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Fostering Environmental Performance through Green Supply Chain Practices: Empirical Evidence from Manufacturing Firms in Pakistan

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Abstract: *Achieving sustainable performance is a challenging but useful tool for firms in this competitive environment. The literature highlights several avenues to address sustainable performance, but there is a lack of emphasis on common practices and strategies. This study examines the role of green initiatives, specifically eco-design, green purchasing and reverse logistics, in addressing environmental performance. Practice-based view theory is used to evaluate the influence of these common green practices on a firm's environmental performance. A total of 214 participants were approached to participate in this study and data analysis was conducted using AMOS. The findings reveal a significant and positive impact of eco-design, green purchasing and reverse logistics on environmental performance. This study provides implications for practitioners, policymakers and academics regarding environmentally oriented business operations that could better serve manufacturing firms. Additionally, firms are encouraged to focus on easily imitable, easy-to-transfer and easy-to-understand practices to address sustainable performance.*

Keywords: GSCM, environmental performance, eco-design, reverse logistics, green purchasing, supply chain management.

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1. Introduction

Recent environmental issues, natural disasters, global warming, and climate change have gained significant attention from stakeholders worldwide. The continuous increase in carbon dioxide (CO_2) emissions has led to higher levels of hazardous air pollution, resulting in widespread environmental damage. Challenges such as resource degradation, environmental contamination, climate change, and biodiversity reduction are causing ecological balance to deteriorate. As these environmental problems are expected to worsen, individuals, governments and businesses are becoming increasingly concerned about environmental security. Businesses that face public and governmental scrutiny for contributing to environmental degradation need to review their production methods and other operations.

In this regard, green supply chain management (GSCM) is an established practice that can be used to address corporate accountability and environmental issues from a supply chain perspective (Adriana, 2009). With the growing interest of customers, the public and legislators worldwide in environmental concerns, businesses have created a wide variety of ecologically friendly initiatives and 'green' commodities. Hoffmann (2007), Zhu et al. (2008) and Yung et al. (2011) have discussed the rise of 'green' businesses and products. As an increasing number of foreign consumers and buyers now demand goods that do not contain harmful or hazardous chemicals, it is becoming more important for businesses to become environmentally conscious. Consequently, the use of naturally obtained resources in production processes has gradually reduced to minimize environmental damage from harmful manufacturing.

Green et al. (1996, 2012) state that cost savings and compliance with rules and regulations are key factors in introducing environmental protection. Bowen et al. (2001) find that GSCM activities are more widely adopted by enterprises if they are accompanied by financial and organizational incentives. GSCM has been one of the most studied topics in the past two decades due to widespread concerns about environmental

contamination, aggressive methods and increased international understanding of environmental issues (Hervani et al., 2005).

Organizational operations contribute continuously to environmental issues, climate change, and global warming. To thoroughly understand and address these problems, organizations must recognize the causes of environmental issues within their reach, such as manufacturing, shipping, procurement and final products. When businesses manufacture products and services to satisfy demand, they use scarce energy and cause environmental degradation by releasing hazardous air, soil, waste and water into the environment (Azapagic, 2003). The environmental performance of an organization is measured by its ability to minimize emissions, reduce waste production, avoid the use of toxic and hazardous chemicals, and decrease environmental incidents. Any action a company takes to lessen the harmful effects of its products or services on the environment is considered part of its GSCM efforts.

Well-designed environmental standards can enhance manufacturers' efforts to innovate green products and new technologies (Shrivastava, 1995). According to Shrivastava (1995), firms can distinguish their products and improve quality while reducing production costs through advancements in products and processes. Additionally, considering packaging design can help address environmental concerns. While the research on GSCM is well-established, there is still a dearth of studies in developing countries such as Pakistan (Eltayeb et al., 2011). Many scholars have proposed green initiatives as organizational strategies in the developing world, but more research is needed on GSCM.

The literature extensively covers other green practices, but there is insufficient focus on reverse logistics in the context of environmental performance. Reverse logistics is a vital tool for addressing environmental issues in consumer-driven economies such as Pakistan. Therefore, this study aims to operationalize reverse logistics in the context of manufacturing firms in Pakistan and examine its role in enhancing environmental performance. The underlying idea is that isolated environmental practices alone cannot significantly impact the environment and industry (Geng et al., 2017; Dzikriansyah et al., 2023). When these practices are interconnected, they have a greater effect (Hervani et al., 2005).

Understanding the influence of GSCM practices on environmental performance is crucial for establishing a company's sustainable

performance. This study explores the causal associations between green purchasing, eco-design, reverse logistics, and environmental performance. The study proposes adapting green emission control policies in supply chains of large corporations so that they can encourage smaller peers to adopt similar practices. In doing so, this study offers a theoretical framework that incorporates green activities, collaborative drivers, and collaborative frameworks to address the existing research gap and identify future research opportunities, particularly in GSCM. The main question we seek to answer is: do GSCM practices significantly impact environmental performance in Pakistani manufacturing firms?

Furthermore, we address the gaps in current GSCM protocols in several ways. The results provide empirical evidence for the association between GSCM and environmental performance. In addition, this research expands the GSCM literature and emphasizes the importance of GSCM practices in influencing the environment and improving environmental performance. To achieve greater environmental performance in the GSCM context, an original matrix is proposed to explain the relationships and positive aspects of green purchasing, eco-design, and reverse logistics. Moreover, we focus on the Pakistani context since it is largely under-researched. Pakistan has not received much coverage in the literature on operations and environmental management. Therefore, we gather survey data from Pakistani manufacturing companies to conduct the investigation.

Implementing GSCM is particularly important for Pakistani manufacturing firms, as it helps them gain recognition within the global networks of multinational companies. This study has various implications for practitioners, academics and policymakers. The results are significant for enhancing environmental sustainability, which has been a challenge for the industrial sector, and for justifying the implementation of GSCM practices.

The rest of the study is organized as follows: Section 2 discusses the literature review and hypothesis development, while Section 3 outlines the methodology used to conduct this research. Section 4 provides the results with an accompanying discussion in Section 5. Finally, in Section 6, the practical and theoretical contributions of this study are discussed, along with suggestions for future research directions.

2. Literature Review

2.1. Theoretical Underpinning and Hypothesis Development

Compared to resource-based view (RBV) theory, practice-based view (PBV) theory focuses on well-known and widely applicable organizational practices across industries. PBV theory is centered on organizational knowledge, which contributes to strategic management. Additionally, PBV theory incorporates elements of the industrial-organizational, resource-based, and knowledge-based views to structure organizational strategic development. In simpler terms, PBV theory has the potential to explain industry structure, internal operations and practices, and the practicality of knowledge when formulating organizational strategies. Previous research supports the inclusion of PBV theory as a foundation, as widely adopted organizational practices significantly affect performance. The literature indicates that firms vary in their implementation of accepted practices, and these variations are closely linked to performance optimization (Khan & Qianli, 2017).

Studies conducted by Bloom et al. (2007, 2013) reveal the strong influence of practice-based strategies on organizational performance. These studies focus on common practices such as setting clear objectives, employing measurable performance metrics, attracting skilled human resources, providing performance-based compensation, and not rewarding underperformers (Rupa & Saif, 2021). The practices examined in these studies are widespread, technologically simple to replicate, and easy to transfer, with consistent findings observed across diverse countries. Notably, a study on Indian textile plants found that companies receiving specific advice from consultants on common practices demonstrated an 11 percent increase in performance compared to control groups that received general advice (Bloom et al., 2013).

These studies highlight that PBV theory can address practices that both enhance and hinder firm performance, making it a fitting theoretical framework for various situations. We propose that PBV theory is a valuable tool for analyzing the strategic practices employed by organizations to measure and enhance performance. By focusing on these practices, managers and policymakers can gain actionable insights and develop specific approaches to maximize performance.

2.2. Environmental Performance

Environmental performance refers to an organization's actions and initiatives aimed at minimizing its ecological footprint and maximizing its positive environmental impact (Yurdakul & Kazan, 2020). It includes aspects such as energy efficiency, waste reduction, pollution control, and resource conservation. Assessing environmental performance involves evaluating an organization's compliance with environmental regulations, adoption of sustainable practices, and efforts to combat climate change.

The literature identifies several factors that influence environmental performance (Kalyar et al., 2019), including organizational culture, the leadership's commitment to sustainability, technological innovation for cleaner production processes, stakeholder engagement, government policies and regulations, access to environmental information and expertise, and market incentives such as consumer demand for eco-friendly products and services. Effectively managing these factors can significantly improve an organization's environmental performance and contribute to a more sustainable future.

In recent years, GSCM has gained importance in conventional supply chain management. Some studies suggest that closer collaboration with vendors in product innovation can enhance overall business efficiency (Song & Benedetto, 2008). However, conflicting findings exist regarding this integration. The term 'green supply chain management' (Bowen et al., 2001) refers to the development of strategic tools that conserve natural resources. These tools facilitate the incorporation of GSCM, leading to improved environmental efficiency and business performance. This approach reduces waste, harmful substances and toxic chemicals, promoting community well-being (Dzikriansyah et al., 2023; Khan et al., 2023). Additionally, these activities contribute positively to environmental sustainability (Eltayeb et al., 2011). According to a case report on SMEs, green practices have resulted in reduced material and water use, as well as minimizing waste generation (Ki-Hoon, 2009).

Azevedo et al. (2011) emphasize that green initiatives can enhance environmental performance by reducing waste generated by businesses. Various studies (Zhu & Sarkis, 2004; Kung et al., 2012; Khan et al., 2022) provide evidence that green activities significantly decrease the production of hazardous waste through different practices. Environmental performance is evaluated based on the positive impact of GSCM and green engineering

activities on the natural environment, both internally and externally to organizations. Therefore, this study aims to assess environmental performance after implementing GSCM and green innovation practices in the manufacturing sector.

2.3. GSCM Practices

Numerous scholars have explored the importance of implementing a green supply chain for sustainable development ((Sarkis et al., 2011; Green et al., 2012; Khan et al., 2024). The natural resource-based view, as exemplified by Hart (1995), suggests that environmental initiatives can be a profitable source for enterprises. Implementing sustainable practices is believed to have positive effects on organizational sustainability, such as reducing energy consumption and material usage, enhancing stakeholder engagement, lowering costs, and improving market efficiency.

Several studies have examined the impact of eco-friendly supply chain management on economic, environmental and social performance (Zhu et al., 2005, 2013; Zhu & Sarkis, 2007; Schmidt et al., 2017). However, Eltayeb et al. (2011) and Younis et al. (2016) note that the previous research has focused on economic and environmental performance, neglecting to address social performance, which is a crucial component of sustainability. Furthermore, most studies on GSCM have been conducted in developed countries (Geng et al., 2017).

The main environmental benefit of implementing GSCM is that it enhances an organization's environmental friendliness and overall efficiency (Fu et al., 2023). Unlike other areas of the company, such as production, GSCM is a broad field that encompasses various aspects, including organizational analysis and assessment of supply chain management activities (Kitsis & Chen, 2023). In this regard, several hypotheses have been proposed to promote the effective implementation of GSCM approaches (Kusi-Sarpong et al., 2016). While GSCM practices encourage organizations to adopt environmentally friendly technologies to improve their overall operational efficiency, the existing scientific evidence is insufficient to establish a definitive link between GSCM and the implementation of green innovation initiatives to enhance overall organizational efficiency. Therefore, further advancements are expected to effectively address the needs and expectations of all the stakeholders involved (Porter, 2000).

2.3.1. Eco-Design and Environmental Performance

The concept of eco-design, also known as environmental design, involves various stages in which companies develop products or manufacturing processes that have a limited environmental impact (Zhu et al., 2008; Khan et al., 2023). According to Porter and Van Der Linde (1995), innovation plays a crucial role in enhancing a company's competitive advantage. With stricter environmental regulations, it becomes vital to have a comprehensive understanding of a product's lifecycle to make informed decisions on product and design processes. The use of green and ecologically sustainable products not only contributes to environmental preservation but also has the potential to provide a competitive edge to businesses. The main goal of eco-design is to minimize a product's environmental impact while ensuring it meets other essential design requirements, such as cost-effectiveness and functionality (Hejazi et al., 2023). The emphasis on investment recovery and the adoption of environmentally friendly design practices undoubtedly have a positive impact on environmental performance (Ahmad et al., 2022).

Likewise, an environmentally sustainable product greatly influences an organization's viability and serves as a means of gaining a tangible competitive advantage within the company (Grønhaug & Kaufmann, 1988). Many companies implement environmentally sustainable practices in their production processes to differentiate themselves from competitors and gain a competitive advantage (Reinhardt, 1998). Büyüközkan and Çifçi (2012) argue that adopting green design methodologies reduces the negative impact of businesses' products and processes on the environment. Observational research conducted by Zhu and Sarkis (2007) in China's automotive industry has shown that eco-friendly and sustainable practices can minimize the industry's impact on the environment and reduce costs. These practices can also enhance commonality and increase companies' inclination towards sustainability.

González-Benito and González-Benito (2005) argue that eco-design enterprises aim to reduce the use of hazardous substances during production while also achieving significant reductions in energy consumption. The use of eco-design techniques has been shown to positively impact a company's financial and environmental efficiency, as demonstrated by Abdullah et al. (2019). These approaches also contribute to generating a competitive advantage and enhancing business credibility and branding within the industry, as highlighted by Zailani et al. (2012). Noci and Verganti

(1999) use a qualitative methodology to investigate this phenomenon and find a positive association between product innovation and a firm's competitive advantage. Based on the above discussion and empirical evidence, we propose the following hypothesis:

Hypothesis 1: Eco-design has a positive impact on firms' environmental performance.

2.3.2. Green Purchasing and Environmental Performance

Green purchasing refers to the practice of considering environmental factors when making purchases (Rao & Holt, 2005). Selecting the best supplier has a significant impact on achieving a business's environmental priorities. However, choosing the right provider alone is not sufficient to enhance environmental efficiency. It is also necessary to evaluate the management and procurement practices of the supplier to ensure they meet the company's environmental requirements (Ho et al., 2010). Customers and buyers who are highly concerned about environmental issues and policies expect manufacturers to deliver goods and materials that address these concerns.

Additionally, it is important for manufacturers to eliminate materials and packaging that may harm the environment early in the product production process. Rao (2002) observes that green buying programs contribute to greener suppliers and technologies. Several studies have shown that supplier integration can lead to performance deterioration, such as increased time and development costs (Zirger & Hartley, 1994; Ragatz et al., 2002). Green et al. (1996) suggest that green procurement and supply strategies are likely to result in greater environmental outcomes.

Additionally, GSCM activities are explicitly designed to enhance the environmental performance of manufacturing firms. Practices such as green purchasing, consumer cooperation, eco-design, and investment recovery are aimed at improving environmental performance (Ahmad et al., 2022). Furthermore, research has shown that green purchasing is the most significant factor in the effectiveness of environmental management schemes and practices (Zhu & Sarkis, 2004). Firms can enhance their sustainability impact by providing training to suppliers on environmental challenges and helping them develop environmental management system plans (Hamner, 2006). Previous studies (e.g., Bai & Sarkis, 2010) have aimed to construct environmental management frameworks for strategic sourcing.

Based on the positive impact of green purchasing in achieving environmental benefits, we propose the following hypothesis:

Hypothesis 2: Green purchasing has a positive impact on firms' environmental performance.

2.3.3. Reverse Logistics and Environmental Performance

Reverse logistics is a vital component of supply chain management, but it has often been undervalued and underexplored in research (Li et al., 2022). Consequently, there are only a limited number of comprehensive models that incorporate reverse logistics methods in green supply chains. Reverse logistics is typically defined as the process of moving goods in the opposite direction, typically for recycling, remanufacturing, or disposal purposes, from the customer back to the producer (Dowlatshahi, 2000). Reverse logistics processes emphasize the use of products with fewer environmentally harmful raw materials and resource substances, as well as the replacement or recycling of parts or materials (Wu & Dunn, 1995).

While academic research on reverse logistics is growing, it has long been a topic of debate in strategic practice (Georgiadis & Vlachos, 2004; Ellis, 2006). Employing reverse logistics to manage the green supply chain can transform a damaging process into a positive one, reducing inventory costs and enabling effective product management through revenue improvements (Ellis, 2006). Moreover, it increases consumer expectations of product quality and purchasing risk, while also reinforcing their concept of corporate citizenship, particularly in terms of environmental responsibility (Mollenkopf et al., 2005).

The literature suggests that reverse logistics can be seen as the most crucial and dynamic operation within a green supply chain (Rogers & Tibben-Lembke, 2001). Some studies have found a positive relationship between reverse logistics and environmental efficiency (Huscroft et al., 2013). Considering the above discussion, we propose the following hypothesis:

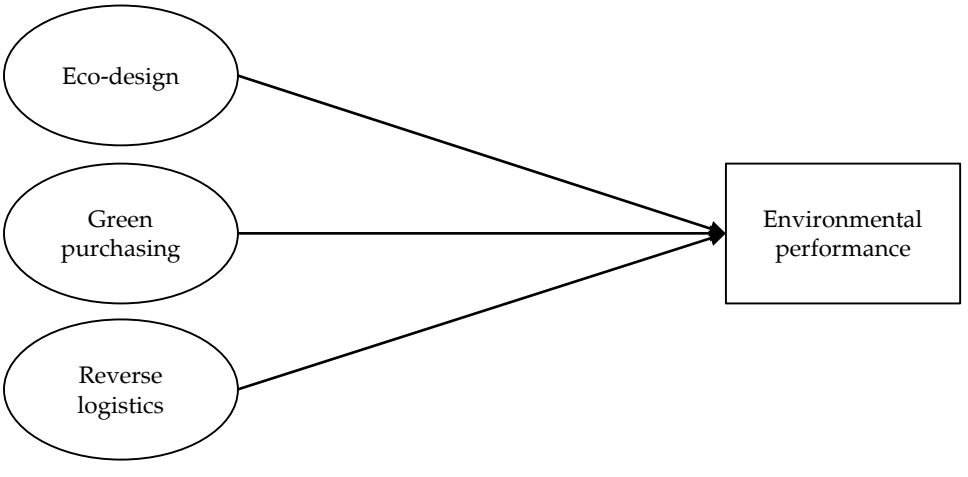
Hypothesis 3: Reverse logistics has a positive impact on firms' environmental performance.

2.4. Research Framework

In eco-design, we consider the environmental impact of a product at every stage of its lifespan, without compromising important design criteria such as price or usefulness. Reusability, product recovery, remanufacturing, resource efficiency, and the ability to disassemble components for reuse are all crucial elements of eco-friendly design. Eco-design actively manages a product's performance in terms of energy consumption, resource allocation, pollution, and waste generation, thereby reducing environmental hazards throughout its lifespan. Green purchasing demonstrates a nation's commitment to economic growth and prosperity while safeguarding the environment and the resources used in production.

Moreover, by ensuring that businesses purchase environmentally friendly items, green procurement contributes to the long-term sustainability of these organizations. Reverse logistics brings several benefits, including reduced waste, increased resource conservation, and extended product life cycles. Recycling helps conserve both energy and raw materials, while reusing or repairing items serves manufacturing and packaging requirements. Figure 1 illustrates the study's research framework.

Figure 1: Research Framework



3. Methodology

3.1. Sample Size and Sampling Technique

This study has employed a deductive approach and quantitative techniques to complement its explanatory research design. The sample size was calculated using G-Power and based on the description by Saunders et al. (2003). This research method focuses on testing hypotheses and analyzing the results to validate or reject them. Convenience sampling was used due to the unavailability of a proper sampling frame and an unknown population.

3.2. Data Collection

Initially, convenience sampling was used to select 250 supply chain professionals from small, medium and large manufacturing firms in Pakistan. Data was collected using a well-designed questionnaire that utilized a Likert scale ranging from 1 ('strongly disagree') to 5 ('strongly agree'). The questionnaire was created on Google Forms and distributed to participants through various channels, such as LinkedIn, email, WhatsApp, Facebook, and lead generation techniques. The questionnaire was adapted from the previous literature on GSCM. The GSCM practices and environmental performance data were obtained from Zhu and Sarkis (2004) and Zhu et al. (2013). The data collection took place in Karachi as it is the largest manufacturing hub in Pakistan. A total of 214 complete and usable responses were received and used for data analysis.

3.3. Data Analysis Technique

Structural equation modeling (SEM) was employed to analyze the data. This technique combines factor analysis and multiple regression analysis to evaluate the relationships between measured variables. SEM is a multivariate statistical analysis method used to assess structural links. AMOS 21 software was utilized for data analysis, as it is a well-known software in the social sciences with well-defined threshold values.

4. Data Analysis

4.1. Descriptive Analysis

The primary purpose of the descriptive analysis is to provide a concise summary of the key aspects of the data in this research. It offers an

overview of how respondents from different industries have utilized green supply chain techniques to enhance environmental performance.

Table 1 presents the average company size of the sample. Out of the 214 respondents, 47 (or 22 percent) represented businesses with 200–399 staff members. A total of 32.7 percent of the businesses had over 1,000 employees (70 enterprises). Therefore, the majority of the respondents were from medium or large corporations. Table 2 displays the respondents' information by sector. Nearly 50 percent of the respondents came from various industries, including food products and beverages, computer and electronic products, car and transport equipment, and the chemical/rubber industry. Additionally, 76 out of 214 companies (36 percent) did not have ISO14000 certification, while 63 companies (29.4 percent) had ISO14000 certification.

Table 1: Demographic Profile of Employees

		Frequency	Percent	Valid percent	Cumulative percent
Valid	between 200 and 399	47	22.0	22.0	22.0
	between 400 and 599	14	6.5	6.5	28.5
	between 600 and 899	2	.9	.9	29.4
	between 900 and 1,000	18	8.4	8.4	37.9
	over 1,000	70	32.7	32.7	70.6
	under 200	63	29.4	29.4	100.0
	Total	214	100.0	100.0	

Table 2: Demographic Profile of Firms

		Frequency	Percent	Valid percent	Cumulative percent
Valid	Airline	8	3.7	3.7	3.7
	Arms production	4	1.9	1.9	5.6
	Bank	2	.9	.9	6.5
	Building material	7	3.3	3.3	9.8
	Car and transport equipment	19	8.9	8.9	18.7
	Chemical, rubber, and plastic products	14	6.5	6.5	25.2
	Clothing manufacturing	8	3.7	3.7	29.0
	Computer and electric products and components	27	12.6	12.6	41.6
	Defense	4	1.9	1.9	43.5
	Electrical and mechanical services	6	2.8	2.8	46.3
	Food products and beverages	47	22.0	22.0	68.2
	Freight forwarding company	7	3.3	3.3	71.5
	Healthcare	4	1.9	1.9	73.4

	Frequency	Percent	Valid percent	Cumulative percent
Health-related	6	2.8	2.8	76.2
Hospital	4	1.9	1.9	78.0
IT services	4	1.9	1.9	79.9
Medicines	4	1.9	1.9	81.8
Pharmaceutical	7	3.3	3.3	85.0
Service	9	4.2	4.2	89.3
Services	7	3.3	3.3	92.5
Solar, energy, testing lab machines	6	2.8	2.8	95.3
Switchgear	1	0.5	0.5	95.8
Terminal operations	9	4.2	4.2	100.0
Total	214	100.0	100.0	

4.2. Reliability of Measurement Model

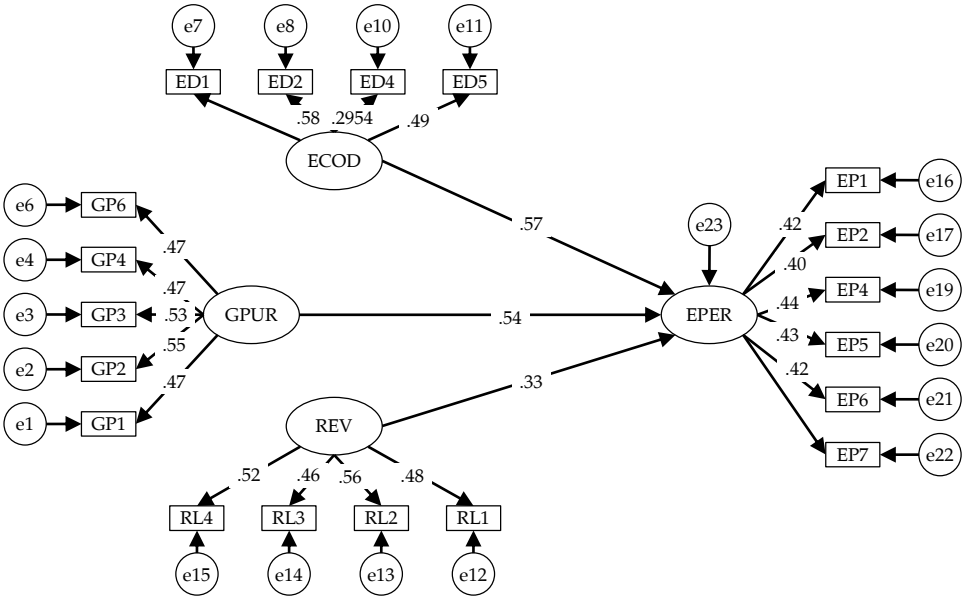
The questionnaire consisted of 19 items that assessed the relationship between environmental performance, reverse logistics, eco-design, and green purchasing. To determine the questionnaire's reliability, Cronbach's alpha was calculated for the four latent components. The reliability and consistency of the questionnaire were excellent, with a Cronbach's alpha greater than 0.7. Dependability indicators are provided in Table 3, which also presents the findings for all constructs. The composite reliability scores for the constructs are all above the recommended 0.7, indicating a high level of precision in the measurements.

Table 3: Summary of Reliability Analyses

Construct/variable	Cronbach's alpha	No. of items
Eco-design	0.81	4
Reverse logistics	0.78	4
Green purchasing	0.76	5
Environmental performance	0.88	6

Confirmatory factor analysis (CFA) is a statistical technique used to evaluate the quality of a model with latent factors. The model measures the variance caused by the structural model in the observed set of variables linked to the independent variables. Figure 2 displays the values indicating the fit of the model to the data. The values show a medium fit between eco-design and environmental performance (0.57) and moderate conformity between green purchase and environmental performance (0.54). The correlation between reverse logistics and environmental performance is fair (0.33).

Figure 2: CFA Results



4.3. SEM Estimation and Hypothesis Testing

SEM estimation and hypothesis testing are performed after analyzing all the components of the theoretical causal model. AMOS 21 was used to evaluate the assumptions. The results of the structural model are as follows: $\chi 2 = 0.909$; df = 1.389; p = 0.000; CFI = 0.913; RMSEA = 0.043.

Table 4: Model Fitness (CMIN)

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	44	202.821	146	0.001	1.389
Saturated model	190	0.000	0		
Independence model	19	827.869	171	0.000	4.841

A CMIN/DF value less than 3 indicates a good match between the hypothetical model and the sample data (Table 4).

Table 5: Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	0.755	0.713	0.917	0.909	0.913
Saturated model	1.000		1.000		1.000
Independence model	0.000	0.000	0.000	0.000	0.000

The chi-square test and the normed fit index may be affected by small sample sizes. The comparative fit index (CFI) assesses model fit by comparing it to the hypothesized model. Higher values on the CFI scale (ranging from 0 to 1) indicate a more satisfactory fit (Table 5).

Table 6: RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	0.043	0.027	0.056	0.801
Independence model	0.134	0.125	0.144	0.000

An RMSEA value below 0.08 indicates a close approximation. The result of 0.043 suggests a satisfactory match with the given model (Table 6).

Table 7 shows that eco-design has a positive impact on environmental performance (β= 0.416; p = 0.000). This means that hypothesis 1 is accepted, indicating that companies with eco-design practices achieve greater environmental performance. The results suggest that eco-design can influence environmental performance by implementing green packaging, labeling, and practices that extend the product's lifecycle. This positive impact of eco-design is expected to encourage companies to adopt environmentally friendly behaviors.

The second hypothesis, stating that green purchasing has a positive impact on environmental performance, is also accepted (β= 0.563; p = 0.002). The results reveal a positive correlation between green purchasing and environmental performance. This implies that companies with a positive attitude toward green purchasing exhibit higher environmental performance. Two conclusions can be drawn from this finding: green purchasing increases companies' concern for environmental performance, and ISO certifications can be utilized to enhance their environmental performance.

The third hypothesis, which suggests that reverse logistics has a positive impact on environmental performance, is also accepted (β= 0.288; p

= 0.013). This demonstrates that companies that incorporate reverse logistics into their operations tend to improve their environmental performance. These results suggest that to encourage companies to adopt green reverse logistics, environmental concerns need to be emphasized. Companies should be convinced that environmental performance is equally important as financial performance. If the government and corporations succeed in raising environmental awareness, companies' overall attitude toward reverse logistics will become favorable, leading to an improvement in environmental performance.

Table 7: Hypothesis Testing

			Estimate	SE	CR	p value
EPER	<---	ECOD	0.416	0.123	3.382	0.000
EPER	<---	GPUR	0.563	0.181	3.104	0.002
EPER	<---	REV	0.288	0.116	2.483	0.013

5. Discussion

This research contributes to the growing body of knowledge on green supply chain practices by examining the relationship between GSCM activities and environmental outcomes. The study focuses on three aspects of GSCM: green purchasing, eco-design, and reverse logistics, and their impact on environmental performance. The results show that all three GSCM practices significantly contribute to environmental performance. Managers can use these findings to select appropriate GSCM strategies to improve specific performance areas. Green purchasing, eco-design, and reverse logistics are key external GSCM activities that have a positive influence on environmental performance.

These findings are consistent with previous research. For example, Sroufe et al. (2000) and Walker et al. (2008) both find a positive association between eco-design and environmental performance. Green et al. (2012) report a positive connection between eco-design and environmental performance, although it was unrelated to financial performance. Zhu and Sarkis (2004) highlight the substantial positive correlations between eco-design and environmental performance. Since eco-design is a company-wide effort, it focuses on improving the environmental characteristics of goods and processes internally, with minimal collaboration with other businesses. Therefore, the impact of such an improvement is directly related to the firm's internal performance.

Dangelico et al. (2017) also emphasize the positive influence of eco-design on environmental performance when considering different GSCM methodologies. An eco-design strategy can give firms a competitive advantage by creating durable goods and designing products or manufacturing processes that consume less energy. To mitigate environmental and economic risks and develop eco-designed products and processes, more businesses are forming partnerships with customers and suppliers (Vachon & Klassen, 2006). Thus, previous research supports the idea that eco-design improves environmental performance.

Additionally, there is a positive link between eco-friendly spending and environmental performance. This may be because a company's environmental performance drives its green purchasing strategy (Eltayeb et al., 2011). Schoenherr et al. (2014) find that green purchasing is connected to improved environmental performance and can be considered a strategic resource. However, few empirical studies have explored the impact of customer collaboration on promoting green principles in supply chains (Kumar et al., 2014). Generally, an organization's response to consumer pressures depends on its green purchasing activities, and the level of green purchasing reflects the influence of customers (Walker & Jones, 2012). This study provides insights into customer collaboration in supporting green purchasing efforts.

Previous research also shows that green purchasing and supply chain management practices benefit environmental performance (Green et al., 1996). Green marketing strategies have been shown to enhance a company's reputation, image, and sales, thereby positively affecting its environmental and economic performance (Abdullah et al., 2019). Sarkis et al. (2011) also stress the importance of customer collaboration and green purchasing as significant corporate resources. Del Brío et al. (2007) propose an innovative matrix approach within a GSCM framework to understand the link between the responsibilities of green suppliers and customers in achieving greater environmental performance.

Reverse logistics has been proven to be effective in reducing waste and costs, as evidenced by several studies (Hosseini et al., 2014). Recent research has emphasized the crucial role of reverse logistics in supply chain management, as it allows for the identification and critical analysis of supply chain problems (Kumar et al., 2014). Studies have also shown that reverse logistics has an impact on environmental performance (Christmann, 2000; Huang et al., 2010).

Reverse logistics techniques are highly effective in lowering consumer risk, building a positive brand image, and ensuring customer loyalty, ultimately leading to increased customer value (Rogers & Tibben-Lembke, 2001; Russo & Cardinali, 2012). However, the successful implementation of reverse logistics requires the coordination of both forward and backward material and information movements (Guide & Van Wassenhove, 2002). Tibben-Lembke (2002) highlights the importance of considering product life cycle features and their interaction with reverse logistics in terms of environmental performance. Furthermore, Vasudevan and Prakash (2016) find that reverse logistics is a critical component of recycling in businesses.

6. Conclusion and Recommendations

Based on PBV theory, this study has operationalized and tested the relationships between green purchasing, eco-design, reverse logistics, and environmental performance. The results indicate that eco-friendly supply chain practices improve environmental efficiency. Specifically, green purchasing, eco-design, and reverse logistics all have a positive impact on environmental performance. Therefore, we can conclude that these factors significantly influence the environmental performance of businesses.

Among the variables examined, green purchasing and eco-design have the greatest impact on environmental performance. The study revealed a strong association between green purchasing and environmental performance. This may be because green purchasing methods prioritize environmental protection, which directly affects a company's environmental performance. Furthermore, by implementing efficient reverse logistics solutions, businesses can reduce carbon emissions, improve air quality, and eliminate wasteful trips caused by inefficient return processes. Companies are increasingly adopting reverse logistics methods such as return management, refurbishing, recycling, and proper disposal of materials to promote sustainable development, reduce costs, and extend the lifespan of products. Consequently, this facilitates the integration of green practices throughout the entire supply chain.

6.1. Theoretical and Practical Implications

This study draws on PBV theory and contributes to the existing literature, with several theoretical implications. Unlike RBV and institutional theory, the integration of PBV theory offers a practical

implementation of strategic approaches like GSCM. As a result, it yields better outcomes and generates more favorable results for manufacturing firms in tackling environmental issues.

This research also has practical implications for both manufacturing practitioners and policymakers. In developing nations, most producers aim to improve their economic conditions. However, companies that prioritize short-term gains at the expense of the environment are destined to fail in the long run. Managers can utilize the findings from this study to assess the costs and benefits of various eco-friendly initiatives, thereby enhancing the company's long-term financial and environmental performance.

6.2. Limitations

This research focuses on the implementation of GSCM techniques in manufacturing companies in Pakistan. It is worth considering that the model can also be applied to other types of businesses in Pakistan, such as wholesalers and retailers. In future studies, it would be beneficial to examine and analyze the circumstances that promote consumer collaboration at both the macro and micro levels. Other areas for investigation include interindustry disparities, the impact of human resource practices and organizational structures, and the influence of managers' environmental views and attitudes.

While this study primarily focuses on Karachi, future research could be conducted in other geographical areas. Furthermore, due to the inclusion of small and medium firms in Pakistan, basic GSCM practices were selected as they require fewer resources. To further enhance the understanding of GSCM on a national level, future studies could explore different GSCM practices. Finally, it is important to note that this research used convenience sampling, which limits the generalizability of the results. Future research could adopt a probability sampling method to better represent the population.

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