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Unveiling the Role of Green Logistics Management in Improving SMEs' Sustainability Performance: Do Circular Economy Practices and Supply Chain Traceability Matter?

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Abstract: Sustainability has been widely recognized as a pervasive phenomenon that underlies the operations and performance of businesses. Recent research has examined the effect of green logistics management on the sustainability performance of businesses. However, we contend that the relationship between green logistics management and the sustainability performance of firms is not direct but mediated through circular economy practices. We analyze the direct and indirect effects of green logistics management on business sustainability performance via circular economy practices, using the natural resource-based view and resource dependence theory as our theoretical underpinnings. This study also assesses the moderating effect of supply chain traceability on the associations. Drawing upon the empirical data from 211 Bangladeshi manufacturing SMEs, we performed the PLS-SEM technique to assess the hypotheses. The findings show that green logistics management positively affects organizations' circular economy practices and sustainability performance. Furthermore, supply chain traceability strongly affects SMEs' circular economy practice but fails to moderate the linkage between green logistics and sustainability performance. Finally, circular economy practice mediates the linkage between SMEs' green logistics management and sustainability performance. We also conducted the Sobel test to validate the mediation. Our findings advance the natural resource-based view and resource dependence theory while improving the understanding of green logistics management, circular economy practices, and sustainability performance. Given the dearth of literature assessing the complex interactions among these variables, our findings have pivotal implications.

Keywords: green logistics management; circular economy practices; sustainability performance; supply chain traceability; small and medium enterprises

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Citation: Zhou, B.; Siddik, A.B.; Zheng, G.-W.; Masukujjaman, M. Unveiling the Role of Green Logistics Management in Improving SMEs' Sustainability Performance: Do Circular Economy Practices and Supply Chain Traceability Matter? *Systems* **2023**, *11*, 198. https://doi.org/10.3390/systems11040198

Academic Editors: Marco Ardolino and Luna Leoni

Received: 6 March 2023
Revised: 31 March 2023
Accepted: 6 April 2023
Published: 16 April 2023

1. Introduction

The environmental consequences of commercial operations have recently garnered increasing awareness. Academics, organizations, customers, and other stakeholders have given this issue considerable attention [1,2]. Nowadays, stakeholders require firms to take accountability for negative repercussions caused by their commercial activities. As a result, firms worldwide are continuously seeking ways to integrate environmental factors into their strategic planning [3]. The impact of logistics on emissions and energy consumption has been highlighted in previous studies [4,5]. The growing focus on sustainable practices has brought attention to the importance of Green Logistics (GL), which emphasizes the environmental impact of logistics activities [6]. GL aims to manage logistics operations to balance economic, environmental, and social concerns [7]. Therefore, GL plays a crucial role in promoting awareness of environmental issues and encouraging stakeholders to consider the impact of their actions.

Bangladeshi firms, mainly small and medium enterprises (SMEs), had been reluctant to adopt green and sustainability initiatives [8,9]. Sustainability (the proper combination of economic, environmental, and social factors) is the most important issue faced by small and medium-sized enterprises (SMEs) currently, since SMEs must be economy-focused owing to unpredictability on both the demand and supply sides, as well as to the existence of countless rivals [10]. Most ecological and sustainability initiatives are costly, making it more difficult for small and medium-sized enterprises (SMEs) to adhere to intended environmental and social goals following local rules and global demands, while staying competitive. Since SMEs do not operate within robust regulatory frameworks, most SMEs are not eager to improve their sustainability performances [8]. However, the scenario has recently changed as many manufacturing SMEs implement environmental and sustainable projects while abiding by international regulations [11]. Moreover, international organizations are funding Bangladeshi SMEs to incorporate green and environmental initiatives to attain sustainability goals and ensure workplace safety [12]. Consequently, it is essential to investigate the crucial drivers of the sustainability performance of Bangladeshi manufacturing SMEs.

Extant studies on Green Logistics Management (GLM) have mainly emphasized GLM's effect on ecological sustainability [13]. Nevertheless, a dearth of literature exists on how the GLM affects a firm's sustainability performance (SP) through circular economy practices (CEP). Circular economy (CE) is a relatively new paradigm that maximizes the economic, environmental and social components of enterprises to convert the entire society into one that is more sustainable via the participation of all stakeholders involved. The circular economy (CE) concept is built on "the regenerative cycle, which facilitates the reuse of used products, parts, and materials efficiently, thereby increasing profitability and reducing environmental distraction" [14]. Several studies have documented the challenges and opportunities of adopting CEP in SMEs. Researchers have established CEP as a crucial predictor of SMEs' sustainability performance [9,10,15]. Literature has established that SMEs' CEP ameliorates their sustainable-oriented innovation and subsequent SP [15–17]. Recent research indicates that GLM can be regarded as an organizational component supporting the CEP [4]. Extant literature [18] contended that the GLM is a necessary precondition and fundamental procedure for establishing a CE. Another stream of literature demonstrates the pivotal role of the GLM in ameliorating a firm's sustainability performance. One group of scholars has corroborated the linkage between the GLM and the different dimensions of sustainability performance [13,19], while another group has reported the linkage between the GLM and a firm's overall SP [5,7,20]. Conversely, another area of research contends that the relationship between GLM and SP is not always direct [21], creating contradictory findings in the literature. Some studies have unveiled a significant association between GLM and SP [22,23], while others have reported an insignificant association [21]. This inconclusive evidence compels us to study the function of CEP in the interaction between GLM and SP. As the GLM is a prerequisite for implementing the CEP, which in turn increases the sustainability performance of enterprises, we hypothesize that CEP successfully mediates the influence of GLM on SP. In addition, we posit that supply chain traceability (SCT) positively impacts the CEP of firms and acts as a moderator in the GLM-CEP association. Recent studies suggest that the exploitation of the SCT can be an essential catalyst for addressing supply chain disruptions and promoting green initiatives in the logistics system to help improve CE practices [21,24].

This research draws on the NRBV of firms to conceptualize the GLM as a critical driver of organizations' CEP and SP. The NRBV is strongly supported by the research on GLM and CE, suggesting that organizations seek to improve and reconcile their interaction with natural settings [25,26]. The NRBV perspective demonstrates how green goods may offer organizations strategic abilities and favorable ecological impacts [2]. This study also employs the resource dependence theory (RDT) [19] as a theoretical lens, arguing that organizational production depends on acquiring and preserving critical resources. This results in an organization's dependency on its surrounding environment, leading to interdependent organizational behavior and uncertainties. Extant studies have drawn upon the RDT to define the SCT, as the SCT requires multiple stakeholders' collaboration and strong relationships [21]. This study uses the NRBV to understand how the GLM drives the CEP and SP of organizations and the RDT to predict how the SCT will lead to an improved CEP. Thus, this research addresses the following questions: RQ1: Does green logistics management affect manufacturing SMEs' sustainability performance? RQ2: What roles do circular economy practices and supply chain traceability play in improving sustainability performance of SMEs?

We aim to assess the interconnection among GLM, SCT, CEP and SP, and make several crucial contributions accordingly. First, this study increases the prevalence of NRBV and RDT by establishing the significance of these theories in studying green logistics in an emerging economy context. Second, our study advances the GL, CE, and SP literature by assessing the pivotal role of the GLM in enhancing the CEP and SP of firms. Third, no former study has established the mediating function of CEP in the GLM-SP linkage. This scholarship supplements the extant body of knowledge by assessing CEP's role in the interplay between the GLM and SP of firms. Finally, our research expands the understanding of the SCT's function in attaining the CE and sustainability objectives, which opens the door for further research.

The remaining sections of the paper are structured in the following manner: in the second section, we review relevant literature on GLM, CEP, SP and SCT. Section 3 outlines the research methodology of this paper. Section 4 highlights the findings, whereas Section 5 delves into them. The study ends with evaluating the theoretical and practical effects of the GLM on the sustainability of SMEs through enhanced CEP, in addition to considering the study's shortcomings and possible future directions.

2. Literature Review

2.1. The Natural Resource-Based Theory

Since Hart's [26] introduction of the NRBV in the mid-1990s, more environmental scholars have emphasized the enterprises' internal characteristics when investigating corporate greening. Nevertheless, this paradigm is inadequate since it disregards the significance of external factors in determining the advancement of corporate environmentalism [27]. In light of today's very competitive economic climate [28], it is essential to look at how competitiveness affects environmental activism. Researchers can better comprehend the boundary conditions in converting environmental drives into environmental policies and, ultimately, beneficial business results by including this external aspect in the analysis. According to the NRBV theory, environmental practices such as GLM can prevent environmental pollution and protect the environment by remanufacturing used or malfunctioning products [21], which can serve as strategic resources for firms. The theory suggests that recycled products may provide a preemptive competitive advantage for the firm, since they can be used as preferred materials for production. Numerous studies have utilized the NRBV to examine the role of green and environmental practices like GLM, SCT, and CEP in enhancing organizational sustainability. GLM could serve as a strategic resource to create a competitive advantage in the context of NRBV theory [29]. The literature contends that green practices such as GLM and CEP may be considered vital in carrying out the three natural environment strategies proposed by NRBV: "pollution prevention", "product stewardship", and "sustainable development" [21,30]. Hence, this paper draws upon the NRBV to investigate GLM's role in promoting a superior CEP and SP.

2.2. Resource Dependence Theory

The resource dependence theory (RDT) is a crucial paradigm for comprehending the strength of organizations concerning their engagement with their environments [31]. This extends Emerson's [32] theory of power-dependent relations, which posits that the more reliant one firm is on another, the more power the second firm has over the first. Pfeffer and Salancik [33] proposed the RDT, highlighting the limited resources of individual businesses and their necessity to form alliances with external partners. RDT asserts that accessibility to scant materials in an external business setting and a business's dependency on such materials is determined by its actions and sustainability [33].

The critical underlying tenet of RDT is that organizations are rarely independent in terms of strategically vital resources, causing them to depend on other organizations [34]. In addition, businesses aim to reduce uncertainty and control this dependence by carefully creating official and informal connections with other businesses [35]. According to the RDT, businesses rely on one another's environments to access capital, labor, and other essential resources [36]. Previously conducted studies suggest that businesses tend to develop harmonious and cooperative relationships with one another [37]. The RDT has been used in the existing literature to assess the influence of various supply chain procedures and strategies on company outcomes [21,38]. In order to be implemented effectively, the SCT supports the notion that necessitates the involvement of external stakeholders. Due to the SCT's extensive supply chain-wide activities, it may be practically difficult for its adoption by a single organization [21]. The SCT incorporates both a specific product and its constituent parts [39], and, as proposed by the RDT, it necessitates cooperative interaction between a focal organization and its stakeholders. Surprisingly, the RDT also presents companies with excellent regulatory processes for readjusting their framework and attitude to help minimize the unpredictability and reliance on the external environment [40]. These regulatory mechanisms encompass partnerships based on influence or trust, coalitions, joint buying contracts, and other strategic alliances that can promote implementing CE in their supply chain operations.

2.3. Green Logistics Management and Sustainability Performance

"Green logistics" refers to "supply chain management practices and strategies that reduce the environmental and energy footprint of freight distribution, which focuses on material handling, waste management, packaging, and transport" [3]. GL activities are interdependent, and the efforts made in one area often compromise the sustainability of others, which disrupts logistics managers' decision-making processes. Reusable packaging systems, for example, improve resource efficiency and reduce costs but increase the number of reverse logistics routes and, consequently, transportation emissions [24]. Bhattacharya et al. [41] stated that using sustainable energy in supply chain operations might enhance environmental sustainability by reducing carbon emissions and economic performance and resolving numerous challenges that confound company managers. Green principles incorporate environmental considerations into logistical activities to advance society [42]. In 1991, the first green design research addressed the importance of green designs in mitigating the various effects of production wastes. Fortes [6] argued that the dominant themes in literature conducted over the previous two decades were green designs, operations, reverse logistics, waste disposal, and green production.

With growing awareness and market choice for environmentally friendly products, corporations today emphasize sustainability practices [25]. Yet, many SME businesses have inefficient production of goods and services [8,43]. Hence, manufacturing SMEs face several challenges when striving to adopt sustainable practices [44]. According to Bratt et al. [45], there is no universal definition of sustainability: what it entails varies depending on the problem at hand; analogously, the three pillars of sustainability (economic, environmental and social) must be implemented for SMEs to be more sustainable in terms of logistics management [21]. A few studies have explored the linkage between green logistics management (GLM) and corporate sustainability performance [1,21]. GLM entails the gathering and exchanging of information, freight transportation, stock management, and material management across the supply chain [46,47]. Extant literature suggests that green information management, reverse logistics, green transportation, efficient waste management, and sustainable monitoring and assessment all play a role in reducing carbon emissions, waste, energy, and resource consumption, resulting in increased operating performance and environmental sustainability [21]. Khan [23] contended that the GLM promotes environmental and societal welfare by cutting down on emissions and waste products. GLM practices are necessary for environmental sustainability [22], implying green packaging, recycling, repairing, reprocessing, efficient disposal of used products, use of eco-friendly diesel fuel, and using green energy sources all enhance SP. Thus, we hypothesized that:

H1: *GLM positively impacts firms' SP.*

2.4. Green Logistics Management and Circular Economy Practices

The CE notion is gradually gathering momentum, with companies adopting its tenets into their environmental initiatives. CE seeks to retain the monetary value of products, resources, and energy while reducing wastage [3]. CE is a concept that highlights the generation of value through the intelligent use of resources and the diminishing negative ecological impact throughout the lifespan of goods, thereby allowing the reuse of materials [48]. Due to the abundance of proposed CE definitions, it is nearly impossible to make an objective choice. Thus, the authors have settled for the one advanced by Kirchherr et al. [49] following their analysis of 114 CE definitions: "A circular economy describes an economic system that is based on business models which replace the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro level (products, companies, consumers), meso-level (eco-industrial parks) and macro level (city, region, nation and beyond), to accomplish sustainable development, which implies creating environmental quality, economic prosperity, and social equity, to the benefit of current and future generations" [49].

Green logistics is an essential requirement and fundamental mechanism for the advancement of CE. CE and industrial ecology demand the effective circulation and recycling of resources across businesses as a prerequisite. The objective is to optimize the production logistics and regulate the supply chains of enterprises effectively engaging in the CE system [18]. The concept of GL arose to lessen environmental consequences produced by logistics adopting a method of environmental preservation. GL is closely linked to the CE in terms of the technical cycle [50], and both are related to sustainability [51]. The CE suggests that GL should be developed outside a business's supply chain and not limited to waste collection and recycling efforts [52] to retain the value and utility of the resource for as long as possible, in addition to offering considerable value chain benefits. Julianelli et al. [53] highlighted several essential success elements of GL that enable companies to achieve their CE objectives. Based on these arguments, we posit that:

H2: *GLM positively impacts firms' CEP.*

2.5. Circular Economy Practices and Sustainability Performance

The CE is an emerging business and economic model that enables businesses to adopt a more resource-efficient resource usage pattern by increasing value via the conservation and renewal of resources as soon as a product reaches the end of its useful life [54]. CE practices (CEP) are observed to improve corporate performance by increasing product reuse and closed flow while minimizing energy losses, emissions, pollution and costs [55]. Throughout the manufacturing and consuming processes, the CE adheres to the 3R concept ("reduce", "reuse" and "recycle" materials) [55]. The concept has been a focal topic for scholars and practitioners, owing to its potential for material reductions, time savings, abatement of negative externalities, effects, and pressures, as well as the establishment of new firms and jobs, all while deriving economic rewards [56]. Material circularity, natural resource usage, and product longevity result from CE-based production systems linked with sustainable growth [55,57]. With the involvement of all its stakeholders, the

CE evolved as a modern philosophy that maximizes companies' economic, environmental, and social concerns to move society toward higher sustainability [17]. Some CE researchers and practitioners argued that CE implicitly incorporates elements of economic and environmental sustainability [58]. In addition, Walker et al. [59] observed in their qualitative study that most of the leading organizations involved in CE believed that applying CE practices would most likely result in improved SP. Dey et al. [10] proposed an efficient method for implementing CEP in SME organizations by employing proper approaches, resource allocation, and competence development. According to Katz-Gerro and López Sintas [60], 11,000 SMEs in EU-28 member states engage in CE activities. They show that the CEP that SMEs are most likely to engage in are waste minimization, replanning energy consumption, redesigning goods and services, using renewable energy, and water usage. Another study by Prieto-Sandoval et al. [61] identified vital tactics, resources, and competencies for applying CEP in Spanish SMEs across their receive, produce, distribute, use, and recover activity area. Rodríguez-Espíndola [62] contended that CEP promotes sustainable-oriented innovation to boost the SP of Mexican SMEs. Chowdhury [16] concluded that CEP is a crucial driver of SP in Vietnamese SMEs. Therefore, this study hypothesizes that:

H3: *CEP positively impacts SMEs' SP*.

Moreover, existing literature on the connection between GL and SP has yielded inconclusive results. Some scholars have found a positive linkage between GL and SMEs' SP [1,5], while others have argued that GL does not consistently affect corporate sustainability [21]. The inconsistency in findings may be due to mediating variables affecting the link between GL and SP. This study proposes that CEP has a mediating function in the connection between GL and SMEs' sustainability performance. Previous research has established that GL is a crucial driver of firms' circular economy practices [48,63], improving organizational SP [17,64]. Consequently, we posit that:

H4: *CEP mediates the linkage between GLM and SP*.

2.6. Green Logistics Management, Supply Chain Traceability, and Circular Economy Practices

Most supply chain operations are undocumented and untraceable [30], impeding organizations' efforts to eliminate detrimental and inessential processes from the supply chain to help cut down on wastage and emissions and preserve scarce resources [65]. Prior literature has established the SCT as a solution that enables businesses to monitor and trace supply chain operations [66]. The SCT can be defined as the "tracing and tracking of products and activities from the suppliers to the end-consumers and back to the suppliers or manufacturers, which aims at augmenting the effort of firms toward the achievement of improved environmental, social, and business sustainability" [21]. Trivellas et al. [24] suggest that with logistics traceability facilitated by technological innovations, stakeholders may readily obtain reliable and accurate data, resulting in significant resource and material savings for businesses. Traceability considerably increases product movement, thus facilitating overall logistics operations. In addition, adopting blockchain technology for SCT improves information availability and interaction among multiple supply chain participants, thus enhancing the movement of products and resources [67]. Furthermore, it is suggested that SCT based on technology ensures the availability of information, thereby preventing several fraudulent acts such as fake ownership and data manipulation [14].

The CEP entails applying eco-friendly measures that help minimize numerous energy and production cycles, hence regulating several sustainability challenges, including harmful emissions and material wastes [68]. Integrating several eco-friendly practices in logistics management ensures optimal performance by enhancing features such as durability, maintenance, reuse and refurbishment. However, increased costs, talent gaps, lack of awareness about these approaches, quality sacrifices, and supply chain complexities impede the application these green initiatives [69]. Recent research suggests that deploying SCT can be pivotal in addressing these obstacles and encouraging green practices in the logistics system to help enhance CE practices [21,24]. Traceability within the supply chain is essential for improving the green supply chain processes and procedures and a company's sustainable performance to reduce its adverse environmental effects [70]. By utilizing a company's technological assets to develop supply chain traceability among its members, green practices could significantly impact the improvement of sustainability performance [71]. When the supply chain is traceable, the green logistics process and protocols are simpler to handle because any sustainability issues can be identified and rectified at the root. Nandi [72] argued that supply chain traceability is essential for enhancing the agility of the logistics system to promote circular economy practices. Thus, we posit that:

H5: *SCT positively impacts firms' CEP.*

H6: *SCT moderates the relationship between GLM and CEP.*

Drawing on the literature review, we developed the following conceptual framework (Figure 1):

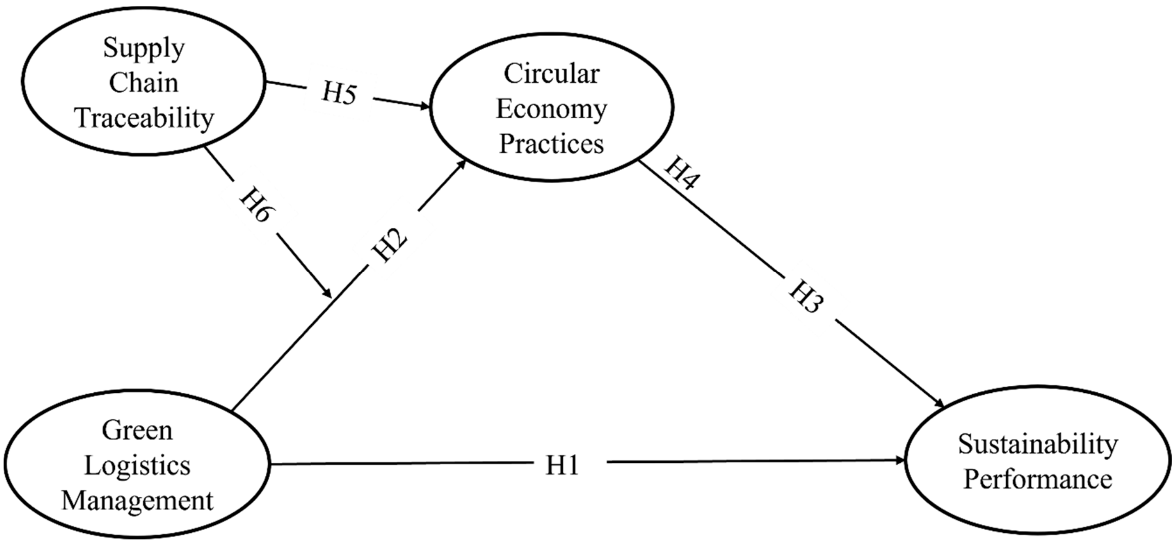

Figure 1. Conceptual model.

3. Methods

3.1. Sample and Data Collection

The data for this study were gathered from Bangladeshi SMEs that have adopted green practices to improve sustainability performance. These SMEs were chosen because they conduct business in a highly volatile setting where green practices such as GLM, SCT, and CEP are crucial for ecological success. Furthermore, SMEs make up the core of the Bangladeshi economy, directly employing millions of people [73]. Although Bangladeshi SMEs are reluctant to adopt environmental practices, the scenario has improved recently. Several international organizations have funded SMEs in different sectors to implement green initiatives and ensure safety [8]. Hence, it is essential to assess how GLM, SCT and CEP can improve environmental sustainability in Bangladeshi SMEs.

The researchers used a self-administered questionnaire to investigate the influence of GLM and SCT on CEP and SP in Bangladeshi SMEs. We performed a pilot study with 33 respondents, including four academics and 29 SME owners. Following their feedback, we made minor modifications to the survey questions. Our survey targeted SME managers who understood their enterprises' operations and performance comprehensively. The researchers distributed the survey to 270 SMEs, accompanied by a cover letter explaining our research goals and mentioning their voluntary engagement. Our respondents were advised that their data would be kept anonymous and used exclusively for scholarly study.

We were able to obtain 211 complete usable questionnaires, resulting in a response rate of 78%. The data collection period was between April to August 2022.

3.2. Respondents' Profile

The complete dataset gathered and processed for this research consisted of the replies of 211 managers from Bangladeshi small and medium-sized firms (SMEs). Most participants (79%) had been hired by their respective companies for at least a year and held their current or most recent managerial roles for at least the same period. In addition, a substantial share (84%) of managers aged between 25 and 50 had attained postsecondary education or above (74%). 58% of the companies supplied services directly to consumers, 15% of the companies served other businesses, and 27% of the companies connected directly with both individuals and businesses. 39% of the sample was comprised of wholesale and retail establishments, which constituted the majority of the responding SMEs. In addition, there were restaurants (26%), pharmacies (21%) and electronics stores (14%). Regarding the age of the companies, the poll targeted four age groups: 3 years (17%), 3–5 years (31%), 6–10 years (29%), and >10 years (22%). Despite these qualities, 54% of SMEs had fewer than 20 employees, 32% had between 21 and 50 employees, and 14% had above 50 employees.

3.3. Measures

We used a variety of questionnaire items to evaluate all of our propositions, which were obtained from prior studies, with a few items adjusted to fit the context of the investigation. Exogenous factors were assessed using a seven-point Likert scale. The instrument was developed according to the guidelines outlined by Mishra et al. [63]. We provided the research constructs and items to four academics and 29 SME experts for pilot testing. They were asked to rate the extent to which they believed these items accurately measured their related concepts. Based on their feedback, some of the questions were revised. We drew twenty items from relevant literature. To assess the green logistics management of SMEs, we used five elements from previous research [46,74] as metrics to determine if firms were engaged in green monitoring, assessment, delivery and transportation, green storage and green packaging. The supply chain traceability of the companies was assessed using five elements from the study by Cousins et al. [30]. We then employed five items from Zeng et al. [75] and Zhu et al. [76] to evaluate the mediator CEP. Finally, we estimated the sustainability performance of the SMEs using five items developed by Agyabeng-Mensah et al. [74]. Before conducting the primary inquiry, we revised the questionnaire based on the feedback received from the SME experts. The measurement items used in this study are presented in Table 1.

Table 1. Measurement Items.

Variables	Codes	Items	Sources
Green Logistics Management	GL1	Green education, monitoring and evaluation	Agyabeng-Mensah et al. [21,74], Baah et al. [46]
	GL2	Green transportation and distribution	
	GL3	Green warehousing and packaging	
	GL4	Waste management and recycling	
	GL5	Sustainable logistics information system	
Supply Chain Traceability	SCT1	Identifying the sources of our raw materials	Cousins et al. [30]
	SCT2	Tracking the processes involved in producing products throughout our complete supply chain	
	SCT3	Tracing the origins of our purchases through the entire supply chain	
	SCT4	Tracking the environmental performance of our complete supply	
	SCT5	Knowing what chemicals or elements are in our purchase	
Circular Economy Practices	CEP1	The firm is devoted to reducing the unit product manual input.	Zeng et al. [75] and Zhu et al. [76]
	CEP2	The firm is devoted to reducing the consumption of raw materials and energy.	
	CEP3	Product packaging materials are used repeatedly.	
	CEP4	The leftover material is used repeatedly to manufacture other products.	
	CEP5	Recycling waste and garbage are reprocessed.	

Table 1. *Cont.*

Variables	Codes	Items	Sources
Sustainability Performance	SP1	Minimization of environmental mishaps, waste generation, and reduced usage of toxic and harmful materials	Agyabeng-Mensah et al. [74]
	SP2	Reduced the environmental impacts of products/service	
	SP3	Minimization of energy consumption and increased rate of renewable energy consumption	
	SP4	Improved stakeholders' knowledge of green activities and involvement in planning and executing environmental practices	
	SP5	Improved community health and safety	

3.4. Data Analysis Technique

This exploratory and confirmatory investigation aimed to examine GLM's impact on SP through CEP. Numerous statistical methods were used to acquire more precise information and inferences. For example, the gathered replies were coded and inspected for mistakes before using analytical procedures. SPSS version 20.0 and Smart-PLS version 3.3.4 were used for statistical analysis to assess the research framework [77] for PLS path modeling to test the dataset. SPSS was initially used to filter the data, identify missing values and outliers, assess descriptively, and evaluate the sample demographic distribution. The links between latent variables in the conceptual framework were then evaluated using PLS-SEM [9]. PLS-SEM was chosen because it is suitable for the examination of complex constructs and exploratory and confirmatory investigations. It indicated increasing the variance of endogenous constructs interpreted by the exogenous variables in reverse to represent the experimental covariance matrix [78], and this research framework was constructed with the help of several pre-existing theories. Thus, PLS-SEM [62] was necessary for predicting latent variables in the model. A total of 5000 iterations were used to calculate the non-parametric bootstrapping [9]. After executing PLS-SEM, the data were assessed in two phases [62]. First, the reliability and validity of the outer model's measurement model were evaluated using composite reliability (CR), average variance extracted (AVE) and Cronbach's alpha (CA) on a total of 211 valid samples. In the second stage, we determined the potential association between these variables. We concluded by performing a mediation analysis. We used the structural model evaluated using the pertinent outcomes of measurements in this study model and the significance and impacts of path parameters [79]. Harman's single-factor assessment was performed per Podsakoff et al.'s [80] guidelines to test common method bias (CMB). A single component constituted 40.35% of the variance, which is below the threshold of 50 percent. Hence, CMB was not an issue in this research.

4. Results

4.1. Measurement Model

While assessing the measurement model, we omitted an item (CE1) from the analysis due to its low factor loadings (<0.60) [81] and employed CA and CR to determine the reliability of the constructs (Figure 2). All CRs exceeded the recommended value of 0.70 [82]. The CA values for each construct also exceeded the 0.70 criterion, confirming the reliability assumption as stated by Hair et al. [83]. To establish the convergent validity (CV), Fornell and Larcker [84] suggest that the AVE values should exceed 0.5 [85]. This study also confirmed the CV, since each model item has a large and significant standardized loading on its target construct [86]. The AVE values of our model constructs, ranging from 0.574 to 0.829, corroborate the CV of the measures (Table 2).

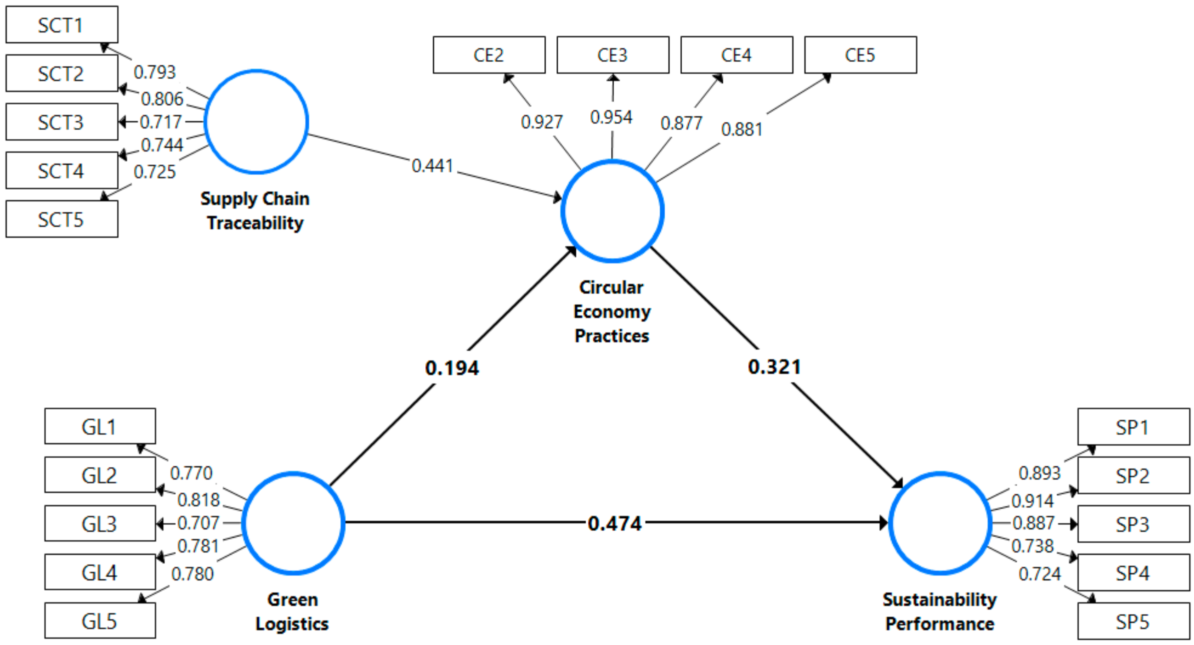

Figure 2. Measurement model.

Table 2. Summary Results of Measurement Model.

Constructs.	Items	Factor Loading	CA	CR	AVE	VIF
Green Logistics Management	GL1	0.770	0.832	0.880	0.596	1.181
	GL2	0.818				
	GL3	0.707				
	GL4	0.781				
	GL5	0.780				
Supply Chain Traceability	SCT1	0.793	0.816	0.871	0.574	1.181
	SCT2	0.806				
	SCT3	0.717				
	SCT4	0.744				
	SCT5	0.725				
Circular Economy Practices	CE2	0.927	0.931	0.951	0.829	1.155
	CE3	0.954				
	CE4	0.877				
	CE5	0.881				
Sustainability Performance	SP1	0.893	0.890	0.920	0.698	n.a
	SP2	0.914				
	SP3	0.887				
	SP4	0.738				
	SP5	0.724				

Note: CA = Cronbach's Alpha, CR = Composite Reliability, AVE = Average Variance Extracted, n.a = not applicable.

In addition, it is critical to analyze the discriminant validity (DV) of the constructs in a measuring model. The Fornell–Larker and Heterotrait–Monotrait correlation ratio (HTMT) criteria were used to determine the DV of our constructs. Regarding the first criterion, the square root of the AVE was calculated for each latent construct [87]. To ensure an acceptable DV, the diagonal values in the associated rows and columns should be substantially larger than the off-diagonal elements [88]. Table 3 shows that this requirement holds for all the factors of our measurement model.

Table 3. Fornell–Larcker Criterion.

Constructs	GL	SCT	CEP	SP
Green Logistics Management	*0.772*			
Supply Chain Traceability	0.391	*0.758*		
Circular Economy Practices	0.366	0.517	*0.910*	
Sustainability Performance	0.591	0.461	0.495	*0.835*

Note: Values in italics represent the square root of AVE.

The HTMT ratio was subsequently employed to assess the model's DV. Our assessment revealed that the model possessed a solid DV, as evidence suggests that the HTMT ratios of the constructs listed in Table 4 are less than the 0.85 recommended by Henseler et al. [89]. The largest HTMT value obtained was 0.667, thus confirming the constructs' DV. Altogether, the constructs of our model exhibited a high degree of reliability and validity.

Table 4. HTMT Criterion.

	Green Logistics	Supply Chain Traceability	Circular Economy Practices
Supply Chain Traceability	0.474		
Circular Economy Practices	0.402	0.579	
Sustainability Performance	0.667	0.547	0.532

4.2. Structural Model

The dataset was examined for potential multicollinearity issues before analyzing the structural model. The correlation analysis revealed the maximum correlation value of the latent constructs as 0.591, indicating the absence of multicollinearity. The variance inflation factor (VIF) was also measured for each construct to ensure its robustness. The VIF values of the latent constructs were found to be 1.181, 1.181, and 1.155 for the GL, SCT and CEP, respectively. The values were significantly less than the highest threshold of 5.00, confirming the model's lack of multicollinearity [90]. After ensuring the model was not multicollinear, it was suitable for the PLS-SEM. The measurement model is presented in Figure 2.

We used the SmartPLS 3.3.4 software to assess the structural model and test the proposed hypotheses in this investigation (see Figure 3). The bootstrapping technique was deployed with 5000 subsamples to determine the significance of the latent construct associations [91]. Since the PLS does not provide the overall goodness of fit metrics, the $R^{2,}$ and Q^2 remain the principal methods for determining the predictive potential of the structural model (Wasko & Faraj, 2005). Table 4 indicates that all R^2 values exceed 0.1 (CEP R^2 = 0.299, SP R^2 = 0.439). As a result, the capability for prediction was established [92]. In addition, the Q^2 value proves the predictive relevance of the endogenous components, with a value exceeding 0 indicating its predictive relevance. The findings also indicated that the predictive relevance of the constructs in this study is substantial (CEP Q^2 = 0.242, SP Q^2 = 0.300) (see Table 5). Also, the model fit was evaluated using the SRMR from the PLS-SEM. The SRMR coefficient was observed to be 0.08, which is less than the maximum threshold of 0.10, suggesting good fit of our model.

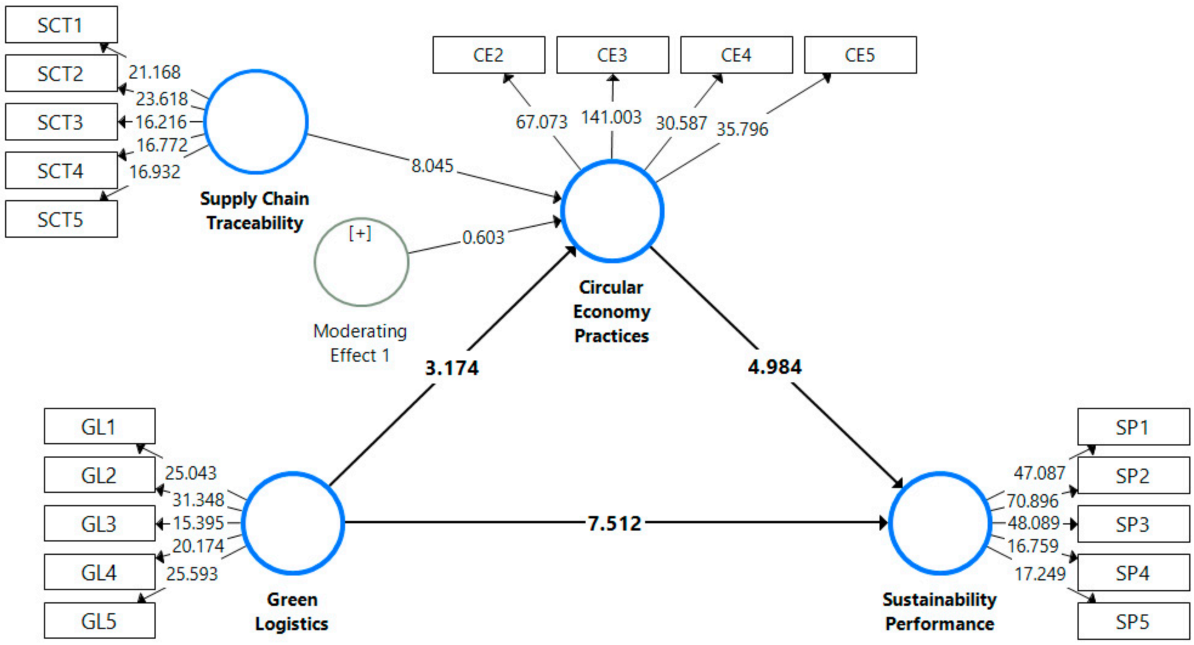

Figure 3. Structural model.

Table 5. Predictive Power of the Model.

Endogenous Constructs	R^2	Q^2
Circular Economy Practices	0.299	0.242
Sustainability Performance	0.439	0.300

After assessing the model's multicollinearity, predictive relevance, and goodness of fit, we analyzed the direct and indirect paths between the GL, SCT, CEP and SP. Table 6 represents each hypothesis's path coefficients.

Table 6. Results of Hypothesis Testing.

Hypotheses	Coefficients	t-Statistics	Remarks
H1: GL → SP	0.481 (0.063) ***	7.512	Supported
H2: GL → CEP	0.195 (0.061) ***	3.174	Supported
H3: CEP → SP	0.318 (0.064) ***	4.984	Supported
H4: GL → CEP → SP	0.061 (0.022) ***	2.837	Supported
H5: SCT → CEP	0.443 (0.055) ***	8.045	Supported
H6: GL * SCT → CEP	−0.034 (0.05)	0.603	Not supported

* $p < 0.05$, *** $p < 0.001$.

Table 6 reports both the direct and indirect effects of the model constructs. First, the GL positively impacted firms' SP ($\beta_2 = 0.481$, $t = 7.512$, $p = 0.000$), confirming hypothesis H1. Moreover, the GL strongly influenced firms' circular economy practices ($\beta_1 = 0.195$, $t = 3.174$, $p = 0.000$), supporting H2. CEP strongly linked positively with firms' SP ($\beta_3 = 0.318$, $t = 4.984$, $p = 0.000$), confirming H3. The mediation analysis revealed that the CEP strongly mediates the GL-SP link ($\beta_4 = 0.061$, $t = 2.837$, $p = 0.005$), confirming H4. Furthermore, we found a positive effect of firms' SCT on their CEP ($\beta_4 = 0.443$, $t = 8.045$, $p = 0.000$), validating hypothesis H5. However, the findings depicted that the SCT had no substantial moderating effect on the association between the GL and CEP ($\beta_4 = -0.034$, $t = 0.603$, $p > 0.05$), invalidating H6. Figure 3 represents the SEM of our analysis.

To assess the robustness of our empirical results—which strengthens the implications of our findings—we conducted the Sobel test to validate our mediation results further. The

Sobel test result also corroborated the CEP's mediating role in the interaction between the GL and SP (β = 0.062, $p < 0.05$) (see Table 7).

Table 7. Sobel Test for Mediation.

	Test Statistic	Std. Error	p-Value
Sobel test	2.688	0.023	0.007
Aroian test	2.651	0.023	0.008
Goodman test	2.728	0.022	0.006

5. Discussion and Conclusions

Improving corporate sustainability practices and performance is critical for achieving national Goals. Several businesses implement eco-friendly and sustainable approaches that promote superior firm-level SP. Several companies, for instance, have incorporated green supply chain management (GSCM) strategies into their business procedures to ensure sustainability. A vital component of a sustainable supply chain is GLM, which may play a significant role in driving corporate SP. Consequently, our paper aimed to assess the function of green logistics in propelling SMEs' SP via CEP.

First, we observed that GLM promotes organizational sustainability. This finding is similar to the outcome of earlier studies [1,5], which reported a strong association between GL adoption and SP. Green logistics functions, including transportation, warehousing, management, and waste disposal, contribute to an organization's environment and overall SP [5]. In addition, Choi and Zhang [93] argued that the GLM substantially boosts the SP of Chinese logistics companies. Khan et al. [94] revealed that the GLM promotes social sustainability in Asian nations by reducing emissions, and waste materials and improving air quality, ultimately promoting better societal health. The NRBV also postulates that GSCM practices would promote superior SP. However, [21] reported a positive effect of the GL on environmental sustainability but a negative effect on business performance.

Second, we noticed that the GLM strongly influences organizational CEP. Firms adopting GL management are more likely to integrate circular economy practices in their business than those that have not. Green logistics spurs the repeated usage of product packaging materials, leftover materials, and recycling waste and garbage reprocessing, thus implementing circular economy practices. Our finding aligns with those of de Souza et al. [48] and Kazancoglu et al. [95], which also argued that adopting green logistics management facilitates firms to enhance their overall CEP. In logistics, a more circular and environmentally friendly production process is associated with implementing GL, which strives to reduce carbon emissions, fossil fuel use, and material returns once it attains the end of its proper life cycle [48].

Next, our findings revealed that the CEP had a crucial impact on the SP of firms. Several studies corroborated the strong effect of CEP on the SP of businesses [64]. The negative impact of business processes on the environment can be mitigated by implementing CEP [96]. CE emerged as a contemporary ideology that optimizes enterprises' economic, environmental, and social considerations to advance society toward greater sustainability through the active participation of all stakeholders [17]. Furthermore, we observed a mediating role of the CEP on the interplay between the GL and SP and that the GLM influences the circular economy practices of firms [48], subsequently affecting their organizational sustainability [64].

In addition, we incorporated the SCT as a moderator in our model to investigate whether it increases or decreases the effect of GL on CEP. The findings revealed that supply chain traceability, as a critical resource of the firm, strongly drives circular economy practices. This finding indicates that the tracing and monitoring information regarding a company's supply chain operations aid in achieving circular economy objectives. This observation is akin to prior studies [97,98], which asserted that a firm's SCT facilitates its CE activities. Kouhizadeh et al. [99] argued that technological integrations such as blockchain technology improves supply chain traceability, which is crucial for implementing circular economy practices in firms [100]. The RDT reveals that enterprises are hardly self-dependent, requiring resources and stakeholder connections to create a competitive advantage. As SCT relies on the resources and connections of various stakeholders to improve sustainable performance, our findings lend credence to RDT. However, evidence of the SCT's moderating effect on the GLM-CEP link could not be found.

5.1. Theoretical and Practical Implications

This work has many theoretical implications for the existing GLM and sustainability literature. First, our paper supplements the conceptual framework of the NRBV and RDT, hence enriching the sparse literature on developing countries' SMEs. Our findings extend the scope of the NRBV and RDT to understand the factors driving CEP and SP in a highly competitive business environment. Second, our research provides factual analysis to reinforce the assertion that GLM implementation is crucial for enhancing CEP and SP [4]. Following the NRBV hypothesis, our results demonstrate that GLM favors the CEP and SP. This result is similar to findings from studies undertaken in other locations worldwide. This illustrates that the NRBV paradigm is not region-specific and can be deployed everywhere to meet CEP and SP objectives. As a result, our scholarship broadens the scope of enterprises' NRBV.

Third, our study adds to the corpus of knowledge by revealing a direct link between CEP and SP. It suggests that a more considerable degree of circular economy activities significantly benefit the SP of Bangladeshi SMEs. Given that most studies that have found a direct association between CEP and SP have been undertaken in developed nations, this observation is an essential supplement to the current research in emerging economies [17]. The NRBV paradigm contributes to advancing the discourse on the role of green initiatives, particularly CEPs, in the SP of organizations.

Fourth, the current study contributes to the literature by examining the mediating effect of CEP on the interaction between the GLM and SP. Green logistics and sustainability studies have mostly emphasized the CEP as an outcome of the GLM [48] and a stimulus of firms' SP [17,64], overlooking its function as a mediator. Therefore, we focus on the mediating factor of CEP between GLM and SP. Our empirical evidence suggests that CEP positively mediates the connection between the GLM and SP and implies that energy and resource usage reduction, recurring use of materials, and reprocessing of recyclable materials enhance the implementation of green transportation and distribution, green warehousing, waste management, and sustainable logistics information systems in to enhance firms' SP substantially. Given that no earlier research has explored the crucial mediating function of the CEP in the GLM-SP relationship, our findings provide an essential contribution to the field.

Fifthly, our research improves our understanding of the significance of SCTs in accomplishing CE and sustainability objectives. The findings give evidence for the direct role of SCT in boosting CEP in Bangladeshi SMEs. The study indicates that identifying and managing information on a firm's warehouse activities, transport, and distribution challenges in logistics has a direct impact on the company's CEP. This research broadens the application of the RDT, and the findings pave the way for future studies to explore the relationship between SCT and GLM in other industries and domains.

In conclusion, the findings of this research have broad consequences for administrators, regulators and policymakers. This research recommends that a company integrate multiple GSCM initiatives with on-the-ground processes while adhering to the CEP to increase efficiency and achieve SP. The CE is a low-cost method several businesses utilize to turn linear economic systems into circular ones enabling long-term corporate sustainability. CE business models may assist in overcoming resource shortage issues while increasing the value of the enterprise. Furthermore, the CEP will boost a company's core competencies in achieving corporate sustainability. Stakeholders are now urged to consider GLM, while building a sustainability action plan and reviewing the results delivered by their CEP.

Considering SMEs are vital contributors to the area's rising economies, the study will substantially impact the South Asian region. In conclusion, this study's findings are pivotal since they offer a profound comprehension of the actual execution of the GL and CEP to obtain better SP.

5.2. Limitations and Future Research Avenues

Despite making significant contributions, the study's findings may be subject to limitations that could guide future studies. This study collected data from small and medium-sized enterprises in Bangladesh, which may limit the universal applicability of its conclusions. Future research may consider collecting data from other regions and industries to verify our observations' reliability. Moreover, although the study samples appropriately represent the intended population, the sample size may influence the findings. Consequently, future studies may consider employing additional strategies to increase respondent participation. Moreover, we adopted the PLS-SEM approach for data analysis and model validation. In the future, covariance-based structural equation modeling (CB-SEM) could be employed to confirm the results in other contexts. Moreover, we explored the moderating effect of SCT on the link between GLM and CEP. However, future research may also expand its moderating effect on other relationships. Finally, we adopted the SP as a single construct from the extant literature. However, a growing body of literature recognizes the SP as a multi-dimensional construct incorporating economic, environmental and social performance. Thus, future researchers may employ a multi-dimensional SP construct to measure how GL and CEP affect firms' SP.

Author Contributions: Conceptualization, B.Z. and A.B.S.; Data curation, M.M.; Formal analysis, G.-W.Z.; Funding acquisition, B.Z.; Investigation, A.B.S.; Methodology, B.Z. and G.-W.Z.; Project administration, M.M.; Resources, G.-W.Z. and M.M.; Software, M.M.; Supervision, G.-W.Z.; Validation, B.Z.; Visualization, A.B.S.; Writing—original draft, B.Z. and A.B.S.; Writing—review & editing, B.Z., G.-W.Z. and M.M. All authors have read and agreed to the published version of the manuscript.

Funding: This study was funded by the China Postdoctoral Science Foundation (Grant no. 2019M663757) and Ministry of Education of the People's Republic of China: "Research on the transmission path and Improvement Countermeasures of 3PLs' service capability to the performance under the background of high quality development (Grant Number is 20XJC790015)".

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data that support the findings of this study are available from the corresponding authors upon reasonable request.

Acknowledgments: The researchers would like to express their gratitude to the anonymous reviewers for their efforts to improve the quality of this paper.

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

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