flammer (2013) and Walls et al. (2012) pointed out inconclusive results for green environmental strategy and business performance. Therefore, further exploration of the implications for green supply chain and logistics practice in the Malaysian context is necessary.

Changing behaviour toward implementing a green environmental strategy is unavoidable for many organisations. Environmental and economic performance awareness, especially in supply chain management among transporters, manufacturing plants, third-party service providers, and consumers towards green practices, is still questionable in Malaysia. Due to the nature of organisational complexity and their interrelations with traditional business objectives, greening initiatives are only stated in the company mission and vision and seldom reach the operational, tactical, and environmental strategic levels. Organisations must integrate company strategy with environmental practices and cooperate with suppliers and customers on environmental and economic performance.

For future research, the researchers could focus on qualitative research to investigate the unsupported hypotheses on green supply chains and environmental and economic performance in the logistics industry in Malaysia. Further research could also focus on the relationship between the supply chain and the logistics function of service providers in Malaysia. Management support, the complexity of the business, organisational culture, and cross-functional collaboration are the potential areas for exploration to provide insights for the third-party service providers in Malaysia, given the 12 MP plans and strategy to cascade down the green concept to the private sector and make the service provider more competitive in the international market.

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