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THE IMPACT OF GREEN SUPPLY CHAIN MANAGEMENT (GSCM) PRACTICES ON FIRM PERFORMANCE

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Abstract:

The heightened awareness of environmental sustainability has prompted organizations, particularly within the manufacturing industry, to revaluate their supply chain management (SCM) practices. Hence, this study explores the relationships between green supply chain management (GSCM) practices and firm performance. Survey data collected from 320 Malaysian manufacturers were used to conduct correlation analysis. Overall, results show that the adoption of GSCM practices enhances environmental and financial performances. Implementation of GSCM practices is an important aspect of manufacturing operations strategy as they help manufacturers not only improve environmental performance but also increase profitability.

Keywords:

Green Supply Chain Management, Environmental Performance, Financial Performance, Manufacturing Industry.

Introduction

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The increasing environmental concerns and regulatory pressures have compelled firms worldwide to adopt sustainable practices in their operations (KPMG, 2020). In response to rising environmental concerns, green supply chain management (GSCM) has become one of the topics that has been widely discussed by academics and practitioners in addressing sustainability issues (Burchardt et al., 2021; Green, Zelbst, Meacham, & Bhadauria, 2012; Habib, Bao, & Ilmudeen, 2020; Henrich, Li, Mazuera, & Perez, 2022; Zhu, Sarkis, & Lai, 2012, 2008). Prior research has shown that GSCM not only leads to better environmental performance but also improves economic and operational performance. The benefits of GSCM practices have long been documented in prior research (Azevedo, Govindan, Carvalho, & Cruz-Machado, 2013; Green et al., 2012; Habib et al., 2020) but they tend to be biased toward developed countries or countries like China (Green et al., 2012; Zhu et al., 2012, 2008).

To replicate the outcomes of prior research, this study examines the role of GSCM practices on the firm performance of Malaysian manufacturers. The manufacturing industry was chosen due to its key contributions to the nation's growth, specifically in gross domestic product (GDP) (24%) and total exports (84%) in 2022 (MITI, 2023b). Although it plays a significant contribution to the economy, the industry also made a substantial contribution to GHG emissions (11%) in 2019 (MITI, 2023a). Hence, this study seeks to address the following research question:

"What is the relationship between GSCM practices and firm performance?"

The remainder of the paper is organised as follows: Section 2 reviews the literature related to GSCM. Sections 3 and 4 present the methodology and findings of this study. Subsequently, Sections 5 and 6 summarise the paper and present some concluding remarks for future work.

Literature Review

Literature review's focus on green supply chain management (GSCM) practices and firm performance within the manufacturing sector.

Based on the below literature, a theoretical framework is illustrated as in:

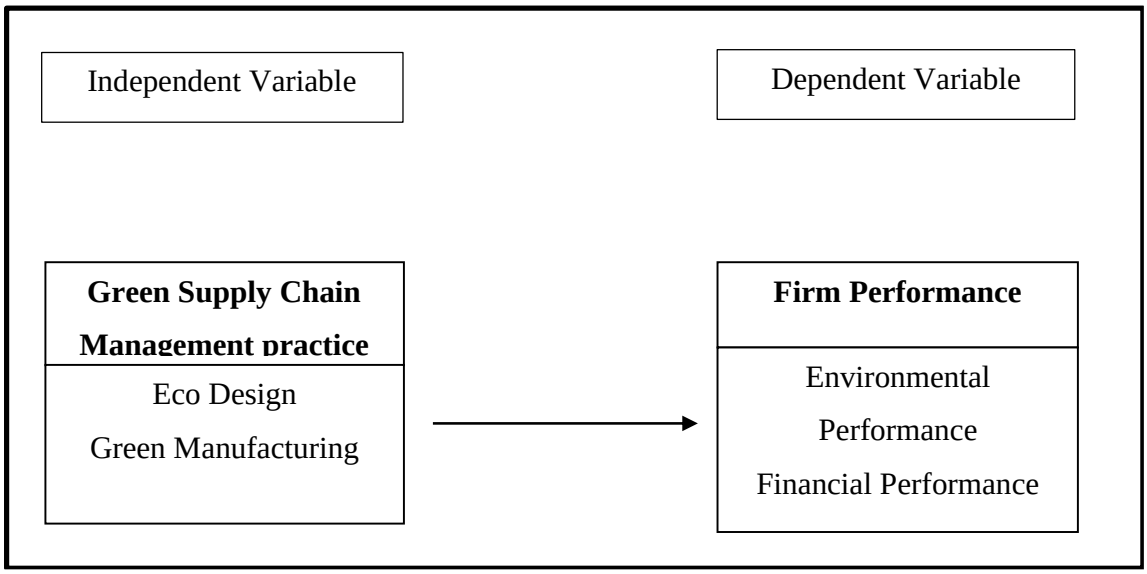

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Figure 1: Theoretical Framework of GSCM Practices and Firm Performance

Definition Of Terms

Green Supply Chain Management

Green supply chain management (GSCM) has emerged as an important tool and philosophy for leading manufacturing organizations (Zhu et al., 2008). GSCM integrates concepts from both environmental protection and supply chain management (SCM) literature. SCM literature refutes the notion that firms are isolated entities striving to avoid dependence on other firms (Lee, Kim, & Choi, 2012). Instead, it emphasizes that firms within a supply chain (SC) must collaborate to achieve overarching SC goals (Frödell, 2011). In contrast, environmental protection literature asserts that businesses should protect the environment by adopting eco-friendly systems (Innes, 2008).

Srivastava (2007) defined GSCM as a comprehensive approach to managing SCs by integrating environmental considerations into all stages of the SC process, from product design and material sourcing to manufacturing, distribution, and end-of-life disposal. Zhu & Sarkis (2004) reviewed a number of GSCM definitions and found a lack of consensus among practitioners. This is due to the concept involving two elements that are new in practice and theory. Therefore, Zhu and Sarkis developed four elements of GSCM practice which include internal environmental management, external GSCM, investment recovery, and eco-design. In addition, GSCM may encompass other practices such as green purchasing, green manufacturing, green logistics, and reverse logistics, all of which are designed to minimize harmful environmental impacts while maintaining or enhancing economic performance (Sarkis, 2003).

Zhu & Sarkis (2004) emphasized that GSCM framework needs to involve collaboration among all SC stakeholders, including suppliers, manufacturers, distributors, and customers, to ensure that environmental objectives are met throughout the entire SC. This collaborative effort is supported by the adoption of innovative technologies and practices that facilitate the integration of sustainability into traditional SCM principles (Seuring & Müller, 2008). In this study, two elements of GSCM practice are considered and discussed next.

Eco-Design

Adoption of eco-design practice requires manufacturers to design products that reduce materials and energy consumption, avoid the use of hazardous products within the manufacturing process that facilitate the reuse, recycle, and recovery of component materials and parts (Zhu et al., 2008). This is in line with the aim of eco-design which is to reduce the environmental impact of a product without making a negative trade-off with other design criteria (Green et al., 2012). Eco-design integrates environmental considerations into the early stages of product development, ensuring that environmental impact is a key criterion in the decision-making process. By incorporating eco-design principles, companies can reduce the ecological footprint of their products and contribute to overall sustainability goals (Tischner & Charter, 2001).

Green Manufacturing

Green manufacturing refers to the process of producing goods in ways that are environmentally friendly and sustainable. It involves adopting practices and technologies that reduce energy consumption, minimize waste, and lower emissions of pollutants and greenhouse gases. Green

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manufacturing aims to improve the efficiency of production processes by optimizing resource use, incorporating renewable energy sources, and reducing reliance on non-renewable and harmful materials (Dornfeld, 2013). Key practices in green manufacturing include waste minimization, pollution prevention, energy efficiency improvements, and the implementation of clean technologies. By focusing on these areas, green manufacturing helps companies achieve regulatory compliance, reduce costs associated with waste and energy, and enhance their reputation among environmentally conscious consumers (Jayal et al., 2010).

Hypotheses Development

Eco-Design Practices And Firm Performance

Research by Fuentes-Fuentes, Albort-Morant, and Lloréns-Montes (2015) showed that firms that adopt eco-design practices tend to improve their financial performance. They found that companies in the shipping industry that implemented green innovation practices such as eco-design initiatives, experience enhanced financial performance metrics such as profitability and return on investment (ROI). Similarly, Albino, Balice, and Dangelico (2009) observed a positive relationship between eco-design practices and financial performance among manufacturing firms, suggesting that environmentally sustainable product design can lead to cost savings and increased market competitiveness. Prior research shows that firms implementing eco-design practices as part of their GSCM initiatives will experience improved environmental performance (Green et al., 2012; Zhu & Sarkis, 2004)). They find that companies that integrate eco-design principles into their product development processes can achieve environmental benefits such as reduced resource consumption and waste generation. Furthermore, their study indicates that such environmentally sustainable practices positively contribute to overall environmental performance outcomes within organizations. Hence, this study posits that:

H1a: There is a significant positive relationship between the adoption of eco-design practices and financial performance.
H1b: There is a significant positive relationship between the adoption of eco-design practices and environmental performance.

Green Manufacturing Practices And Firm Performance

The successful adoption of GSCM practices depends on the implementation of sustainable green manufacturing processes (Seuring and Müller, 2008). Their study shows that firms that implement green manufacturing practices, such as energy-efficient production processes and waste reduction measures, can achieve cost savings and operational efficiencies, leading to improved financial performance. Additionally, Pagell and Wu (2009) found that green manufacturing initiatives positively influence financial performance (i.e., reduced production costs and increased product quality) and improve environmental performance. Research by Golicic and Boerstler (2012) showed that firms that prioritize green manufacturing activities, such as eco-friendly production processes and waste minimization strategies, tend to achieve environmental benefits, including reduced carbon footprint and resource conservation. Similarly, Hofmann and Busse (2011) observed a positive relationship between green manufacturing practices and environmental performance, indicating that sustainable manufacturing initiatives contribute to overall environmental stewardship within organizations. Hence this study posits that:

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H2a: There is a significant positive relationship between the adoption of green manufacturing practices and financial performance.
H2b: There is a significant positive relationship between the adoption of green manufacturing practices and environmental performance.

Research Methodology

A self-administered survey questionnaire was developed to measure eco-design, green manufacturing, environmental performance, and financial performance. Eco-design was operationalized using ten items measured on five-point Likert scales ranging from 1- ("strongly disagree"), to 5 - ("strongly agree"), following prior studies (Zhu, Sarkis, & Geng, 2005). For a measurement of environmental performance, a five-point item scale developed by Zhu & Sarkis (2007) was used. All items were measured using a five-point Likert scale 1 – ("not at all") to 5 – ("very significant"). Financial performance was operationalized using four items. Respondents were asked to evaluate their firms' performance against their competitors on a five-point Likert scale ranging from 1 - ("worst in the industry"), 3 - ("about the same as competitors"), 5 - ("best in industry)) (Wong, Wong, & Boon-itt, 2012).

Data were collected from 321 manufacturing companies of all sizes in Klang Valley, Malaysia using an online survey hosted by Google form. The questionnaire was targeted at top and senior management level positions who would be undoubtedly familiar with the strategic direction of their sustainable practices. A list of such individuals was obtained from the Federation of Malaysian Manufacturers (FMM). It included 1786 different companies with SIC codes of (151) "production, processing, and preserving of meat and meat products", (210) "manufacture of paper and paper products", (259) "manufacture of other fabricated metal products", (303) "manufacture of air and spacecraft and related machinery" and (383) "recycling of metal waste and scrap". The respondents' distribution according to job function, management level, industry sector, number of employees, and age of company is presented in Table 1.

Table 1: Demographic Profile of The Sample

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Category	Percentage (%)
Job Function	
Marketing/ Sales	1.9
Production/ Manufacturing	38.3
Planning	7.2
Purchasing/ Procurement	0.93
Logistic/ Distribution	19.9
Research and Development	8.4
Supply Chain	18.7
Others	4.6
Management Level	
Top management/C- Level	25.9
Senior management	33.0
Middle management	0.31
Junior management	11.2
Non-management	3.7
Industry Sector	
Food, Beverage & Tobacco	18.8
Textiles, Wearing Apparel, Leather & Footwear	5.1
Wood, Furniture, Paper Products & printing	12.8
Petroleum, Chemical, Rubber & Plastic	29.8
Non-metallic Mineral Products, Basic Metal & Fabricated, Metal Products	10.0
Electrical & Electronics Products	27.8
Transport Equipment & Other Manufactures	8.7
Others	31.0
No of employees	
less than 5	0.31
5 to less than 75	39.8
75 to not exceeding 200	30.84
Over than 200	28.97
Years of Operation	
1 – 5 years	1.55
6 – 10 years	14.95
11 – 15 years	16.2
16 – 20 years	21.5
Over than 20 years	46

Results and Discussions

Descriptive Statistics

Descriptive statistics employing IBM SPSS version 28 was utilized to summarize the data features (see Table 2). The results show eco-design and green manufacturing have a mean of 3.59 and 3.71 respectively, indicating the agreement of the respondents on GSCM practices. For environmental performance, companies scored on average 3.49 (out of five), showing that these manufacturers performed towards "relatively strong" performance. In contrast, findings show that manufacturers' performance in terms of financial is slightly better than their competitors (3.18 out of five). In addition, the standard deviation for all variables is rather small, indicating low variation. Findings show that both skewness and kurtosis are less ± 1.0, showing that all variables are normally distributed.

Table 2: Descriptive Statistics

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Variables	Skewness	Kurtosis	Standard Deviation	Mean	Mode	Median
Eco design	-.76	.14	.95	3.59	4.00	3.83
Green manufacturing	-.84	.16	.95	3.71	4.00	4.20
Environmental performance	-.35	-.41	.82	3.49	4.00	3.60
Financial performance	.22	-.28	.75	3.18	3.00	3.00

Correlation

The Pearson correlation analysis was used to examine the relationships between GSCM practices and firm performance. The results indicate that all the correlations are significant at the 0.01 level (2-tailed), demonstrating strong relationships between the independent and dependent variables as illustrated in Table 3.

Table 3: Pearson Correlation Analysis

		Eco design	Green manufacturing	Environmental performance	Financial performance
Eco design	Pearson Correlation	1	.842**	.755**	.625**
	Sig. (2-tailed)		0.000	0.000	0.000
	N	321	321	321	321
Green manufacturing	Pearson Correlation	.842**	1	.798**	.641**
	Sig. (2-tailed)	0.000		0.000	0.000
	N	321	321	321	321
Environmental Performance	Pearson Correlation	.755**	.798**	1	.698**
	Sig. (2-tailed)	0.000	0.000		0.000
	N	321	321	321	321
Financial Performance	Pearson Correlation	.625**	.641**	.698**	1
	Sig. (2-tailed)	0.000	0.000	0.000	
	N	321	321	321	321

**. Correlation is significant at the 0.01 level (2-tailed).

Specifically, the results show that eco-design has a strong positive correlation with environmental performance (r = 0.755, p = 0.01), and financial performance (r = 0.625, p = 0.01). Thus, H1a and H1b are accepted. This is aligned with a study by Green et al., (2012) findings that manufacturers with eco-design products tend to improve their environmental performance. In designing eco-friendly products, it is also important for manufacturers to provide suppliers with design specifications especially when green purchasing is an important consideration for manufacturers (Zhu et al., 2012). On the other hand, a positive association between eco-design and financial performance is due to products' benefits (i.e., cost savings from reduced material and energy consumption, improved product efficiency, and enhanced brand reputation), that attract environmentally conscious consumers and differentiate the company in the marketplace (Tischner & Charter, 2001). Additionally, eco-design products can lead to regulatory compliance and avoidance of penalties, further contributing to financial performance. Eco-design is crucial as it proactively addresses environmental issues at the product development stage, ensuring sustainability throughout the product lifecycle. This approach not only helps in achieving regulatory compliance and reducing environmental harm

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but also meets the growing consumer demand for sustainable products, thus enhancing market competitiveness. The integration of eco-design can result in long-term cost savings and improved stakeholder relationships, further boosting a firm's overall performance.

Similarly, green manufacturing shows significant positive correlations with environmental performance (r = 0.798, p = 0.01). Green manufacturing practices, such as waste reduction, pollution prevention, and energy efficiency, directly contribute to lowering the environmental footprint of production activities (Dornfeld, 2013). These practices ensure that firms can achieve sustainability targets, reduce harmful emissions, and optimize resource utilization, which are critical for maintaining environmental standards. The significant positive association between green manufacturing and financial performance (r = 0.641, p = 0.01), implying that effective green manufacturing can reduce operational costs through energy savings, waste minimization, and improved resource efficiency (Jayal et al., 2010). As such, both H2a and H2b are accepted.

Multiple Regression Analysis

The coefficient determination of r^2 = 0.656 implies that 65.6% of the variance in the firm performance is explained by two independent variables consisting of eco-design and green manufacturing. This denotes that 34.4% may be explained by other variables that have not been considered in this study. These could be green purchasing, customer cooperation, and investment recovery which can lead to improved environmental and financial performance (Green et al., 2012; Zhu et al., 2012). The 65.6% might be due to a wide range of sectors that were involved in the study. Different sectors might have different views on GSCM.

Conclusion

This study posits that GSCM affects the firm performance of manufacturers. To confirm this relationship, correlation, and multiple regression analyses were used to examine the influence of GSCM practices of eco-design and green manufacturing on firm performance of environmental and financial. The study finds a number of significant results that support such relationships. These results provide managerial implications and future research direction.

The findings underscore the strategic importance of integrating green practices into SC operations to achieve competitive advantage and environmental stewardship. The study offers scope for firms to determine which GSCM practices should be given propriety in order to improve their firm performance. To reap the benefits of improved environmental and financial, firms must include GSCM practices as part of their strategic direction. This can ensure that the implementation of GSCM is supported at the top management level.

Despite its contributions, this study faced several limitations that offer avenues for future research and improvement. Primarily, the research was confined to manufacturing firms in the Klang Valley region, limiting the generalizability of findings beyond this specific geographic area. It is suggested that future research should expand the scope to include a broader range of industrial sectors and geographical regions within Malaysia to provide a more comprehensive understanding of GSCM practices.

Second, this study adopted a survey questionnaire for generalizability. Future research may adopt a mixed-methods approach, including qualitative methods like interviews or focus

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groups, to gain better insights into the study area. This will be beneficial for manufacturing firms to transition towards better GSCM.

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