

Article

Integrating Green Entrepreneurial Orientation, Green Information Systems, and Management Support with Green Supply Chain Management to Foster Firms' Environmental Performance

Rashed Al Karim ^{1,*} , Md Karim Rabiul ² , Towhid Ahamed ¹, Dewan Niamul Karim ³ 
and Mahmuda Mehzabeen ¹

¹ School of Business Administration, East Delta University, Chittagong 4209, Bangladesh; ahamedtowhid1@gmail.com (T.A.); mmehzabeen46@gmail.com (M.M.)

² Faculty of Hospitality and Tourism, Prince of Songkla University, Phuket 83120, Thailand; mdkrabiul@gmail.com

³ Department of Management Studies, Jahangirnagar University, Savar, Dhaka 1342, Bangladesh; niamulmgt@juniv.edu

* Correspondence: alkarim.rashed@gmail.com

Abstract: This study examines the mediating role of green entrepreneurship orientation and the green information system on green supply chain management and firms' environmental performance relationship. It also investigates the moderating role of management support in the above association. The data were gathered from 355 manufacturing employees conveniently via a structured questionnaire administered during the survey. PLS-SEM was employed to analyse the data. Green entrepreneurial orientation and the green information system mediate the green supply chain management and environmental performance relationship. Equally, management support moderates the same association. The mediating role of green entrepreneurial orientation and the green information system and the moderating role of management support are the unique contributions towards green supply chain management and environmental performance association.

Keywords: green supply chain management; green entrepreneurial orientation; green information system; management support; environmental performance



Citation: Karim, R.A.; Rabiul, M.K.; Ahamed, T.; Karim, D.N.; Mehzabeen, M. Integrating Green Entrepreneurial Orientation, Green Information Systems, and Management Support with Green Supply Chain Management to Foster Firms' Environmental Performance.

Sustainability **2024**, *16*, 4921. <https://doi.org/10.3390/su16124921>

Academic Editor: Alessio Ishizaka

Received: 22 April 2024

Revised: 5 June 2024

Accepted: 6 June 2024

Published: 8 June 2024



Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

The organization's green responsibilities have garnered increased interest due to the growing consciousness among customers regarding the preservation of the environment, social responsibility, and environmental sustainability [1,2]. Therefore, green supply chain management (henceforth GSCM) has attracted considerable interest in recent years [3–5]. GSCM practices have been adopted by organizations in response to consumer demand for environmentally sustainable products and services [6–8]. Furthermore, rising consumer environmental consciousness and regulatory regulations are driving enterprises to manage their operations from an environmental aspect with the application of GSCM for the economy's long-term growth [1,3,9]. Most manufacturers today use GSCM to cut down on waste, pollution, resource use, and greenhouse gas emissions [10]. To prevent suboptimal performance at the partner level and develop environmentally favourable processes, products, and services, it is imperative that every link in the supply chain coordinates its endeavours [11]. To address the growing environmental issues including resource scarcity, climate change, and environmental pollution, the economy must be developed in a green and sustainable way [12]. By integrating energy efficiency and waste reduction into manufacturing processes, a GSCM strategy can assist a company in advancing technological innovation while simultaneously reducing environmental contamination caused by operations [5,13,14].

Because of the growing danger to the world's environment from the rapid development of the industrial sector, environmental sustainability has emerged as a pressing issue in recent years [9]. GSCM may boost corporate sustainability by reducing energy and material use, enhancing stakeholder involvement, lowering expenses, and improving product quality. Every step of the supply chain, from the procurement of raw materials to manufacture, distribution, and storage, as well as packaging, is carried out with the goal of lowering carbon emissions [13].

In contrast, Bangladesh's manufacturing sector also has issues with supply, transportation, and other infrastructure issues. The inefficiency and environmental concern in that industry's transport networks influence the sector's overall sustainability [15]. The environment is also adversely impacted by the RMG, textile, steel, leather, and other manufacturing industries' waste disposal in Bangladesh [16–19]. Additionally, excessive waste disposal from the Bangladeshi manufacturing industry damaged the marine environment's physical, biological, and chemical components, endangering the health of people, cattle, animals, fish, and other species [16,17]. GSCM techniques are expected to reduce air pollution, liquid and solid waste, and the use of hazardous substances, which are used to measure environmental performance (ENP). The Bangladeshi manufacturing industry, crucial for socioeconomic growth, faces encounters in water and air pollution, workplace safety, and worker social security. Despite these challenges, companies recognize the importance of GSCM techniques for sustainable success, with some industries incorporating environmental considerations into their corporate policies, while others have yet to do so [20].

Although previous research has made significant contributions to our knowledge of the impacts of GSCM on long-term organizational performance, there are still significant gaps for improvement. First, earlier research in Bangladesh focused on GSCM procedures and obstacles [16,17] as well as critical success factors of GSCM [21], GSCM practices assessment [22], and the influence of GSCM on behavioural intention [8] and firms' sustainable performance [20,23]. However, a limited number of studies [7] (Karim et al., 2024) have focused on how GSCM practices impact the manufacturing industry's ENP in Bangladesh based on employee perspectives. More specifically, it is unknown how GSCM is linked to ENP through green entrepreneurial orientation (GEO) and green information systems (GISs). Henceforth, we test the mediating role of GEO and GIS between GSCM and ENP relationship.

Second, according to Al shourah [24], the most significant component in adopting GSCM is management support at all levels. Upper management's dedication is crucial for environmental excellence [25–27]. Moreover, the initial step towards success can be taken by top management through promoting employee involvement, fostering a cultural shift, enhancing knowledge management, and cultivating committed employees [28–30]. For these reasons, this study argues that management support is a crucial moderating variable to strengthen the relationship between GSCM practices and the ENP of firms. Nonetheless, the earlier scholars ignored how the GSCM and ENP relationship is moderated by management support (MS).

Consequently, the two objectives are the following: (1) to determine the nexus of GSCM and ENP in the context of Bangladesh's manufacturing industry, with GEO and GIS serving as mediators; and (2) to investigate the moderating role of MS in the relationship between GSCM and ENP. Through an investigation of the moderating impact of MS and the mediating effects of GEO and GIS on the connection between GSCM practices and ENP, the findings of this study will enhance the current knowledge base by addressing the identified research gaps and facilitating the transition towards a sustainable manufacturing industry through the reduction of negative environmental consequences.

Since this study examines the impact of GSCM approaches on organizations' ENP, it employs a natural resource-based perspective (NRBV) as a theoretical framework. The NRBV is an extension of Barney's [31] resource-based perspective (RBV). The NRBV builds on Barney's [31] resource-based viewpoint (RBV) which defines internal abilities and resources as restricted, essential, valuable, and irreplaceable. In 1995, Hart [32] introduced

an extended iteration of this viewpoint, referred to as the natural resource-based viewpoint (NRBV), which considers the firm's interaction with the natural environment. This NRBV comprises three interrelated strategic capabilities: pollution prevention, product stewardship, and sustainable development. NRBV posits that environmental applications, including GSCM, can be regarded as a strategic resource that improves the performance of a firm. This is because GSCM practices are challenging for competitors to replicate, as they are founded on knowledge and experience. For instance, competitors are unable to readily replicate the positive image that can be established through GSCM [1,23].

2. Literature Review

2.1. Green Supply Chain Management (GSCM)

The conventional supply chain consumes a lot of resources and emits a lot of pollutants, resulting in resource scarcity, environmental harm, and pollution [2,14]. Implementing GSCM is critical for long-term company and environmental growth [14,33]. GSCM is the process of converting green inputs or materials into green outputs that may be recycled and reused at the final stage of the lifespan [2]. As defined by Zhu et al. [34], GSCM integrates reverse logistics, green purchasing, and the entire process cycle—suppliers, manufacturers, and customers—into the supply chain. GSCM is becoming more popular because it is now a requirement for every organization to cut down on activities that hurt the environment and enhance how customers and suppliers of green products work together [14]. GSCM is all-green activities for buying, making, distributing, and getting things back and considers all stages of material and logistical management as well as the waste disposal after it has been used [35]. The main goal of GSCM is to reduce things that harm the environment, such as wasting products, using up non-renewable resources, and making pollution [12].

2.2. Green Entrepreneurial Orientation (GEO)

GEO, an entrepreneurial method, considers enterprise decision-making in critical company-level jobs, strategy-making, and management ideas to find innovative ways to build and revive organizations [36]. GEO helps companies anticipate customer requirements and offer new goods and services before rivals since competition encourages companies to explore new possibilities [20,37]. GEO supports entrepreneurs as they pursue their objectives of green innovation and risk-taking, as well as finding new opportunities and making revenue [23]. Entrepreneurial orientation often grasps the firm decision-making stance in the major firm-level task, strategy-making process, and management concepts to uncover new prospects for organizational development and renewal [36].

2.3. Green Information System (GIS)

Yang et al. [38] define green information systems (GISs) as customized information systems used to monitor environmental activities and consequences. GIS aids in the creation and implementation of information systems (ISs), such as collaboration software, teleconferences, environmental monitoring systems, and automation systems, which foster and promote environmentally conscious operations and long-term growth [38–40]. It supports and strengthens organizational activities for innovative green thinking and environmental sustainability [38]. Some researchers, for example [41,42], say that you cannot have a good supply chain without GISs. Similarly, it has been shown that information systems are crucial for environmental sustainability, as they facilitate the alignment of organizational practices with information planning and sustainability. Although GIS was only conceptualized recently, it is already being indicated as a game-changer in the fields of environmental management and sustainability innovation [38,43,44].

2.4. Environmental Performance (ENP)

Environmental performance includes producers' attempts to minimize eluent waste, rubbish, airborne pollutants, and the usage of toxic substances [6,34]. Previous research has provided insights into the GSCM practice's planned work for focusing on envi-

ronmental performance [6,25]. A few factors that reflect the decreased use of energy, toxic/harmful/hazardous material use, and waste abatement are used to measure ENP. Because most of the product attributes are decided during this phase, eco-design is another green technique that is regarded as the one with the most significant impact on ENP [6]. The industrial sector has several opportunities to use GSCM and green strategies to increase its environmental performance. These environmental controls raise the organizations' chances of surviving in the actual world. Because of their significance to the ENP system and the company's long-term viability, environmental analytics and reviews have been increasingly important in recent years [45].

2.5. Hypothesis Development

2.5.1. Relationship between GSCM and ENP

In the production and operations management field, the connection between GSCM methods and ENP has been extensively researched and practically confirmed [20,46]. GSCM has become a strategic need because of the growing consumer demand for goods that are both ecologically sustainable in and of themselves and are created using environmentally friendly production techniques [8,25]. GSCM strategies assist in increasing environmental performance by using less water, energy, and hazardous and toxic materials in manufacturing, as well as producing less waste, effluent, air pollutants, and environmental disasters. GSCM strategies enhance the well-being and safety of employees and communities [20,47]. ENP improvements were found to be positively correlated with the adoption of GSCM techniques, according to Yildiz Çankaya and Sezen [48]. Practices including eco-design, consumer participation, green purchasing, and investment recovery are intended to have a positive effect on ENP [25]. Numerous studies [25,46,47] looked at the different factors that affect how green supply chains are put into place and found a positive effect between green supply chains and ENP.

Hypothesis 1 (H1). *GSCM positively impacts ENP.*

2.5.2. Relationship between GSCM and GEO

GEO may be considered a highly valuable intrinsic capacity in terms of dynamic flexibility to adapt to and use strategic techniques (e.g., GSCM) and subsequently enhance the performance of the manufacturing industry [20,37]. GEO's resource mobilization skills help the manufacturing industry to use green technology and green manufacturing, which improve production efficiency while reducing energy consumption and contamination [20,49]. To address current and future issues raised by environmentally conscious customers and stakeholders, GEO discovers appropriate market potential and often takes proactive steps toward adopting environmentally friendly procedures [50]. Likewise, to optimize consumer value, the GEO firm innovates, develops, and offers ecologically sustainable products and services. Studies revealed a significant connection between GSCM and GEO [20]. After examining the association of GSCM and GEO, Alavi et al. [51] conclude that, in the contemporary world, locating pertinent and correct information is a useful tool for addressing environmental concerns and subjects for ensuring a safe environment.

Hypothesis 2 (H2). *GSCM positively impacts GEO.*

2.5.3. Relationship between GSCM and GIS

GIS activities focus on pollution avoidance, green purchasing, and sustainable development, while GSCM involves eco design, green operations, green procurement, and internal environmental management [38,44]. The effective implementation of the GSCM guidelines is contingent upon the capability of an industry's information systems to gather data about environmental sustainability measures as well as the consequences of its manufacturing,

procuring, selling, and logistical operations. The information necessary to advance environmental sustainability throughout the supply chain can be obtained through an analysis of the data [25]. GIS plays a crucial role in supporting the administration of environmental operations by assisting the organization's inner system of environmental management and addressing the reporting requirements of different stakeholders [25]. Since GSCM and GIS are both used to achieve ecological objectives, these actions are likely connected through shared dimensions. GSCM and GIS processes may give a synergy on business sustainability, albeit this integration is rather informal because neither relies on the other [38].

Hypothesis 3 (H3). *GSCM positively impacts GIS.*

2.5.4. Relationship between among GEO, GIS, and ENP

GEO is viewed as a crucial influencer and has a beneficial impact on the ENP of the industrial sector [52]. Government regulatory bodies, varied stakeholders, internal values, and moral standards push industries to decrease contamination that harms the atmosphere [53]. Internal GEO significantly influences industry motivation to advance ENP by compelling industries to establish a system for resource use and legal compliance [54]. Manufacturing companies with poor internal GEO are confronted with a few challenges about their validity; as a result, the industry is attempting to respond in a constructive way to improve its ENP [53]. ENP participation by manufacturing companies is also affected by external GEO. In proportion to Yu and Huo [55], external GEO forces organizations to progress their ENP due to stakeholder demand. In response to external GEO, manufacturing sectors are lowering air and earth pollution, resulting in pro-environmental conduct [55].

Several studies in the GSCM literature have emphasized the benefits of GIS strategic initiatives on the enduring environmental success of firms [12,38,56]. GIS is a critical resource for organizations seeking to advance green strategy through the optimization of information flows both internally and externally [38]. Organizational changes brought about by GIS, particularly those relating to the design and reengineering of business processes, not only increase productivity and effectiveness but also allow for quicker responses to societal and buyer necessities for ecologically sustainable products and services [12]. By advancing ENP in terms of quality, efficiency, and cost reduction, GIS-implementing organizations gain a competitive advantage over their adversaries. Furthermore, in terms of operations and strategy, organizations gain an edge when they recognize and capitalize on relational opportunities showed by GIS [56].

Hypothesis 4 (H4). *GEO positively impacts ENP.*

Hypothesis 5 (H5). *GIS positively impacts ENP.*

2.5.5. Mediating Role of GEO and GIS

Prior research indicates that industry adoption of GSCM techniques has a substantial effect on the ENP and GEO transforms industry practices by decreasing environmental impact and pollution [45,57]. GEO, unable to directly improve corporate efficiency without strategic actions such as GSCM procedures, incorporates entrepreneurial characteristics into strategy formulation [36]. The GEO-focused manufacturing industry seeks customer feedback to develop environmentally friendly products. The GEO-based enterprise quickly meets client demand for ecologically friendly products by using GSCM procedures, much to the satisfaction of environmentally aware customers [20]. On the other side, industries are integrated into competing companies, and GEO continuously watches opponent strategy. The GEO firm takes a proactive environmental effort, such as GSCM practice, before a rival action by methodically and continually gathering, monitoring, and evaluating competitor strategy [20]. Thus, we propose the following:

Hypothesis 6 (H6). *GEO mediates the GSCM and ENP relationship.*

Moreover, the role of GIS is that it can support GSCM-friendly practices and ENP growth. It enhances business operations in favour of environmentally friendly innovations and procedures [39,40,43]. In terms of coordination, implementing GIS encourages information exchange on environmental initiatives throughout the entire GSCM and helps to grow ENP [43]. GIS-driven organizational changes enhance productivity, effectiveness, and respond faster to societal and customer necessities for green products and services [12]. Additionally, before this study, the relationship between GSCM and ENP as mediated by GEO and GIS techniques had not been investigated. Hence, we suggest the following:

Hypothesis 7 (H7). *GIS mediates the GSCM and ENP relationship.*

2.5.6. Moderating Role of Management Support

The significance of multi-level management support in fostering effective GSCM practices becomes apparent when analysing the manufacturing industry. Efficient GSCM practices require the support of upper management because they highlight the principles outlined in the comprehensive foresight of the manufacturing industry and facilitate change via communication [24]. According to a thorough empirical review of 141 research studies on the support of upper management for GSCM practice adoption, it is the most important driver for firms to adopt GSCM practices. Managers should evaluate previous, current, and potential sustainability concerns to establish a streamlined organizational framework for innovative management strategies and implement policies and procedures to assist firms in adapting to GSCM practices [27]. In the Korean manufacturing sector, Chu et al. [58] discovered a positive correlation between GSCM and support from management. Furthermore, Agi and Nishant [59] discovered that the type of interactions between managerial staff and supply chain partners has a substantial influence and drives the application of GSCM techniques in Gulf nations' firms. A survey of Indian senior construction project managers found that their support for green problems strongly correlated with GSCM implementation, which promotes the expansion of the industry and environmental preservation through innovation and technology [26].

Furthermore, in the context of GSCM practices, the existing literature has clarified the significance of senior management support within the executive board and the commensurate effect on organizational commitment [29]. The successful adoption of environmental practices, such as GSCM practices, needs support not just from top management but from midlevel management. The endorsement of middle-level management is essential for the acceptance of green practices throughout all departments within an organization. Additionally, effective cooperation plays a vital role in ensuring the successful implementation of these practices. Effective interaction between business managers and environmental professionals is crucial for the implementation and maintenance of environmental practices within the realm of business management [28–30]. Considering the above discussions, we propose following hypotheses:

Hypothesis 8 (H8). *MS positively impacts ENP.*

Hypothesis 9 (H9). *MS moderates the GSCM and ENP relationship.*

3. Methods

3.1. Instrument, Sample, and Data Collection

To test the assumptions presented in the literature review (Figure 1), self-administered surveys were carried out in the manufacturing sector of Chattogram, Bangladesh's port and commercial city, using a standardized questionnaire. The questionnaire has two parts. The initial part includes respondents' gender, age, education, and managerial position. The second section consists of 27 questions categorized as green supply chain management

(GSCM1-GSCM6), green entrepreneurial orientation (GEO1-GEO5), green information system (GIS1-GIS8), management support (MS1-MS3), and environmental performance (ENP1-ENP5).

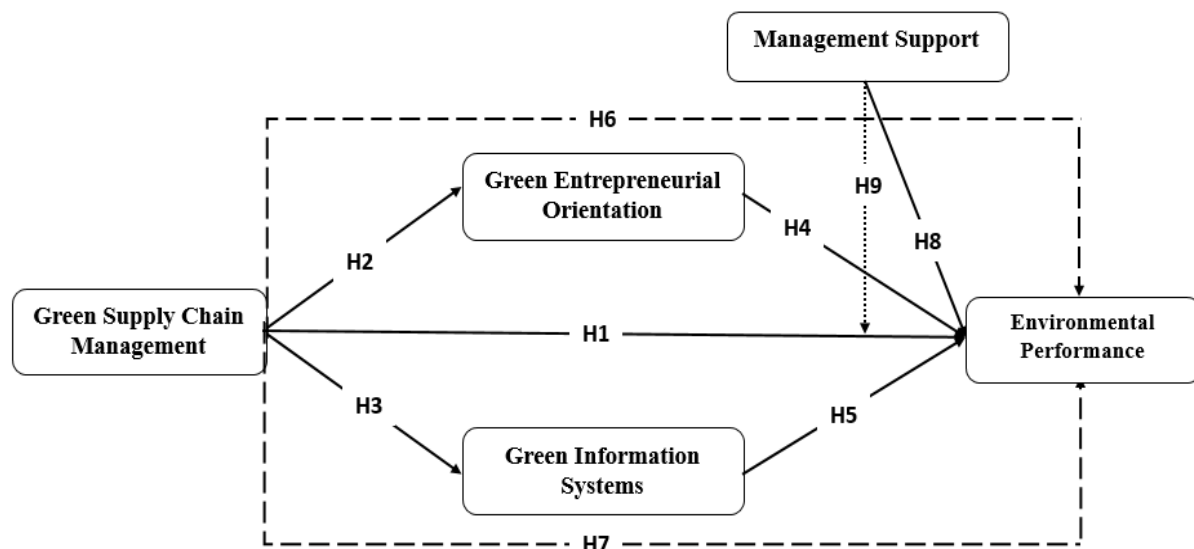


Figure 1. The conceptual framework of this study. Source: Developed by authors.

The organizations that were chosen as targets were chosen from a wide array of categories situated in Chattogram, encompassing the textile, steel, and ready-made garments industries. The selection process was contingent on personal relationships, including colleagues, friends, relatives, and connections with alumni. After a careful selection process, we sent an email to 50 manufacturing organizations, requesting their consent to participate in the survey. Out of 50, only 32 organizations were granted permission to conduct the survey. The respondents in this study were employed in various departments within specific organizations, holding positions ranging from executive to management.

In addition, the population size of the selected groups was indeterminate due to the absence of a comprehensive list for certain organizations, while others declined to disclose the information due to confidentiality concerns. Thus, we followed the recommendation provided by Krejcie and Morgan [60], which suggests that when the population is unknown, a sample size of 384 is adequate. Consequently, to accumulate data for this investigation, convenience sampling was implemented due to its simplicity, efficiency, and affordability. Additionally, we selected the employees from 32 manufacturing organizations for data collection based on their availability. Additionally, this sampling approach enables us to gather data from a substantial number of individuals with minimal effort. We took special precautions to protect the privacy and anonymity of respondents. Furthermore, we stated unequivocally that the data we obtained would be utilized purely for academic reasons, with no personal details gathered or shared with external parties.

In total, 600 questionnaires were disseminated to 32 manufacturing companies in Chattogram, the commercial capital of Bangladesh, including the steel industry, textile industry, and ready-made garment industry. The questionnaires were distributed physically with the cooperation and approval of HR managers from selected manufacturing organizations in Chattogram. The collection of data began in August 2023 and finished in October 2023. Out of 600 survey questionnaires, 378 were returned after many follow-ups. However, 23 of the 378 questionnaires were deemed unsuitable and eliminated from the investigation due to incompleteness. In this study, 355 questionnaires were found usable for further processing, with a 59.16% response rate.

3.2. Measures

To quantify both the endogenous and exogenous variables of the present investigation, a survey instrument with 27 items based on previously validated scales was developed. Employees of the selected organizations were asked to rate their opinions on a five-point Likert scale (where strongly disagree = 1 and strongly agree = 5). Following the prior study [2,8], we also considered GSCM as a unidimensional construct. Accordingly, we selected 6 items from Zhang et al. [2] to measure GSCM. Next, the mediating variables GEO and GIS contain 5 and 8 items, respectively, chosen from Habib et al. [23] and Green et al. [25]. The moderating variable MS has 3 items chosen from Zhu et al. [34]. Lastly, ENP contains 5 items obtained from Habib et al. [23].

3.3. Outliers, Common Method Bias, and Missing Data Treatment

All items for variables went through factor analysis in SPSS to examine the component matrix and variance percent of the variables. The fact that a single component accounts for 27.78% of the total cumulative variance of 61.45% indicates that the likelihood of common method bias is less as the value is less than 50% [61]. By employing the Mahalanobis distance check, outliers were identified and eliminated, whereas absent values were automatically detected by PLS-SEM. The absence of anomalies and incomplete data in the dataset was verified.

4. Findings

4.1. Respondents Profile

Approximately 54.4% of the participants were male, while 45.6% were female, as shown in Table 1. Regarding the age range, 41.7% of the respondents belonged to the 31–40 age bracket, 26.2% were between the ages of 21 and 30, and 22.2% were between the ages of 41 and 50. In terms of level of education, 44.5% of respondents held a master's degree, 27.6% held a bachelor's degree, and 25.9% held professional degrees. Regarding management level position, 40.3% of the respondents were mid-level managers, 34.4% were senior-level managers, and 18.6% were junior level managers.

Table 1. Respondents' demographic profile (N = 355).

Demographic	Category	Frequency	Percent (%)
Gender	Male	193	54.4
	Female	162	45.6
Age Group	21–30 Years	93	26.2
	31–40 Years	148	41.7
	41–50 Years	81	22.8
	Above 50 Years	33	9.3
Education	Bachelor's Degree	98	27.6
	Master's Degree	158	44.5
	Professional Degree	92	25.9
	Other	7	2.0
Management Position	Top level	122	34.4
	Middle level	143	40.3
	Junior level	90	25.4

Source: Developed by authors.

4.2. Measurement Model

To evaluate the convergent and divergent validity of the variables, the procedure recommended by Hair et al. [62] was employed. To measure convergent validity, an algorithm was employed to examine composite reliability (CR), item loadings, and average variance extracted (AVE). Table 2 shows that CR and AVE values exceeded Ramayah et al.'s [63] standards of 0.70 and 0.50, respectively. To improve data quality, two items such

as GSCM2 and GIS2 were deleted due to poor loading of below 0.5 [62]. The findings of the PLS algorithm are displayed in Table 2.

Table 2. Construct reliability and validity.

Construct	Items	FL	α	CR	AVE
Green supply chain management	GSCM1	0.712	0.858	0.899	0.641
	GSCM3	0.877			
	GSCM4	0.833			
	GSCM5	0.733			
	GSCM6	0.835			
Green entrepreneurial orientation	GEO1	0.843	0.859	0.899	0.641
	GEO2	0.761			
	GEO3	0.774			
	GEO4	0.832			
	GEO5	0.789			
Green information system	GIS1	0.692	0.852	0.888	0.531
	GIS3	0.786			
	GIS4	0.655			
	GIS5	0.774			
	GIS6	0.712			
	GIS7	0.701			
	GIS8	0.770			
Management support	MS1	0.899	0.893	0.933	0.823
	MS2	0.929			
	MS3	0.894			
Environment performance	ENP1	0.840	0.899	0.925	0.711
	ENP2	0.885			
	ENP3	0.819			
	ENP4	0.798			
	ENP5	0.872			

Note: FL = Factor Loading; α = Cronbach's Alpha; CR = Composite Reliability; AVE = Average Variance Extracted. Source: Developed by authors.

To establish the discriminant validity of the constructs, this study employed the HTMT ratio as recommended by Henseler et al. [64]. It is expected that the HTMT ratio should be below the threshold of 0.90. Along with the results provided in Table 3, the HTMT value does not surpass the specified threshold of 0.90, as proposed by Henseler et al. [64].

Table 3. Discriminant validity (HTMT).

Constructs	ENP	GEO	GIS	GSCM	IEM	VIF (<3)
ENP	-----					
GEO	0.839	-----				2.837
GIS	0.788	0.885	-----			2.889
GSCM	0.827	0.839	0.832	-----		2.600
MS	0.660	0.642	0.686	0.678	-----	1.732

Source: Developed by authors.

4.3. Structural Model

The current study employed the SmartPLS bootstrap technique, as suggested by Chin [65], to examine theoretical causal relationships. The multicollinearity issue was addressed at an early stage by the computation of the variance inflation factor (VIF). Table 3 shows that all predictors' VIF values are below the required 3.0 [62], indicating that multicollinearity is not an issue in this study. Next, we employ a bootstrapping procedure with 5000 resamples and 355 cases to determine the significance of the presented hypotheses as per Hair et al. [62]. Table 4 displays details of the hypothesis testing results.

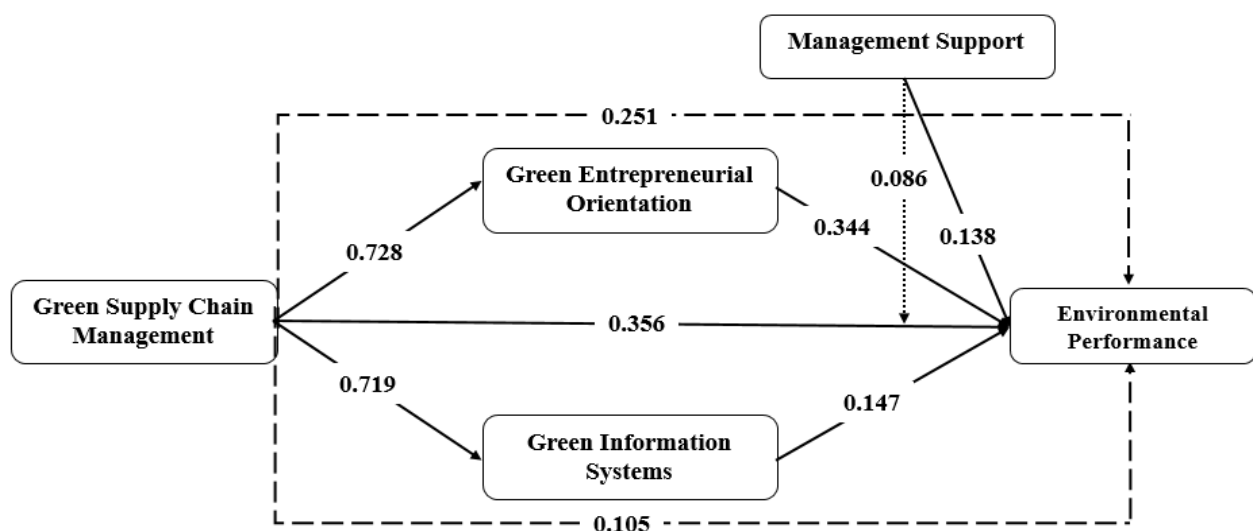
Table 4. Summary of hypotheses' results.

Hypothesis Path	Beta	t-Values	p-Values	CI(BC)		Decision
				5.0%	95.0%	
Direct effect						
H1: GSCM → ENP	0.356	5.411	0.000	0.252	0.468	Supported
H2: GSCM → GEO	0.728	22.528	0.000	0.666	0.774	Supported
H3: GSCM → GIS	0.719	19.974	0.000	0.646	0.769	Supported
H4: GEO → ENP	0.344	4.195	0.000	0.216	0.487	Supported
H5: GIS → ENP	0.147	1.884	0.030	0.021	0.278	Supported
H8: MS → ENP	0.138	2.370	0.009	0.040	0.232	Supported
Mediation effect						
H6: GSCM → GEO→ ENP	0.251	4.194	0.000	0.160	0.356	Supported
H7: GSCM → GIS→ ENP	0.105	1.884	0.030	0.016	0.200	Supported
Moderation effect						
H9: GSCM*MS → ENP	0.086	1.812	0.035	0.012	0.156	Supported

Note: CI(BC): Confidence Interval Bias Corrected. Source: Developed by authors.

Table 4 shows a substantial positive correlation between GSCM and ENP ($\beta = 0.356$; $p < 0.05$), GEO ($\beta = 0.728$; $p < 0.05$), and GIS ($\beta = 0.719$; $p < 0.05$). Similarly, GEO ($\beta = 0.344$; $p < 0.05$), GIS ($\beta = 0.147$; $p < 0.05$), and MS ($\beta = 0.138$; $p < 0.05$) were substantially and positively linked with ENP. Thus, the t-values and p-values support all the direct relationships (H1 to H5 and H8).

The mediation investigation shows that GEO ($\beta = 0.251$; $p < 0.05$) and GIS ($\beta = 0.105$; $p < 0.05$) act as mediators in the connection among GSCM and ENP, hence confirming hypotheses H6 and H7. Similarly, the moderating effect reveals that the interaction impact of MS ($\beta = 0.086$; $p < 0.05$) considerably influences the relationship between GSCM and ENP, hence providing support for hypothesis H9 (see Figures 2 and 3).

**Figure 2.** Estimated structural model. Source: Developed by authors.

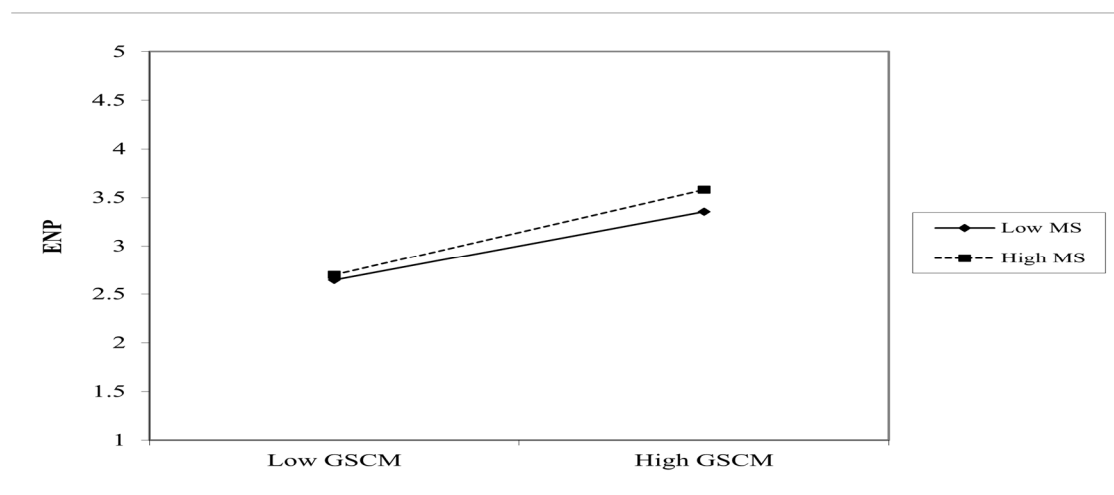


Figure 3. Visual presentation of moderator effect (MS). Source: Developed by authors.

4.4. Model Quality

In addition, the model quality was assessed using the R^2 value, PLS prediction, and SRMR value, as recommended by Hair et al. [62]. The findings, as presented in Table 5, indicate that the variables ENP, GEO, and GIS exhibit R^2 values of 0.658, 0.531, and 0.516, respectively. These values are considered to represent a moderate level of structural model quality, in accordance with the criteria established by Chin [65]. Furthermore, the Q^2 values of endogenous variables (ENP, GEO, and GIS) were larger than zero, suggesting the model's predictive ability [62]. Lastly, the SRMR value of 0.076 indicates a decent fit of the study model, as SRMR values below 0.08 are indicative of a good fit [64].

Table 5. Model Quality.

Constructs	R^2	Q^2 Predict (>0)	SRMR (<0.8)
ENP	0.658 (Moderate)	0.455	0.076
GEO	0.531 (Moderate)	0.332	
GIS	0.516 (Moderate)	0.266	

Source: Developed by authors.

5. Discussions

As posited, the study findings confirmed the significant effects of GSCM on GEO, GIS, and ENP and supported hypotheses $H1$ ($GSCM \rightarrow ENP$), $H2$ ($GSCM \rightarrow GEO$), and $H3$ ($GSCM \rightarrow GIS$). These findings were consistent with numerous authors' findings [23,25,46–48,56]. GSCM practices enhance the eco-friendliness of manufacturing operations and boost ENP where it is a metric used to evaluate a company's success in cutting down on environmental impacts such as pollution, waste, and chemical consumption [46,48]. According to the confirmation of $H1$, GSCM has become a strategic need because of the increased demand from customers for ecologically friendly products that are manufactured utilizing processes to improve ENP in the Bangladeshi manufacturing industry. In addition, GEO innovates, manufactures, and supplies environmentally friendly products and services, focusing on customer value maximization. Its resource mobilization capabilities aid in adopting green technology, increasing production efficiency, reducing energy use, and preventing pollution [23,49]. Similarly, GIS assists environmental governance by making institutional environmental management systems easier to use and meeting the reporting needs of diverse stakeholders [25].

As predicted, GEO and GIS are the powerful mechanisms of the manufacturing industry that maintain ENP, and they are significantly linked with ENP, thus confirming hypotheses $H4$ ($GEO \rightarrow ENP$) and $H5$ ($GIS \rightarrow ENP$). These results aligned with earlier

studies by Feng et al. [52] and Yasir et al. [53]. GEO is a crucial aspect of ENP, as industries face pressure to reduce pollution from various sources, including government regulations, stakeholders, industry ideals, and ethical values. The internal GEO significantly impacts the industry's motivation to progress ENP, leading to manufacturing businesses taking steps to reduce their contribution to air and ground pollution, a positive development for the environment [53,54]. Similarly, GIS has a role in supporting GSCM-friendly practices and ENP development. It improves corporate operations in favour of eco-friendly strategies and procedures [39,43]. In terms of collaboration, deploying GIS promotes information sharing on environmental activities throughout the whole GSCM and aids in the growth of ENP [43].

Correspondingly, GEO and GIS both mediate the relationship of GSCM and ENP in the Bangladesh manufacturing industry perspective and confirmed hypotheses H6 ($GSCM \rightarrow GEO \rightarrow ENP$) and H7 ($GSCM \rightarrow GIS \rightarrow ENP$). Other studies based on GSCM-ENP have not yet examined the combined mediating role of GEO and GIS in this association, making this study's contributions unique. Under such conditions, the manufacturing sector of Bangladesh can place greater emphasis on GEO. Industries are merged by competing businesses, and GEO monitors competitor strategies continuously. Moreover, GIS-GSCM collaboration actions such as decreasing pollution and hazardous materials, ensuring environmentally responsible purchasing, and developing eco-friendly goods may support sustainable development by assuring enterprises' ENP. Effective industry positioning is dependent on the GIS's capacity to capture data on environmental sustainability programs and the effects of the organization's manufacturing, procuring, marketing, and logistics operations [12,38]. Both GEO and GIS may help execute a preventive environmental effort, such as the GSCM practice, prior to a rival movement by gathering, tracking, and assessing competitor strategy carefully and consistently [20,39,43].

Furthermore, it is significant to mention that a positive correlation exists between MS and ENP. Additionally, MS functions as a substantial moderator in the relationship between GSCM and ENP. These findings validate hypotheses H8 ($MS \rightarrow ENP$) and H9 ($GSCM * MS \rightarrow ENP$). The effective acceptance and execution of advancements, such as innovative initiatives, activities, and technology, rely heavily on managerial support. Upper management must be completely committed to ensuring environmental excellence [25]. The moderation result provides a distinct contribution to the current investigation by deepening comprehension of GSCM and the manufacturing sector's environmental performance. As far as the authors are aware, this study is one of the few that investigates how MS affects the association of GSCM and ENP.

5.1. Theoretical Implication

This research contributes to the existing scholarly discourse by offering insightful viewpoints on the literature concerning GSCM, with a specific focus on the manufacturing sector of Bangladesh. Prior studies [1,7,23,56] have examined the relationship between GSCM practices and ENP in developing and emergent nations. However, it is surprising that there is a lack of studies that explicitly focus on the viewpoint of employees in the manufacturing sector of Bangladesh and how these practices affect the ENP of the firm. Furthermore, the link between GSCM and ENP via GEO and GIS has yet to be explored in previous studies. Determining empirical connections between GSCM, GEO, GIS, and ENP in the context of the Bangladeshi manufacturing sector, this study thus contributes to the body of knowledge.

Furthermore, it was previously undisclosed whether GEO and GIS could serve as mediating variables between GSCM and ENP. Consequently, the current investigation stands as one of the initial few to scrutinize the mediating role of GEO and GIS in the connection between GSCM and ENP. The results of this research underscore the substantial mediating role of GEO and GIS in the relationship between GSCM and ENP, while also contributing to the body of knowledge on GSCM, GEO, GIS, and ENP.

Previous studies have failed to identify how MS moderates GSCM-ENP. This is the first investigation to examine how MS moderates the GSCM-ENP connection. Given the significant reliance on management support for the effective adoption and implementation of innovations like GSCM, the findings of the moderation constitute a unique contribution to the present study that enhances the understanding of GSCM and ENP of the manufacturing industry.

Finally, this study validates the NRBV theory by showing that GSCM practices may improve an organization's ENP. As a result, the adoption of GSCM practices facilitates the growth of an organization's unique environmental management capabilities, leading to improved productivity [1]. In a nutshell, by aligning internal and external operations, firms can achieve even greater levels of green performance when they employ a holistic strategy for configuring their GSCM-based organization [66].

5.2. Managerial Implication

This study highlights practical recommendations and implications for manufacturing companies regarding the effective adoption and integration of GSCM practices to enhance ENP, thereby mitigating environmental impacts and bolstering competencies. First, the framework employed in this investigation can be beneficial to managers who wish to enhance and acquire environmental performance through the application of GSCM techniques. The enhancement of environmental performance can only take place when firms give priority to the advancement of GSCM. Additionally, it is advised that managers acquire environmentally sustainable supplies from distributors who have obtained ISO-14001 EMS certification, an accreditation that verifies compliance with all environmental regulations [29,30]. Furthermore, to mitigate environmental consequences, managers must encourage and supervise the implementation of environmentally friendly transportation methods, reduced travel distances, and recyclable packaging materials.

Next, the study's results imply that GEO and GIS have emerged as innovative and effective indicators of ENP growth with the collaboration of GSCM practices. One of the challenges that managers face when implementing GSCM strategies is the constant requirement for adaptation and change [30]. Managers must understand the operational relationships that exist between the implementation of GSCM and the activities that comprise GEO and GIS to ensure sustainable environmental performances. Organizations face challenges in reaping the benefits of improved environmental performance if they fail to initially implement distinctive organizational practices and subsequently align them with GSCM processes.

Furthermore, the GIS has not been used rigorously in Bangladesh's manufacturing industry because the government has not done enough to enforce it and the procedures are expensive. It is imperative to implement GIS technologies to preserve a competitive advantage and innovation in the field of ecology. This technology-driven initiative enables employees to experiment with novel technologies, thereby improving business operations. To ensure a seamless integration, managers should encourage improvisation and ingenuity to foster casual alignment between GSCM and GIS [12].

Additionally, the results of the study demonstrate the importance of management support at various levels in the promotion of successful GSCM practices, which is evident when the manufacturing industry is assessed. The effective adoption of innovations, such as new programs and technologies, is significantly dependent on managerial support from upper, middle, and lower management. This devotion is essential for environmental excellence, as it promotes awareness, comprehension, and execution of the environmental vision and business strategy. Thus, support from management is essential for effective GSCM practices because it drives change via effective communication and promotes the beliefs defined in the manufacturing industry's holistic strategy [28–30].

5.3. Conclusions

This study investigated the impacts of GSCM practices on the GEO, GIS, and ENP of manufacturing industries in Bangladesh. It also examined the mediating role of GEO and GIS and the moderating role of management support on GSCM and firms' ENP relationship. The findings confirm the positive impacts of GSCM on GEO, GIS, and ENP. The findings further confirm the significant mediating role of GEO and GIS along with the strong moderating effect on GSCM and firms' ENP relationship. This validates the applicability of NRBV and thus adds value to NRBV. Although there are some limitations, the findings suggest practicing GSCM in the manufacturing industry to minimize the adverse impacts on the environment and maintain sustainable business environmental performance.

To sum up, GSCM is mostly driven by legislation and regulations requiring environmental compliance; thus, it is anticipated that GSCM techniques will decrease the use of toxic substances, liquid and solid waste, and air pollution, all of which are used to evaluate the green performance of the manufacturing industry of Bangladesh. Likewise, GSCM provides several positive aspects to the Bangladeshi manufacturing industries, such as greater transportation capacity, the recycling and reuse of packaging, decreased resource consumption (water and electricity), and adherence to environmental requirements [67].

5.4. Limitations and Future Scopes

This research makes substantial contributions to the fields of theory and practice; however, it has specific limitations that offer prospects for further investigation. First, the data collection was limited to Chittagong, Bangladesh's economic capital. Data were collected from 32 manufacturing companies. Some companies refused to gather data from their employees, while other employees were hesitant to participate in the survey due to privacy concerns. The results may not represent the entire population. Thus, future studies may include more cities and more sectors to increase manufacturers and sample size to represent the population. Furthermore, the participants for this research were chosen through convenience sampling, which could cause bias, as it relied on the availability of employees from the supply chain department. To collect more generalized data, future investigations may use any of the probability sampling strategies.

While the current study uses GEO and GIS as mediating variables, future research may consider other GSCM best practice-related mediating variables, such as green market orientation, green self-efficacy, green employee engagement, green psychological climate, organizational culture, and consumer behaviour, to achieve a more favourable environmental performance outcome. The study advocates that GSCM's impact on ENP may be enhanced by considering other moderating factors such as green entrepreneurial orientation, competitive intensity, management capability, and top management risk aversion. Lastly, this study used a quantitative approach to assess the link among the study variables, so future research should include qualitative approaches, like interviews or case studies, to gain a more profound comprehension of the motivations and problems encountered by firms while implementing GSCM.

Author Contributions: R.A.K. generated the idea and wrote the introduction, gap, contributions, and analysis. M.K.R. guided the analysis and partially shaped the manuscript and written method. D.N.K. contributed to developing hypotheses and discussions. T.A. and M.M. collected data and wrote the literature review. All authors have read and agreed to the published version of the manuscript.

Funding: There is no external funding for conducting this research.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data are available on demand.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Al Karim, R.; Kabir, M.R.; Rabiul, M.K.; Kawser, S.; Salam, A. Linking green supply chain management practices and environmental performance in the manufacturing industry: A hybrid SEM-ANN approach. *Environ. Sci. Pollut. Res.* **2024**, *31*, 13925–13940. [\[CrossRef\]](#)
2. Zhang, W.; Zhang, X.; Zhou, Q. How does knowledge seeking and knowledge generation promote green supply chain management? An empirical study from China. *Int. J. Logist. Res. Appl.* **2021**, *26*, 37–57. [\[CrossRef\]](#)
3. Khan, M.T.; Idrees, M.D.; Rauf, M.; Sami, A.; Ansari, A.; Jamil, A. Green supply chain management practices' impact on operational performance with the mediation of technological innovation. *Sustainability* **2022**, *14*, 3362. [\[CrossRef\]](#)
4. Nureen, N.; Liu, D.; Ahmad, B.; Irfan, M. Exploring the technical and behavioral dimensions of green supply chain management: A roadmap toward environmental sustainability. *Environ. Sci. Pollut. Res.* **2022**, *29*, 63444–63457. [\[CrossRef\]](#) [\[PubMed\]](#)
5. Rahman, H.U.; Zahid, M.; Ullah, M.; Al-Faryan, M.A.S. Green supply chain management and firm sustainable performance: The awareness of China Pakistan Economic Corridor. *J. Clean. Prod.* **2023**, *414*, 137502. [\[CrossRef\]](#)
6. Amjad, A.; Abbass, K.; Hussain, Y.; Khan, F.; Sadiq, S. Effects of the green supply chain management practices on firm performance and sustainable development. *Environ. Sci. Pollut. Res.* **2022**, *29*, 66622–66639. [\[CrossRef\]](#)
7. Karim, R.A.; Kawser, S.; Rabiul, M.K.; Chowdhury, T.; Murtaza, F.N.Y. Green supply chain management practices and environmental performance in the healthcare sector: The mediating role of green innovation. *Glob. Knowl. Mem. Commun.* **2024**, ahead-of-print. [\[CrossRef\]](#)
8. Karim, R.A.; Rabiul, M.K.; Kawser, S. Linking green supply chain management practices and behavioural intentions: The mediating role of customer satisfaction. *J. Hosp. Tour. Insights* **2023**, ahead-of-print. [\[CrossRef\]](#)
9. Silva, G.M.; Gomes, P.J.; Sarkis, J. The role of innovation in the implementation of green supply chain management practices. *Bus. Strategy Environ.* **2019**, *28*, 819–832. [\[CrossRef\]](#)
10. Khan, K.I.; Babar, Z.; Sharif, S.; Iqbal, S.; Khan, M.I. Going green? Investigating the role of GSCM practices on firm financial and environmental performance through green innovation. *Int. J. Procure. Manag.* **2021**, *14*, 681–701. [\[CrossRef\]](#)
11. Green, K.W.; Inman, R.A.; Sower, V.E.; Zelbst, P.J. Impact of JIT, TQM and green supply chain practices on environmental sustainability. *J. Manuf. Technol. Manag.* **2019**, *30*, 26–47. [\[CrossRef\]](#)
12. Yang, Z.; Sun, J.; Zhang, Y.; Wang, Y. Synergy between green supply chain management and green information systems on corporate sustainability: An informal alignment perspective. *Environ. Dev. Sustain.* **2020**, *22*, 1165–1186. [\[CrossRef\]](#)
13. Akhtar, F.; Huo, B.; Wang, Q. Embracing green supply chain collaboration through technologies: The bridging role of advanced manufacturing technology. *J. Bus. Ind. Mark.* **2023**, *38*, 2626–2642. [\[CrossRef\]](#)
14. Zhang, W.; Zhang, X.; Zhang, M.; Li, W. How to coordinate economic, logistics and ecological environment? Evidences from 30 provinces and cities in China. *Sustainability* **2020**, *12*, 1058. [\[CrossRef\]](#)
15. Gomes, D.; Daud, D. Implementation of Green Supply Chain Management in Ready-made Garment (RMG) Sector of Bangladesh. *IOP Conf. Ser. Mater. Sci. Eng.* **2020**, *780*, 072017. [\[CrossRef\]](#)
16. Uddin, M.; Hoque, N.; Mowla, M.M.; Uddin, M.N.; Mamun, A. Challenges and pathways to green supply chain management: Evidence from manufacturing sectors in an emerging economy. *Int. Soc. Sci. J.* **2022**, *72*, 655–679. [\[CrossRef\]](#)
17. Das, T.K.; Sheikh, W.; Islam, N.; Siddik, A.B. Conceptual Framework of Green Supply Chain Management in Manufacturing Firms of Bangladesh. *Int. J. Supply Chain. Manag.* **2021**, *10*, 52–66.
18. Karim, R.A.; Kasim, A. Environmental externalities and reality of CSR practices (environmental) in Bangladesh. *Int. J. Environ. Pollut. Res.* **2018**, *6*, 1–15.
19. Karim, R.A.; Kasim, A. Urgent Need for CSR in Bangladesh with an Emphasis on Environmental Urgent Need for CSR in Bangladesh with an Emphasis on Environmental Issues. In Proceedings of the Knowledge Management International Conference (KMICe), Miri Sarawak, Malaysia, 25–27 July 2018; pp. 25–27.
20. Habib, M.A.; Bao, Y.; Ilmudeen, A. The impact of green entrepreneurial orientation, market orientation and green supply chain management practices on sustainable firm performance. *Cogent Bus. Manag.* **2020**, *7*, 1743616. [\[CrossRef\]](#)
21. Banik, A.; Taqi, H.M.M.; Ali, S.M.; Ahmed, S.; Garshasbi, M.; Kabir, G. Critical success factors for implementing green supply chain management in the electronics industry: An emerging economy case. *Int. J. Logist. Res. Appl.* **2022**, *25*, 493–520. [\[CrossRef\]](#)
22. Rupa, R.A.; Saif, A.N.M. Impact of Green Supply Chain Management (GSCM) on Business Performance and Environmental Sustainability: Case of a Developing Country. *Bus. Perspect. Res.* **2022**, *10*, 140–163. [\[CrossRef\]](#)
23. Habib, M.A.; Bao, Y.; Nabi, N.; Dulal, M.; Asha, A.A.; Islam, M. Impact of strategic orientations on the implementation of green supply chain management practices and sustainable firm performance. *Sustainability* **2021**, *13*, 340. [\[CrossRef\]](#)
24. Alshourah, S.; Mansour, M.; AlZeaiden, K.; Azzam, Z. The effect of top management support and support supplier development on green supply chain management in the construction jordanian. In *The Implementation of Smart Technologies for Business Success and Sustainability: During COVID-19 Crises in Developing Countries*; Springer International Publishing: Cham, Switzerland, 2022; pp. 191–202.
25. Green, K.W.; Zelbst, P.J.; Meacham, J.; Bhaduria, V.S. Green supply chain management practices: Impact on performance. *Supply Chain. Manag. Int. J.* **2012**, *17*, 290–305. [\[CrossRef\]](#)
26. Mojumder, A.; Singh, A. An exploratory study of the adaptation of green supply chain management in construction industry: The case of Indian construction companies. *J. Clean. Prod.* **2021**, *295*, 126400. [\[CrossRef\]](#)

27. Moshood, T.D.; Nawansir, G.; Mahmud, F.; Sorooshian, S.; Adeleke, A.Q. Green and low carbon matters: A systematic review of the past, today, and future on sustainability supply chain management practices among manufacturing industry. *Clean. Eng. Technol.* **2021**, *4*, 100144. [\[CrossRef\]](#)
28. Alshourah, S. Role of Strategic Orientation Dimensions of Green Supply Chain Management Practices in Jordanian Manufacturing Companies. *Zarqa J. Res. Stud. Humanit.* **2022**, *22*, 380–390.
29. Suryanto, T.; Haseeb, M.; Hartani, N.H. The correlates of developing green supply chain management practices: Firms level analysis in Malaysia. *Int. J. Supply Chain. Manag.* **2018**, *7*, 316–324.
30. Zhu, Q.; Sarkis, J.; Cordeiro, J.J.; Lai, K.-H. Firm-level correlates of emergent green supply chain management practices in the Chinese context. *Omega* **2008**, *36*, 577–591. [\[CrossRef\]](#)
31. Barney, J. Firm resources and sustained competitive advantage. *J. Manag.* **1991**, *17*, 99–120. [\[CrossRef\]](#)
32. Hart, S.L. A natural-resource-based view of the firm. *Acad. Manag. Rev.* **1995**, *20*, 986–1014. [\[CrossRef\]](#)
33. Rahman, M.M.; Rahman, M.S. Green reporting as a tool of environmental sustainability: Some observations in the context of Bangladesh. *Int. J. Manag. Account.* **2020**, *2*, 31–37.
34. Zhu, Q.; Sarkis, J.; Lai, K.-H. Confirmation of a measurement model for green supply chain management practices implementation. *Int. J. Prod. Econ.* **2008**, *111*, 261–273. [\[CrossRef\]](#)
35. Khan, M.; Ajmal, M.M.; Jabeen, F.; Talwar, S.; Dhir, A. Green supply chain management in manufacturing firms: A resource-based viewpoint. *Bus. Strategy Environ.* **2022**, *32*, 1603–1618. [\[CrossRef\]](#)
36. Hughes, P.; Hodgkinson, I.R.; Hughes, M.; Arshad, D. Explaining the entrepreneurial orientation–performance relationship in emerging economies: The intermediate roles of absorptive capacity and improvisation. *Asia Pac. J. Manag.* **2017**, *35*, 1025–1053. [\[CrossRef\]](#)
37. Altinay, L.; Madanoglu, M.; De Vita, G.; Arasli, H.; Ekin, Y. The interface between organizational learning capability, entrepreneurial orientation, and SME growth. *J. Small Bus. Manag.* **2016**, *54*, 871–891. [\[CrossRef\]](#)
38. Yang, Z.; Sun, J.; Zhang, Y.; Wang, Y. Peas and carrots just because they are green? Operational fit between green supply chain management and green information system. *Inf. Syst. Front.* **2018**, *20*, 627–645. [\[CrossRef\]](#)
39. Corbett, J. Using information systems to improve energy efficiency: Do smart meters make a difference? *Inf. Syst. Front.* **2013**, *15*, 747–760. [\[CrossRef\]](#)
40. Watson, R.T.; Boudreau, M.-C.; Chen, A.; Huber, M. Green IS: Building sustainable business practices. *Inf. Syst.* **2008**, *1*–17.
41. De Camargo Fiorini, P.; Jabbour, C.J.C. Information systems and sustainable supply chain management towards a more sustainable society: Where we are and where we are going. *Int. J. Inf. Manag.* **2017**, *37*, 241–249. [\[CrossRef\]](#)
42. De Camargo Fiorini, P.; Jabbour, C.J.C.; de Sousa Jabbour, A.B.L.; Stefanelli, N.O.; Fernando, Y. Interplay between information systems and environmental management in ISO 14001-certified companies: Implications for future research on big data. *Manag. Decis.* **2019**, *57*, 1883–1901. [\[CrossRef\]](#)
43. Khan, S.A.R.; Qianli, D. Impact of green supply chain management practices on firms' performance: An empirical study from the perspective of Pakistan. *Environ. Sci. Pollut. Res.* **2017**, *24*, 16829–16844. [\[CrossRef\]](#)
44. Gholami, R.; Sulaiman, A.B.; Ramayah, T.; Molla, A. Senior managers' perception on green information systems (IS) adoption and environmental performance: Results from a field survey. *Inf. Manag.* **2013**, *50*, 431–438. [\[CrossRef\]](#)
45. Seman, N.A.A.; Govindan, K.; Mardani, A.; Zakuan, N.; Saman, M.Z.M.; Hooker, R.E.; Ozkul, S. The Mediating Effect of Green Innovation on the Relationship between Green Supply Chain Management and Environmental Performance. *J. Clean. Prod.* **2019**, *229*, 115–127. [\[CrossRef\]](#)
46. Zhu, Q.; Sarkis, J.; Lai, K.-H. Institutional-based antecedents and performance outcomes of internal and external green supply chain management practices. *J. Purch. Supply Manag.* **2013**, *19*, 106–117. [\[CrossRef\]](#)
47. Eltayeb, T.K.; Zailani, S.; Ramayah, T. Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes. *Resour. Conserv. Recycl.* **2011**, *55*, 495–506. [\[CrossRef\]](#)
48. Yildiz Çankaya, S.; Sezen, B. Effects of green supply chain management practices on sustainability performance. *J. Manuf. Technol. Manag.* **2019**, *30*, 98–121. [\[CrossRef\]](#)
49. Jiang, W.; Chai, H.; Shao, J.; Feng, T. Green entrepreneurial orientation for enhancing firm performance: A dynamic capability perspective. *J. Clean. Prod.* **2018**, *198*, 1311–1323. [\[CrossRef\]](#)
50. Nikolaou, I.E.; Tasopoulou, K.; Tsagarakis, K. A typology of green entrepreneurs based on institutional and resource-based views. *J. Entrep.* **2018**, *27*, 111–132. [\[CrossRef\]](#)
51. Alavi, B.; Tavana, M.; Mina, H. A dynamic decision support system for sustainable supplier selection in circular economy. *Sustain. Prod. Consum.* **2021**, *27*, 905–920. [\[CrossRef\]](#)
52. Feng, M.; Yu, W.; Wang, X.; Wong, C.Y.; Xu, M.; Xiao, Z. Green supply chain management and financial performance: The mediating roles of operational and environmental performance. *Bus. Strategy Environ.* **2018**, *27*, 811–824. [\[CrossRef\]](#)
53. Yasir, M.; Majid, A.; Qudratullah, H. Promoting environmental performance in manufacturing industry of developing countries through environmental orientation and green business strategies. *J. Clean. Prod.* **2020**, *275*, 123003. [\[CrossRef\]](#)
54. Chan, R.Y.K.; He, H.; Chan, H.K.; Wang, W.Y.C. Environmental orientation and corporate performance: The mediation mechanism of green supply chain management and moderating effect of competitive intensity. *Ind. Market. Manag.* **2012**, *41*, 621–630. [\[CrossRef\]](#)

55. Yu, Y.; Huo, B. The impact of environmental orientation on supplier green management and financial performance: The moderating role of relational capital. *J. Clean. Prod.* **2019**, *211*, 628–639. [\[CrossRef\]](#)
56. Kalyar, M.N.; Shoukat, A.; Shafique, I. Enhancing firms' environmental performance and financial performance through green supply chain management practices and institutional pressures. *Sustain. Account. Manag. Policy J.* **2020**, *11*, 451–476. [\[CrossRef\]](#)
57. Paulraj, A. Understanding the Relationships between Internal Resources and Capabilities, Sustainable Supply Management, and Organizational Sustainability. *J. Supply Chain. Manag.* **2017**, *47*, 19–37. [\[CrossRef\]](#)
58. Chu, S.H.; Yang, H.; Lee, M.; Park, S. The impact of institutional pressures on green supply chain management and firm performance: Top management roles and social capital. *Sustainability* **2017**, *9*, 764. [\[CrossRef\]](#)
59. Agi, M.A.N.; Nishant, R. Understanding influential factors on implementing green supply chain management practices: An interpretive structural modeling analysis. *J. Environ. Manag.* **2017**, *188*, 351–363. [\[CrossRef\]](#)
60. Krejcie, R.V.; Morgan, D.W. Determining sample size for research activities. *Educ. Psychol. Meas.* **1970**, *30*, 607–610. [\[CrossRef\]](#)
61. Podsakoff, P.M.; MacKenzie, S.B.; Lee, J.Y.; Podsakoff, N.P. Common method biases in behavioral research: A critical review of the literature and recommended remedies. *J. Appl. Psychol.* **2003**, *88*, 879–903. [\[CrossRef\]](#) [\[PubMed\]](#)
62. Hair, J.F., Jr.; Howard, M.C.; Nitzl, C. Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. *J. Bus. Res.* **2020**, *109*, 101–110. [\[CrossRef\]](#)
63. Ramayah, T.; Cheah, J.; Chuah, F.; Ting, H.; Memon, M.A. Partial least squares structural equation modeling (PLS-SEM) using SmartPLS 3.0. In *An Updated Guide and Practical Guide to Statistical Analysis*, 2nd ed.; Pearson: Kuala Lumpur, Malaysia, 2018.
64. Henseler, J.; Hubona, G.; Ray, P.A. Using PLS path modeling in new technology research: Updated guidelines. *Ind. Manag. Data Syst.* **2016**, *116*, 2–20. [\[CrossRef\]](#)
65. Chin, W.W. The partial least squares approach to structural equation modeling. *Mod. Methods Bus. Res.* **1998**, *295*, 295–336.
66. Lerman, L.V.; Benitez, G.B.; Müller, J.M.; de Sousa, P.R.; Frank, A.G. Smart green supply chain management: A configurational approach to enhance green performance through digital transformation. *Supply Chain. Manag. Int. J.* **2022**, *27*, 147–176. [\[CrossRef\]](#)
67. Nozari, H.; Fallah, M.; Szmelter-Jarosz, A. A conceptual framework of green smart IoT-based supply chain management. *Int. J. Res. Ind. Eng.* **2021**, *1*, 22–34.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.