

Article

# The Effects of Green SCM Implementation on Business Performance in SMEs: A Longitudinal Study in Electronics Industry

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**Abstract:** The evolution of green supply chain management (GSCM) in small and medium-sized enterprises (SMEs) remains underexplored in the literature. Specifically, this study assesses the changes in the effects of GSCM implementation on employee job satisfaction, operational and relational efficiency, and business performance of SMEs that serve as suppliers to large buying firms. The present study collected survey data from 193 electronics manufacturers in South Korea twice in a seven-year time gap, evaluated the reliability and the validity of individual measures, and employed structural equation modeling (SEM) to test the model hypotheses. The results commonly found in the two studies with the time gap are (1) the positive effects of GSCM implementation on employee job satisfaction and operational and relational efficiency, (2) the positive effects of both operational and relational efficiency on business performance, and (3) the positive relationship between operational efficiency and relationship efficiency. Moreover, the positive effect of employee job satisfaction on business performance is found only in the latter study (Study II). The results suggest that GSCM implementation is a critical factor for SME suppliers to establish sustainable long-term relationships with buying firms in the electronics industry, and it also helps manufacturers improve employee job satisfaction and operational efficiency over time. The present study is believed to enhance an understanding of key factors in association with GSCM that positively influences the business performance of SME suppliers.

**Keywords:** green SCM; GSCM; SMEs; implementation; job satisfaction; operational efficiency; relational efficiency; business performance; structural equation modeling; SEM



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## 1. Introduction

There has been growing awareness of environmental protection in our societies, and companies have been under institutional pressures, such as market pressure and regulatory pressure for it. More eco-friendly production processes are implemented in various industries as climate changes cause many disasters, such as wildfires in Australia and California in 2019–2020 and the electric blackout in Texas due to a winter storm in 2021. As an increasing number of customers prefer environmentally friendly products and services, regulatory authorities are applying incremental pressure on companies to curb activities, such as generating carbon emissions and producing toxic products that have adverse environmental effects [1,2]. Many companies are making great efforts to introduce environmentally friendly processes to get reasonable Environmental, Social, and Corporate Governance (ESG) rates and stay competitive. Eight out of the top 10 conglomerate groups in South Korea have recently established ESG committees or announced the establishment of such a committee at holding companies or de facto holding companies [3]. The ESG committee is usually formed in the board of directors, the company's top decision-making body. It is responsible for reviewing significant decisions, such as management plans and investments related to ESG. Samsung C&T and Hyundai Mobis were chosen from all

outside directors, while the rest of the companies included one CEO [3]. In 2019, most of the Standard and Poor's 500 companies issued sustainability reports [4]. According to the Korea Corporate Governance Agency, only 12 of the top 100 KOSPI-listed companies established ESG and Sustainable Management Committee as of 2020.

This study pays attention to the green supply chain management (GSCM) practices of small and medium-sized enterprises (SMEs) in the electronics industry of South Korea. These new systems are usually designed to comply with more strict new environmental regulations. In the early and mid-2000s, the European Union and other major countries established new, solid environmental regulations and systems, especially in the electronics industry, such as the Waste Electrical and Electronic Equipment Directive. The South Korean government also adopted similar laws that all Korean electronics firms must comply with when assembling and building electronic products. It was critical for small and medium-sized suppliers because most customer companies exported and sold products in major foreign markets and required all suppliers to redesign their systems to manage environmental compliance.

This study aims to explore the effects of the implementation of GSCM practices on business performance and other associated factors. Thus, its results are expected to deliver new understandings to SMEs, which implemented GSCM practices to improve operations for better business performance. When this research project was conducted for the first time, multinational enterprises (MNEs) started realizing the importance of green management and implementing its programs to compete in the global market. Since then, various related studies on GSCM have been published, and many of them argued that GSCM played a positive role in the company's economic or environmental performance.

Studies have recently investigated the effects of internal factors such as organizational cultures, green information systems, and managerial structure on the relationship between GSCM and organizational performance [5]. The impacts of GSCM initiatives and sustainability performance have not been fully explored but are crucial to improving supply chain sustainability [6]. Schmidt et al. [7] warned that GSCM practices are accompanied by additional initial and operating costs and reduce profitability in the short term. They also suggested that the practices would eventually enhance economic performance as environmental factors that increase initial costs were likely to be offset in the long run. Such stakeholders in the supply chain require transparent information about the influence of operational activities on society and the environment [2]. Hansen and Klewitz [8] also placed partnerships in the supply chain at the center of SMEs' long-term green strategies that stimulate adaptations. As economic performance increases in the long run, trust among stakeholders in the supply chain can be expected to build up. The focus of this study is to examine the changes of GSCM effects on efficiencies and performance from a longitudinal perspective. In particular, we would like to find out how employees' perceptions at the introduction of GSCM's practices differed from those of seven years later.

Therefore, the second project was planned out with the two following research questions:

1. What are the relationships between the implementation of GSCM practices and the business performance outcome?
2. How have these relationships changed over time?

Accordingly, data were collected twice from the same SMEs in the Korean electronics industry over a seven-year time gap. This study examines the results for the two periods and compares the outcomes of the hypotheses testing. This longitudinal study attempts to investigate whether the perceived effectiveness of GSCM implementation has been changed over seven years. Since longitudinal studies track the same subjects, their results are known to be more valid and accurate than those of cross-sectional studies. In addition, because the two data sets from one company share the same "genetics," their differences are assumed to come from environmental factors [9]. This research project contributes to the GSCM literature in that no prior studies have validated a longitudinal GSCM research model by collecting data at time intervals.

This paper is organized as follows. Section 2 provides the background of the study. In Section 3, this study develops hypotheses based on previous studies. Section 4 explains descriptive statistics and test of hypotheses. Section 5 reports the statistical results, and Section 6 discusses the findings and implications of the study.

## 2. Research Background

Responsible organizations observe the environment for sustainable development. Studies have explored a contextual influence that helps organizations stimulate corporate environmental responsibility [10–12]. Babiak and Trendafilova [13] frame sustainable practices and examine the causal drivers of environmental behavior. Sustainable SCM has been a growing interest for organizations and researchers over the past two decades. Companies adopting environmental or green management are viewed as socially responsible and sustainable [14–16]. Carbone et al. [17] suggest that researchers need to investigate the respective roles of corporate environmental responsibility worldwide, at both the corporate and supply chain levels.

### 2.1. GSCM Practices

Research on the environmental aspect of supply chain management has indulged in incorporating environmental issues into the supply chain functions and processes, such as procurement, supplier selection, product and service design, and transportation [18–21]. Meanwhile, in the mid- and late-2000s, the European Union (EU), the United States, and most major economies established strong regulations on environmental management especially in the electronics industry [22,23]. Hence, it has become essential for business organizations to go green and companies have adopted GSCM practices for the improvement of environmental performance as well as business competitiveness.

A great number of SCM studies have attempted to define what GSCM entails. It is because the study of GSCM has emerged as a core concept and effective management tool for leading organizations of most industries [24]. First of all, GSCM is simply minimizing all kinds of negative impacts of a firm's supply chain on the environment. It is a novel approach for business organizations to decrease environmental effects and enhance ecological efficiency to achieve greater profit and market growth objectives. Moreover, GSCM incorporates environmental thinking into traditional closed-loop SCM [25]. It helps make environmental philosophy embedded into the business and attain the organizations' sustainable growth [26]. Additionally, the integration of eco-friendly activities and processes for asset transformation needs the right decision-making process [27]. Most of all, business organizations began to examine environmental issues throughout the entire supply chain to enhance their environmental performance [21,28].

Zhu and Sarkis [29] categorized GSCM practices into four dimensions: internal environmental management, external GSCM practices, investment recovery, and eco-design. Then, they made two groups of factors out of the external GSCM practice category, green purchasing and cooperation with customers in their succeeding research [24,30,31]. Green purchasing is about the environmental control in upstream of the firm's supply chain and cooperation with customers is about collaborative efforts between the vendors and the buying companies on environmentally conscious product design, production, and packaging. They claim that their measurement model is a "self-diagnostic tool" to be utilized to identify areas for improvement as well as a good monitoring method for maintaining the excellence of the manufacturer's GSCM practices [24]. Lee et al. [21] investigated the implementation of GSCM practices among electronic manufacturers using a measurement model made up of four dimensions: internal environmental management, green purchasing, cooperation with customers, and eco-design.

Internal environmental management has been the most commonly implemented set of GSCM activities by manufacturing firms [21,24]. Specifically, the commitment to GSCM from the senior management team and environmental compliance/auditing programs are found to be the two most recognizable factors out of the eight within this dimension

and most of the surveyed firms answered that they already initiated the implementation of these practices or were currently considering their adoption. Aich and Tripathy [32] utilized an interpretive structural model (ISM) to develop a hierarchical map showing inter-relationships among success factors of GSCM in Indian computer peripheral manufacturers. One of their major findings was that (1) green logistics, (2) green design, and (3) green procurement were linkage factors aligned in parallel, connecting short-term green activities to operational performance. As one of the important GSCM waste management processes, the remanufacturing of e-waste and its critical factors were examined by Singhal et al. [33] to build up an ISM presenting their hierarchical interrelationships. They found government incentives and green awareness were the most reliable factors of remanufacturing of e-waste in India.

Green purchasing is another main GSCM factor that applies environmental analysis not only to the first-tier suppliers of the focal firm but also to the suppliers of the immediate suppliers [21,30]. On this matter, the manufacturers monitor these suppliers with respect to their environmental compliance. Lamming and Hampson [34] suggested that the buying firm must set enforceable environmental standards in materials procurement so that suppliers carefully conduct their operations and accordingly monitor the business activities of their own suppliers. Other studies such as Hsu and Hu [35] also highlight that eco-friendly purchasing practices should consist of GSCM initiatives such as supplier environmental compliance audits or supplier's environmental assessment and certifications.

Cooperation with customers or with buying companies is a critical element in terms of GSCM, especially if a supplier is contracted with the companies that export and sell their products in foreign countries. The buying companies often help their suppliers that may not be knowledgeable about the environmental regulations and laws of such foreign governments. Moreover, a joint effort between the focal firms and suppliers on various subjects, such as eco-friendly technology development, cleaner product and process design, and integration of information systems between the two parties, should create the best results.

Gonzalez-Benito [36] also encourages businesses to value the eco-friendly design of new products. Hence, eco-friendly design is one of the key GSCM practices helping meet the objectives such as replacing toxic substances with safer and cleaner materials, reducing resource consumption, and raising organizational awareness and commitment to the product [36]. Zhu and Sarkis [30] emphasize that the levels of emitting pollution or certain chemicals are already determined at the design stage of selecting materials and the production process in the product life cycle. Goli and Davoodi [37] presented a strategic framework coordinating and optimizing production and distribution by integrating the supply chain with open-shop processes. Sangaiyah et al. [38] suggested a robust linear programming model and a metaheuristic algorithm that can handle a natural supply uncertainty in liquefied natural gas (LNG) supply chain planning.

## 2.2. GSCM and Organizational Performance

GSCM entails the identification of suitable assessment methods to obtain a comprehensive understanding of the field [39]. Hence, prior studies in the GSCM context have attempted (1) to identify the GSCM practices to be implemented; and (2) to determine the benefits of such GSCM implementation. The former is discussed in the previous section and the latter in this section.

Studies in the early stage of GSCM literature showed concerns that companies could lose their competitiveness caused by increased costs from adopting GSCM practices in the short term [40]. According to Khanna and Anton [41], corporate environmental management (CEM) is a self-regulatory business approach aiming to protect our environment and build a system that furnishes environmental concerns to production decision-making. Madsen and Ulhi [42] argue that the CEM adoption harmonizes an environmental strategy with other strategic issues, such as long-term corporate goals and product positioning. In general, a proactive approach indicates an innovative strategic treatment to pollution

prevention, and a reactive attitude to dealing with environmental issues implies extra production costs, which have a negative impact on competitiveness. In this line of thinking, Madsen and Ulhi [42] claim that the result of proactive pollution prevention programs could be cost savings in production and/or improvements in product values and brand image of the company. This will, in turn, make the company more competitive in the market [43].

As found in recent literature, that GSCM practices result in improved business performances, Seman et al. [44] indicate that successful implementation of GSCM practices excels business organizations' environmental performance. They argue that the implementation of the GSCM system helps increase the value of green innovation, has a positive influence on the organizational environmental performance, and, thus, supports organizational process innovation for sustainable market leadership. Feng et al. [45] note that both internal and external GSCM practices help enhance internal efficiency, including environmental and operational efficiencies. These obtained efficiencies will, thus, lead to improved financial performance. Chavez et al. [46] argue that the two operational performance dimensions, quality and delivery, are identified as the two constructs yielding higher customer satisfaction levels than flexibility and cost reduction.

### 2.3. GSCM and SME Suppliers

Companies are encountering market environments changing fast, and the competitiveness of SMEs relies increasingly more on the early discovery of market needs and identification of new customers [47]. In a society heavily relying on global business transactions, sustainability becomes an essential agenda for industries, and industries view SMEs as a critical part of global value chains, where they have to meet the environmental requirements of their multinational customers [48]. As governments of large economies pass more strict environmental regulations to match the expectations of different social organizations, large global companies tend to enhance their environmental performance. Similarly, SMEs also should attempt to better control the environmental impact of their own operations [49]. The growing concern regarding environmental issues leads manufacturing companies to seriously consider implementing green procurement practices in their supply chain processes [50]. In this regard, SCM is often identified as a vital element of a company's competitive edge [50].

The key role of SMEs in global SCM is critical from not only economic but also environmental perspectives. Global supply chains can also ensure suppliers' compliance with environmental regulations. If buying firms define environmental criteria during their procurement process, then SMEs also need to supply materials that meet these specifications to succeed in the market [51]. Moreover, the focal firm needs to orchestrate actions of its supply chain members from different countries to manage its green supply chain, and the SMEs in the supply chain may feel pressure from this coordinated action [52]. However, the greening of the supply chain should be viewed as a threat to the small suppliers and also be regarded as a window of opportunity in their national and global markets [21,53]. Along this line of reasoning, even if small and medium-sized suppliers may lack the resources and infrastructure to fully operate a green supply chain [28], they must not be criticized and treated as bottlenecks adversely affecting the environmental performance in an entire supply chain [54].

## 3. Hypotheses Development

Figure 1 depicts our theoretical model where implementation of GSCM practices has a direct, positive effect on the firm's business performance (BP) as well as indirect effects through employee job satisfaction (ES), operational efficiency (OE), and relational efficiency (RE). Definitions of the constructs adopted in this study are provided in Table 1.



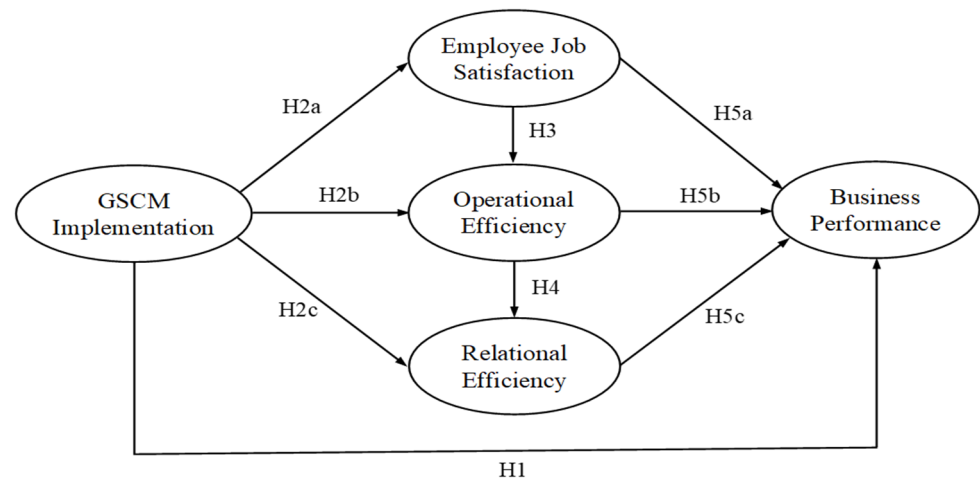


Figure 1. The research model.

Table 1. Construct definitions.

Construct	Definition	References
GSCM practice implementation	Adoption of green supply chain management practices including internal green management, green purchasing, cooperation with customers, and eco-design for developing corporate and operational strategies for the firm's environmental sustainability	Zhu et al. [24]
Internal environmental management	Support and encouragement from senior managers to adopt green practices	Zhu et al. [24]
Green purchasing	The procurement of products that have a reduced influence on human health and the environment	Zhu et al. [24]
Cooperation with customers	Inter-firm relations providing formal and informal mechanisms that enhance trust, reduce risk, and in turn improve cooperation	Zhu et al. [24]
Eco-design	The integration of environmental aspects into the product development process by balancing ecological and economic requirements	Rusinko [55]; Zhu et al. [24]
Employee job satisfaction	The feeling that employees have on their jobs related to the relationship with their working environment and supervisors	Homburg and Stock [56]; Zhou et al. [57]; Ahmad and Raja [58]
Operational efficiency	The ability of supplier firms to reduce cycle time and costs, create greater customer value, and improve product quality	Rusinko [55]; Zhu et al. [24]; Zacharia et al. [59]
Relational efficiency	The ability of supplier firms to increase openness and transparency in the business processes working with buyers so that suppliers can build credibility and trust in the relationship with buyers	Pfeffer and Salancik [60]; Zacharia et al. [59]; Zacharia et al. [61]
Business performance	Financial and non-financial performance of the organization as a result of the implementation of GSCM practices as well as improvement in operational/relational efficiency and employee job satisfaction	Zhu et al. [24]; Zacharia et al. [59]; Ya'kob and Jusoh [62]

### 3.1. Implementation of GSCM Practices and Business Performance

Attention to the relationship between implementation of GSCM practices and business performance has become rapidly widespread in both academic theory-building and corporate operations. Early studies that examined the effects of GSCM adoption on firm performance reported mixed results regarding performance improvement [19,21,63,64]. However, the similar effects found in later empirical investigations were consistently positive. Kuei et al. [65] discovered that the environmental management capabilities of business organizations are positively linked to firms' economic performance. Feng et al. [45] and Wong et al. [66] confirmed that redesigned supply chain operations with eco-friendly practices yielded positive financial performance both directly and indirectly. In a similar way, Jackson et al. [67] attempted to unveil the relationship between eco-friendly practices adoption and financial performance of the firms. Previous research found that top management and middle management support have been considered a critical success factor of GSCM practice implementation because strong communication with upper-level management helps environmental professionals effectively tackle the environmental issues [20,21,23,24]. Sarkis et al. [20] also pointed out that cross-functional cooperation is positively associated with environmental progress. Li et al. [11] revealed that successful green supply chain operations helped enhance firms' profitability and boost firms' reputations. Thus, we propose the following hypothesis:

**Hypothesis 1 (H1).** *The implementation of GSCM practices is positively related to the business performance at the firm level.*

### 3.2. GSCM Implementation on Job Satisfaction and Efficiency

Corporate employees are influenced instinctively by decisions made by top management. When the decision is expected to bring an innovative change into the corporate culture, employees are likely to respond with an improved perception of their job and the company they are working at. It is an argument frequently debated by a number of prior studies that one of the results of corporate social responsibility is an improvement in employees' goodwill and job satisfaction [68,69]. Environmental audit or an international standard for environmental management such as ISO 14001 certification can be viewed as green innovation practices making employees feel safer [31]. In addition, from the perspective of Lee and Chang [70], the innovative spirit in the organizational culture and group-oriented teamwork in the culture show a positive impact on job satisfaction of the employees. Employees could feel safer and be more satisfied with their new environmentally friendly manufacturing operations and working processes due to the removal of unsafe levels of toxic materials from the production process.

Prior research has claimed that GSCM can improve operational efficiency in terms of quality, flexibility, cost, and delivery [40,46]. In addition, Zailani et al. [71] reported that the adoption of GSCM practices (e.g., environmental purchasing) led to improved operational performance, especially in terms of product quality and cost reduction. Firms with a good internal environmental management system use pollution-prevention technologies in production processes, which are known to be more efficient in the long run. It is because they are likely to consume fewer materials and energy, and, thus, increase operational efficiency at lower operating costs.

Business organizations cannot view their operations as green without successfully incorporating their environmental goals with the upstream members in their supply chains [72]. As stronger environmental regulations on production and packaging have been widely adopted in most large economies, firms face increasing institutional pressures on their daily supply chain management [73,74]. Eco-design is even further complicated because of unceasingly evolving environmental awareness and standards. In this respect, focal firms focus on assessing suppliers' environmental performance for eco-friendly supplies and often provide resources to help improve suppliers' green operations and capabilities [21,75].

Resource dependency theory explains that organizations that have experiences of obtaining desired outcomes from an inter-organizational relationship tend to value the relationship [60]. Customer companies seek suppliers with installation of environmental systems to integrate their enterprise systems with these suppliers. Recent studies propose that global businesses build a decent degree of inter-organizational trust before initiating collaborative work [21,76,77]. As discussed earlier, to successfully implement GSCM throughout the supply chains, it is critical for the firms to jointly develop cleaner technology for operations, design green processes, and purchase clean raw materials. Thus, the following hypotheses are proposed:

**Hypothesis 2a (H2a).** *The implementation of GSCM practices is positively associated with employee job satisfaction.*

**Hypothesis 2b (H2b).** *The implementation of GSCM practices is positively associated with the operational efficiency of the firm.*

**Hypothesis 2c (H2c).** *The implementation of GSCM practices is positively associated with the relational efficiency between the supplier and the large customer firm.*

### 3.3. Employee Job Satisfaction and Operational Efficiency

Employee job satisfaction is also a measure of the degree of employees' pleasure that leads to better performance [78]. Harrison et al. [79] support this argument as well. Their meta-analysis concluded that employees' job attitudes, including job satisfaction and organizational commitment, precede employees' organizational behavior and performance. In addition, Patterson et al. [80] investigated the connection between organizational climate and performance, and revealed that the two factors are indirectly related. They tested how the company climate measured by employees' perceptions of the organization's policies and practices are associated with productivity. Their test results presented that workers' job satisfaction mediates the link between the company climate and productivity. Thus, the relationship between employees' job satisfaction and operational efficiency is hypothesized as:

**Hypothesis 3 (H3).** *Employee job satisfaction is positively related to the operational efficiency of the firm that implemented GSCM practices.*

### 3.4. Operational Efficiency and Relational Efficiency

Relational efficiency can also be positively influenced by operational efficiency [59]. Zacharia et al. [59] claim that a firm can earn greater levels of trust and credibility from the collaborating counterpart when it proves its excellence in its jobs, and the relationship effectiveness will be enhanced as firms in a partnership continuously accomplish success in their joint efforts. Recent literature on GSCM claims that GSCM helps reduce environmental damage along the supply chain because collaboration across functions in the supply chain enables the focal firm to identify environmental issues [66]. Studies argue that working closely with upstream firms is particularly crucial to the implementation of eco-design and eco-packaging for environmental compliance. For this reason, buying firms weigh suppliers' operational capabilities when selecting their collaborating counterparts. According to Zacharia et al. [59], when the supplier proves its operational excellence, it will earn more trust from the buying firm, and we are convinced that relational efficiency can be influenced by operational efficiency. Based on the discussion, the study posits the following hypothesis:

**Hypothesis 4 (H4).** *The improved supplier's operational efficiency has a positive impact on the relational efficiency between the supplier and the large customer firm.*



### 3.5. Effects of Job Satisfaction and Efficiency on Business Performance

Employee job satisfaction represents the degree of pleasure working under current working conditions. Investigations in organizational psychology have often reported that satisfied employees tend to work more efficiently and yield higher productivity and economic performance due to their voluntary commitment [81]. Zhou et al. [57] found evidence in Chinese manufacturers that business performance has a positive impact on employees' job satisfaction. Moreover, better operational efficiency obtained by the technologies can be positively associated with business performance. Less cost paid on raw materials and energy consumption, nearly zero budget spent on pollution control and treatment of waste, especially toxic substances, and improved brand image due to greener products are the instances leading to better business performance. From the suppliers' perspective, building and securing a good collaborative relationship is far more critical. While developing environmentally friendly operations, suppliers consider it important that they cater to environmentally conscious buying companies. Lamming and Hampson [34] argue that this collaboration would offer "better market opportunities for the suppliers to embed its business in the customer's value chain." Moreover, various research reports that a sustainable, long-term relationship between the focal firms and suppliers helps suppliers improve their performance [82–84]. Thus, the following hypotheses are suggested:

**Hypothesis 5a (H5a).** *Employee job satisfaction is positively related to business performance at the firm level.*

**Hypothesis 5b (H5b).** *Operational efficiency is positively related to business performance at the firm level.*

**Hypothesis 5c (H5c).** *Relational efficiency between the supplier and the large customer firm is positively related to the supplier's business performance.*

## 4. Research Methodology

### 4.1. Questionnaire Development

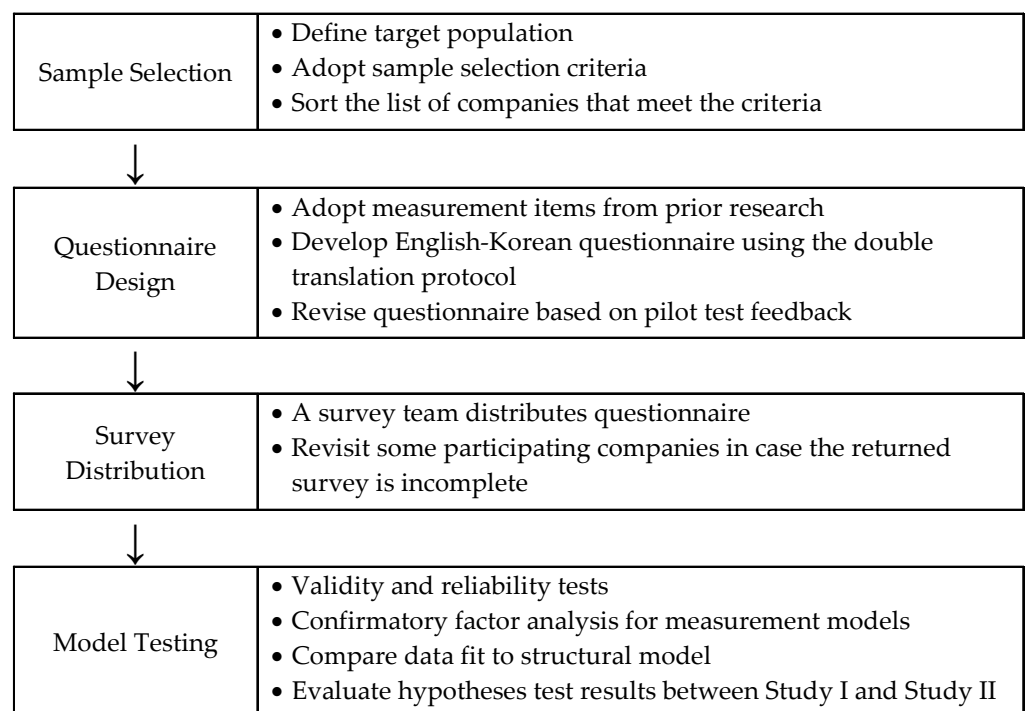
In the present study, we conceptualized GSCM as a higher-order construct that encompasses internal environmental management (IEM), green purchasing (GP), cooperation with customers (CC), and eco-design (ECO), following the work of Zhu et al. [24]. We also employed key items of Zhu and Sarkis [30] to assess the four constructs as mentioned earlier. This study incorporated these measurement items with additional items that are adopted from other research, and the measurement scale instrument was examined in a survey questionnaire format by various studies [24,35,55,57,59,85–87]. We used the five-point Likert scale (1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) because the participating firms were no longer in the GSCM adoption stage. In measuring other variables in the structural model, questions were on the same five-point Likert scale. In the questionnaire development process, the authors used the double translation protocol as follows: (1) the measurement items were written in English first, (2) they were translated into Korean, (3) the questionnaire was reviewed by a panel of experts from academia as well as those in the electronics industry to ask for their comments and suggestions regarding the survey items, and finally, (4) the Korean version was translated back into English. The two English versions have no significant differences.

### 4.2. Data Collection

The operations and supply chain managers of electronics SMEs are chosen because: they are usually involved with major activities of supply chain management, and their position in the supply chains might have a critical environmental impact on focal firms [88]. The population companies of interest have three distinct characteristics that impact the generalizability of this study:

First, they are small and medium-sized suppliers. We select small and medium-sized suppliers in the upstream of supply chains because of their lack of environmental management capabilities that might adversely affect the financial performance and reputation of the buying firm [28,89,90]. Second, they are in the electronics industry. It is a rapidly changing industry due to globalization and technological advances. Consequently, ecological issues and concerns arise fast, and many significant regulatory acts have been and will be enforced globally for this industry. Third, they are Korean firms. South Korea is one of the developed nations with the government's strong environmental enforcement. Moreover, Korean electronics firms such as Samsung and LG Electronics are global leaders in the industry [35,91,92]. Moreover, many of their products are being exported to Europe, where strict environmental laws are enforced.

The questionnaire was administered to operations and supply chain managers of small and medium-sized electronics manufacturers in Korea. The actual survey was conducted in cooperation with a research consulting firm in Korea. After referring to a list of small and medium-sized Korean electronics companies that was publicized by the Korea Investor Service (KIS), the survey team of the consulting firm sorted out the companies by average annual revenue. According to the Ministry of SMEs and Startups of South Korea, manufacturing firms in the electronic parts and components making less than 85 million USD a year are classified as SMEs. The questionnaire was sent out to the operations/supply chain department of 756 companies meeting the criterion. Our survey team explained to the supply chain managers (1) the purpose of our study and (2) how to rate each questionnaire item over the phone. In three weeks, 223 companies mailed the questionnaires back for our first study. When we found unanswered items, telephone calls followed to complete the survey. Seven years later, the survey team contacted the same 223 companies for our second study, and we obtained fully answered questionnaires from 193 companies' supply chain managers, following the same protocol. The methodology adopted to guide our research process is summarized in Figure 2.



**Figure 2.** Methodological framework adopted in the research.

#### 4.3. Non-Response Bias Analysis

To examine possible non-response bias and the generalizability of findings to the population, a t-test was performed to check if there is any significant difference in key attributes

like the number of employees between early and late responses [93]. The t-test results do not indicate statistically significant differences between the two sets, and, thus, the results suggest that the survey received from respondents represents an unbiased sample.

#### 4.4. Measure Assessment

We examined the psychometric properties of our reflective scales using a confirmatory factor analysis (CFA). First, we included all reflective latent variables in a single multi-factorial CFA model. The output indicated the existence of multivariate non-normality. Hence, we utilized the maximum likelihood parameter estimates with standard errors and a chi-square test statistic that are robust to non-normality, using robust maximum likelihood estimation (MLR) in Mplus version 7. The overall fit indices of our model (Study I:  $\chi^2/d.f. = 2.051$ , CFI = 0.899, SRMR = 0.079, RMSEA = 0.074; Study II:  $\chi^2/d.f. = 1.866$ , CFI = 0.905, SRMR = 0.075, RMSEA = 0.067) are acceptable [94,95].

## 5. Results and Discussion

### 5.1. Characteristics of Responding Firms

Table 2 represents the descriptive information of the responding firms and the individual respondents. When it comes to respondents' job titles, the majority were middle (71.5%) and senior (14.5%) managers. The GSCM practices were considered important and were often supervised by top management. In addition, the majority of the respondents (74.1%) have worked for over five years in this profession. All responding firms were classified as SMEs (meeting the criterion suggested in Section 4.3). Here is the distribution: 77 firms (39.9%) with less than 100 employees, 41 firms (21.2%) with 100 to 200 employees, and 75 firms (38.9%) with 200 to 500 employees. Concerning industry classifications of their buyer firms, all 193 firms answered that their buyer firms were in the electronics industry. Nine out of 193 firms noted that they work with clients in the telecommunications and automotive industries; 131 firms (67.9%) were "immediate suppliers to major buying companies", 57 firms (29.5%) "second-tier suppliers", and five firms (2.6%) answered that they "supply to government agencies".

**Table 2.** Characteristics of responding firms.

	Frequency	%
A. Respondents' Job Title		
Top Executive	8	4.2
Senior Executive	28	14.5
Middle Manager	138	71.5
Employee in Charge	19	9.8
Total	193	100.0
B. Respondents' Work Experience (years)		
Less than 5	50	25.9
5–10	76	39.4
11–15	52	26.9
More than 15	15	7.8
Total	193	100.0
C. Firm Size(# of employees)		
50–200	118	61.1
201–400	49	25.4
401–500	26	13.5
Total	193	100.0
D. Industry Classification of the Buying Firms (multiple answers)		
Electronics	193	
Telecommunication	7	
Automobile	2	

**Table 2.** *Cont.*

	Frequency	%
E. Firm's Primary Business Goal in Supply Chain		
First-tier Supplier to Major Firms	131	67.9
Second-tier Supplier	57	29.5
Supplier to Government	5	2.6
Total	193	100.0

### 5.2. Measurement Model

Prior to analyzing the outputs of the structural model, this study evaluated the reliability of individual measures, the reliability for the composite of measures for each construct (internal consistency reliability), and the validity of individual measures (such as convergent validity and discriminant validity) as shown in Table 3. First, both Cronbach's alpha coefficients and composite reliability (CR) were examined for the internal consistency reliability. The obtained Cronbach's alpha values (ranged between 0.841 and 0.972 in Study I; between 0.774 and 0.954 in Study II) exceeded the threshold value of 0.70, recommended by Nunnally and Bernstein [96]. Additionally, all composite reliability values in both datasets showed above the threshold value of 0.70 [97]. We also assessed convergent validity based on the values of average variance extracted (AVE). All AVE values in this paper (ranged between 0.550 and 0.841 in Study I; between 0.546 and 0.838 in Study II) exceeded the threshold value of 0.50, which demonstrated a high convergent validity [97]. There were more variations in all the four performance measurement items in Study I than those in Study II. For the variance comparison over time, all F-statistic values are over 107.268 with less than 0.001 significance levels in the additional F-tests. The results suggest that the business performance of the electronic firms that adopted GSCM practices has stabilized upward over time.

**Table 3.** Reliability and convergent validity.

Construct	Study I			Study II		
	AVE	CR	Cronbach's $\alpha$	AVE	CR	Cronbach's $\alpha$
IEM	0.571	0.868	0.846	0.613	0.888	0.857
GP	0.679	0.894	0.841	0.647	0.879	0.882
CC	0.730	0.915	0.852	0.717	0.909	0.894
ECO	0.550	0.859	0.927	0.546	0.857	0.774
ES	0.663	0.813	0.906	0.584	0.802	0.895
OE	0.692	0.831	0.934	0.700	0.858	0.892
RE	0.841	0.846	0.972	0.838	0.847	0.954
BP	0.748	0.781	0.921	0.699	0.796	0.871

Moreover, as presented in Table A1, all loadings in both tests are statistically significant and range from 0.620 to 0.953. Notably, the factor loadings for the GSCM construct indicate convergent validity at the item level. For the second-order loadings, in the Study I dataset, only IEM2, ECO3, and OE6 obtained less than 0.70 but above 0.60. In the Study II dataset, ECO3, ECO4, and ES1 were between 0.60 and 0.70. Because the criteria for both composite reliability and convergent validity (AVE) exceeded the recommended threshold value, these items between 0.60 and 0.70 were retained in the measurement model. Our study included these items because, conceptually, they were regarded as important for their respective constructs. All factor loadings of the second-order GSCM construct were acceptable and statistically significant. Loadings of all other items are above the recommended cutoff level [98]. Hence, this study finds that all factor loadings are acceptable and reaffirms the convergent validity at the item level.

This study subsequently measured the discriminant validity of the measurement model using the cross-loading method, the Fornell–Larcker criterion, and the heterotrait–monotrait (HTMT) ratio. We performed the cross-loading method for the GSCM constructs

(internal environmental management, green purchasing, cooperation with customers, and eco-design), employee job satisfaction, operational efficiency, relational efficiency, and business performance. This study determined the discriminant validity based on the loadings of factors as compared to the cross-loadings of other constructs. The results of the cross-loading method and Fornell–Larcker criterion are presented in Tables 4 and A2, respectively. Finally, HTMT ratio of correlations, the most recent addition to the discriminant validity test. The HTMT test computes a ratio of the average correlations between latent variables to the geometric mean of the average correlations within items of the same variables [99]. Henseler et al. [99] suggest the HTMT value of over 0.90 as discriminant validity violation. As shown in Table 5, the highest HTMT values are 0.696 in Study I and 0.628 in Study II. These results above show that all the reflective factors in our study fulfilled the cross-loading method, the Fornell–Larcker criterion, and the HTMT ratio that reaffirm the convergent validity and discriminant validity of our constructs.

**Table 4.** Discriminant validity: Fornell–Larcker criterion.

Study I								
Construct	IEM	GP	CC	ECO	ES	OE	RE	BP
IEM	<b>0.756</b>							
GP	0.428	<b>0.824</b>						
CC	0.453	0.493	<b>0.854</b>					
ECO	0.235	0.276	0.236	<b>0.742</b>				
ES	0.282	0.252	0.324	0.364	<b>0.815</b>			
OE	0.569	0.513	0.464	0.531	0.495	<b>0.832</b>		
RE	0.406	0.453	0.536	0.556	0.453	0.396	<b>0.917</b>	
BP	0.531	0.466	0.501	0.405	0.620	0.534	0.610	<b>0.865</b>
Study II								
Construct	IEM	GP	CC	ECO	ES	OE	RE	BP
IEM	<b>0.783</b>							
GP	0.536	<b>0.804</b>						
CC	0.552	0.561	<b>0.847</b>					
ECO	0.330	0.229	0.235	<b>0.739</b>				
ES	0.416	0.254	0.390	0.447	<b>0.764</b>			
OE	0.414	0.484	0.475	0.528	0.572	<b>0.837</b>		
RE	0.506	0.678	0.507	0.488	0.287	0.410	<b>0.915</b>	
BP	0.306	0.440	0.505	0.234	0.410	0.379	0.321	<b>0.836</b>

Note: The bold section is the diagonal cells that list the square root of average variance extracted (AVE) for the reflective constructs.

**Table 5.** HTMT results.

Study I								
Construct	IEM	GP	CC	ECO	ES	OE	RE	BP
IEM	-							
GP	0.540	-						
CC	0.515	0.696	-					
ECO	0.439	0.438	0.424	-				
ES	0.613	0.454	0.373	0.403	-			
OE	0.436	0.231	0.253	0.391	0.342	-		
RE	0.562	0.421	0.446	0.340	0.470	0.652	-	
BP	0.467	0.346	0.362	0.412	0.451	0.667	0.664	-
Study II								
Construct	IEM	GP	CC	ECO	ES	OE	RE	BP
IEM	-							
GP	0.493	-						
CC	0.067	0.071	-					
ECO	0.012	0.008	0.156	-				
ES	0.565	0.491	0.018	0.037	-			
OE	0.453	0.227	0.009	0.017	0.337	-		
RE	0.523	0.449	0.086	0.007	0.467	0.628	-	
BP	0.481	0.352	0.118	0.057	0.393	0.622	0.538	-



### 5.3. Structural Model

This research examined the relationship between the implementation of GSCM practice and job satisfaction as well as two different types of efficiency. Then, the relationship between the above-mentioned factors and business performance was evaluated. Table 5 and Figures 3 and 4 present the results of the structural model estimation.

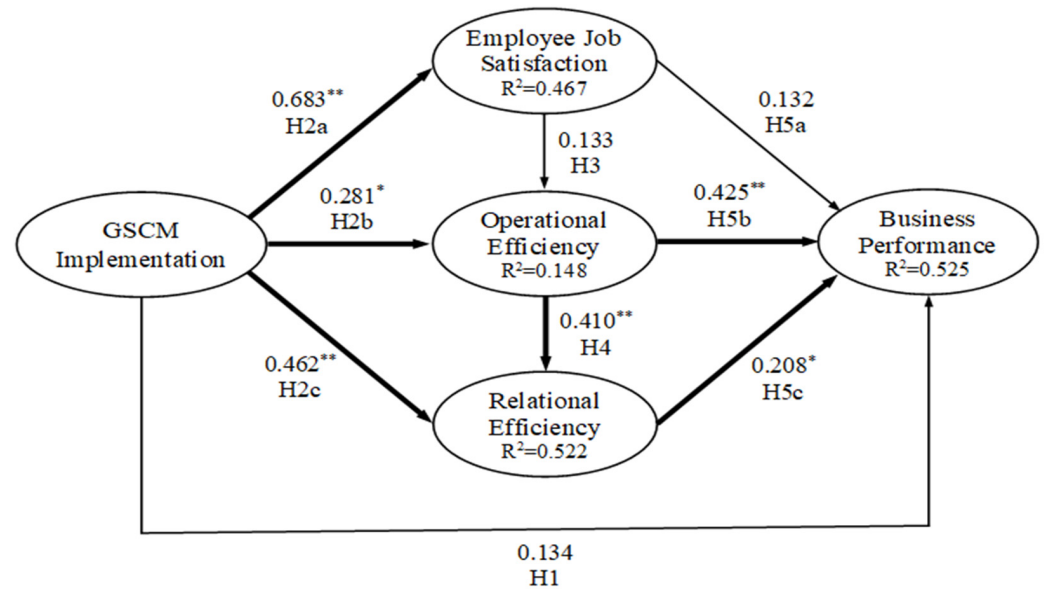


Figure 3. Results of hypothesized research model (Study I). \*\*  $p < 0.01$ ; \*  $p < 0.05$ .

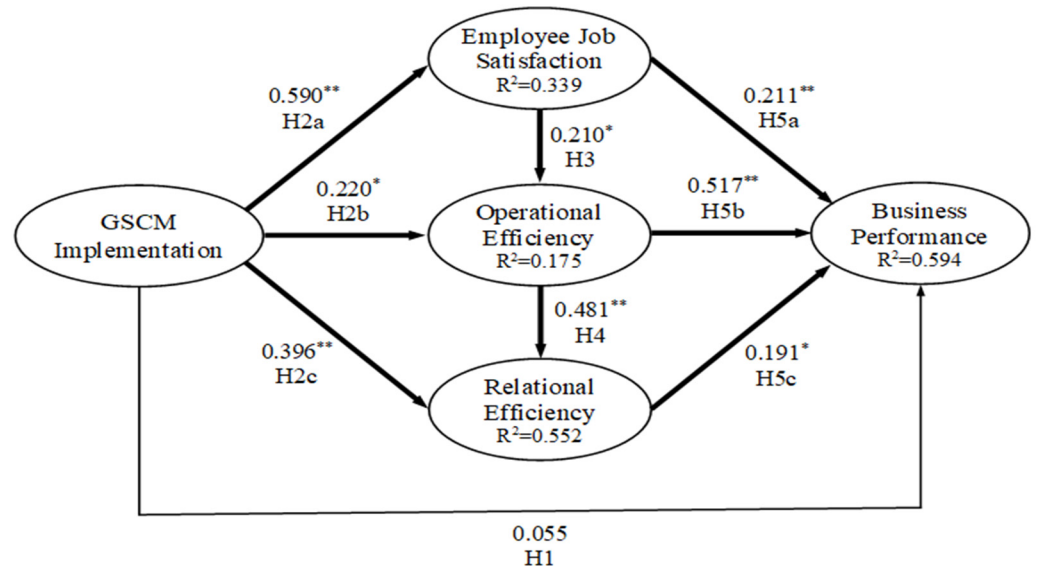


Figure 4. Results of hypothesized research model (Study II). \*\*  $p < 0.01$ ; \*  $p < 0.05$ .

The results summarized in Table 5 confirm that the direct effect of GSCM practice implementation on business performance (H1) is not significant in both studies (Study I:  $b = 0.134$ , n.s.; Study II:  $b = 0.055$ , n.s.). However, the implementation of GSCM practices turns out significantly and positively associated with all three constructs, such as employee job satisfaction (Study I:  $b = 0.683$ ,  $p < 0.01$ ; Study II:  $b = 0.590$ ,  $p < 0.01$ ), operational efficiency (Study I:  $b = 0.281$ ,  $p < 0.05$ ; Study II:  $b = 0.220$ ,  $p < 0.05$ ), and relational efficiency (Study I:  $b = 0.462$ ,  $p < 0.01$ ; Study II:  $b = 0.396$ ,  $p < 0.01$ ). These results provide support for H2a, H2b, and H2c, respectively. The result of our empirical investigation suggests that GSCM implementation was positively associated with employee job satisfaction. This is aligned

with the evidence of previous studies [68,69] reporting that employees' job satisfaction was improved when they felt proud of belonging to a socially responsible firm. Additionally, Green et al. [40] and Chavez et al. [46] viewed that a well-built internal environmental management system and hazardous-material-free manufacturing operations not only helped the workers feel safer but also had a positive impact on operational efficiency. Other studies indicated that stable buyer–supplier relationships decreased the buyers' desire to select new suppliers and led to a longer commitment in the business relationship [100–102].

The effects of employee job satisfaction on operational efficiency (H3) and business performance (H5a) are not statistically significant in Study I ( $b = 0.133$ , n.s.;  $b = 0.132$ , n.s.) but turn out significant in Study II ( $b = 0.210$ ,  $p < 0.05$ ;  $b = 0.211$ ,  $p < 0.01$ ). In other words, even though new innovative operations such as GSCM practices have a positive impact on employee job satisfaction, job satisfaction may not have a statistically significant effect on operational efficiency or business performance in the early stage of implementing the green innovation. H3 and H5a in Study II predict that employee job satisfaction has positive relationships with both operational efficiency and business performance. Ahmad and Raja [55] showed that employee job satisfaction strongly contributes to firm's business performance. Melián-González et al. [81] also found a positive relationship between firm's economic performance and employee satisfaction at the firm level.

Operational efficiency is purported to be conducive to relational efficiency between the focal firms and SME suppliers. H4 postulates that the improved operational efficiency in supplier's manufacturing operations positively influences the relational efficiency between the supplier and the large buying firms. The test results provide support for this hypothesis in both Study I ( $b = 0.410$ ,  $p < 0.01$ ) and Study II ( $b = 0.481$ ,  $p < 0.01$ ), as reported in Table 5. Zacharia et al. [59] confirmed that better operational outcomes helped the suppliers earn a higher level of trust from the customer companies, encouraging the customers to build a more effective working relationship with the supplier. In addition to this research outcome, H5b and H5c also predict that both improved operational efficiency of the supplier and relational efficiency between the supplier and its buying firms positively affect the supplier's business performance. Table 6 shows that the paths of operational efficiency on business performance (Study I:  $b = 0.425$ ,  $p < 0.01$ ; Study II:  $b = 0.517$ ,  $p < 0.01$ ) and relational efficiency on business performance (Study I:  $b = 0.208$ ,  $p < 0.05$ ; Study II:  $b = 0.191$ ,  $p < 0.05$ ) are statistically significant. Thus, both H5b and H5c are supported. This result is consistent with the findings of previous research. Operational efficiency enhanced by innovation was suggested to have a positive impact on business performance [55,59]. Moreover, Zacharia et al. [59] showed that improved relational outcomes by a collaborative partnership in manufacturing led to enhancements in the firm's business performance.

**Table 6.** Comparison of hypotheses test results between Study I and Study II.

	Path (from-to)	Direct Effects (t-Value) Study I	Study II	Hypotheses Test Results Study I	Study II
H1	GSCM Implementation → Business Performance	0.134 (1.212)	0.055 (0.614)	Not Supported	Not Supported
H2a	GSCM Implementation → Employee Job Satisfaction	0.683 (12.121) **	0.590 (8.847) **	Supported	Supported
H2b	GSCM Implementation → Operational Efficiency	0.281 (2.213) *	0.220 (2.010) *	Supported	Supported
H2c	GSCM Implementation → Relational Efficiency	0.462 (7.403) **	0.396 (6.144) **	Supported	Supported
H3	Employee Job Satisfaction → Operational Efficiency	0.133 (1.113)	0.210 (2.054) *	Not Supported	Supported
H4	Operational Efficiency → Relational Efficiency	0.410 (6.686) **	0.481 (8.191) **	Supported	Supported
H5a	Employee Job Satisfaction → Business Performance	0.132 (1.500)	0.211 (2.897) **	Not Supported	Supported
H5b	Operational Efficiency → Business Performance	0.425 (6.400) **	0.517 (8.183) **	Supported	Supported
H5c	Relational Efficiency → Business Performance	0.208 (2.444) *	0.191 (2.411) *	Supported	Supported

Fit indices. Study I:  $\chi^2 = 1402.845$  (d.f. = 684),  $\chi^2/d.f. = 2.051$ , CFI = 0.899, SRMR = 0.079, RMSEA = 0.074. Study II:  $\chi^2 = 1276.063$  (d.f. = 684),  $\chi^2/d.f. = 1.866$ , CFI = 0.905, SRMR = 0.075, RMSEA = 0.067. \*\*  $p < 0.01$ ; \*  $p < 0.05$ .

## 6. Conclusions

The present study examines the effect changes of the GSCM implementation on the business performance of SME suppliers over time. It is found that implementing GSCM practices drives SMEs in the upstream side of the supply chain to improve operational and relational efficiency, employee job satisfaction, which impact business performance. The conclusions that can be drawn from this study are as follows.

Firstly, this study presented that the GSCM implementation helped SME suppliers establish a sustainable long-term relationship with buying firms, which, thus, helped enhance the business performance of the suppliers. Greening supply chains is the initiative to implement a sustainable plan and to cope with changing environments. It can increase competition and uncertainty and, thus, move to a more cooperative relationship with suppliers. Additionally, the suppliers with better GSCM pose less risk to downstream customers that have greater exposure to reputation damage. With this respect, this study revealed that SME suppliers in the electronics industry achieved sustainable competitiveness when they successfully implemented environmental management systems. Past two decades, the increasing awareness of environmental compliance has pushed the buying firms to recognize the importance of strategic aspects of green supply chain management. In the same vein, Lee and Kim [103] and Niesten et al. [104] suggested that the final manufacturers were inclined to maintain tight collaborative relationships with suppliers to fulfill a high level of operational efficiency when they meet strict environmental regulatory requirements [103,104]. The SME suppliers perceived that they have been delivering greater value to their customers overall since they introduced green innovation into their manufacturing systems.

Secondly, this study discovered that GSCM practices helped SME suppliers obtain operational efficiency. Enhanced internal environmental management and cooperation among different functional groups have positive influences on operational efficiency and, thus, reduce waste and redundancies generated during the manufacturing processes, both of which are forms of inefficiency. Furthermore, the results showed that there were attainable monetary benefits to adopting GSCM. From the supplier's perspective, a well-established collaborative relationship with the buying companies allows easy access to the large firms' resources. Consequently, the suppliers, which can reduce the environmental impact of operations activities, will be able to improve cost reduction, quality, delivery, and flexibility across the supply chain [46].

Thirdly, the study results found that impacts of employee job satisfaction on operational efficiency and business performance became meaningful over time. As reported in Table 6, the results of Study I showed no sufficient evidence to support the effects of job satisfaction on the performance factors. In the early stage of GSCM implementation, when Study I was conducted, the employees may have been resistant to changes in their production lines, and they may not have confirmed the effectiveness of the implementation. However, Study II revealed positive relationships of employee job satisfaction with operational efficiency and business performance. The changes may stem from the emphasis on awareness and the clear communication of information about the environmental effort between top management and employees. Schillewaert et al. [105] claim that resistance to innovation is influenced not only by individual characteristics but also by group dynamics. Furthermore, as Muduli et al. [106] recommend, management may have helped employees overcome fear through proper training and by motivating them to realize the organizational and personal benefits.

Lastly, this longitudinal study analyzing key factors for GSCM and the performance of electronics suppliers provides a stepping stone for enriching the theoretical knowledge pool of implementing GSCM practices. The authors collected data twice from the same small and medium-sized manufacturers in the electronics industry over a seven-year time gap. The empirical results may have changed over time as the environment and perception of it are altered from the initial implementation phase to the more stabilized period. Moreover, there has been no longitudinal research evaluating the GSCM implementation and its

relationship with business performance. The present study may enhance knowledge of firms' efforts to implement sustainable supply chains and an understanding of key factors in association with GSCM that have positive influences on the business performance of SME suppliers.

While this study has theoretical and practical contributions, some limitations need to be considered. First, this study was limited in scope to the Korean electronics industry. Further studies on the electronics industry in different countries will extend the meaning of the study results. It is also recommended that future studies apply this study's research model to different industries. Second, even though business performance items were statistically valid, the meaning of business performance seems to be changing over time. As ESG performance is emerging as a critical dimension for developing sustainable strategies, further studies can incorporate ESG performance to measure business performance. Third, future studies can be conducted to examine if the firm size (small vs. medium) changes the significance of the relationship between GSCM implementation and efficiency factors.

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**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Restrictions apply to the availability of these data. Data was obtained from the Korea Investor Service (KIS) and are available from the corresponding author with the permission of the KIS.

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

## Appendix A

For factor loading values with t-statistics, see Table A1. For the report of discriminant validity by the cross-loading method, see Table A2. For the full list of measurement items, see Table A3.

**Table A1.** Standardized factor loadings, reliability, and convergent validity.

Construct	Item	Study I			Study II			AVE (Construct Level)	Cronbach's $\alpha$	Composite Reliability
		Factor Loading	t Value	AVE (Construct Level)	Cronbach's $\alpha$	Composite Reliability	Factor Loading			
GSCM				0.624	0.916	0.967	0.625	0.829	0.968	
IEM (Internal Environmental Management)	IEM1	0.714	17.033	0.571	0.846	0.868	0.613	0.857	0.888	
	IEM2	0.620	12.359							
	IEM3	0.854	29.228							
	IEM4	0.783	22.090							
	IEM5	0.786	22.393							
GP (Green Purchasing)	GP1	0.803	26.113	0.679	0.841	0.894	0.647	0.882	0.879	
	GP2	0.728	18.917							
	GP3	0.829	31.189							
	GP4	0.925	50.208							
CC (Cooperation with Customers)	CC1	0.730	19.814	0.730	0.852	0.915	0.717	0.894	0.909	
	CC2	0.882	42.699							
	CC3	0.882	44.071							
	CC4	0.911	52.178							
ECO (Eco-design)	ECO1	0.717	16.787	0.550	0.927	0.859	0.546	0.774	0.857	
	ECO2	0.736	17.978							
	ECO3	0.679	14.425							
	ECO4	0.732	17.836							
	ECO5	0.835	25.671							





**Table A3.** Summary of measurement results between Study I and Study II.

Constructs and Measurement Items		Study I		Study II	
		Mean	S.D.	Mean	S.D.
<i>Internal Environmental Management</i>					
IEM1	In our firm, environmental management systems exist	3.81	0.841	4.13	0.739
IEM2	Our firm keeps environmental compliance and auditing programs	3.33	0.960	4.47	0.606
IEM3	Our firm maintains cross-functional cooperation for environmental improvements	3.46	1.000	4.27	0.766
IEM4	Senior managers show commitment of Green Supply Chain Management (GSCM)	3.69	0.997	4.44	0.701
IEM5	Mid-level managers support GSCM	3.63	1.002	4.55	0.598
<i>Green Purchasing</i>					
GP1	Environmental audit for suppliers' internal management	3.63	1.003	4.47	0.770
GP2	Suppliers' ISO 14001 certification	3.73	1.046	4.50	0.793
GP3	Eco labeling of our products	3.67	0.969	4.49	0.740
GP4	Cooperation with suppliers for environmental objectives	3.68	0.951	4.50	0.753
<i>Cooperation with Customers</i>					
CC1	Cooperation with customers for eco design	3.67	1.058	4.45	0.831
CC2	Cooperation with customers for cleaner production	3.73	1.026	4.49	0.764
CC3	Cooperation with customers for green packaging	3.72	1.009	4.51	0.782
CC4	Cooperation with customers for developing environmental database of products	3.67	1.002	4.46	0.775
<i>Eco-design</i>					
ECO1	Design of products for reduced consumption of material/energy is important	3.86	1.139	4.54	0.847
ECO2	Design for Disassembly (DFD) is important	3.26	1.202	4.11	0.999
ECO3	Design of products for reuse/recycle is important	3.41	1.188	4.21	0.971
ECO4	Design of products to avoid use of hazardous products and/or their manufacturing process is important	4.01	1.106	4.62	0.760
ECO5	In design of products, Life Cycle Assessment (LCA) is important	3.45	1.118	4.30	0.909
<i>Employee Job Satisfaction</i>					
ES1	Most employees like their jobs in the present operations	3.34	0.768	4.44	0.588
ES2	Most employees consider this employer as first choice	3.50	0.824	4.44	0.654
ES3	Most employees in our firm like their jobs more than many employees of other firms	3.34	0.802	4.43	0.603
ES4	Most employees in our firm do not intend to work for a different company	3.31	0.821	4.34	0.630
ES5	Overall, our employees are quite satisfied with their jobs	3.44	0.734	4.44	0.581
<i>Operational Efficiency</i>					
OE1	Cycle time has been reduced	2.82	1.016	3.83	0.940
OE2	Overall, costs have been lowered	2.85	1.062	3.84	1.003
OE3	Overall, products' quality has been improved	3.15	1.072	4.09	0.956
OE4	Customer service has been improved	3.24	1.069	4.17	0.945
OE5	Project duration has been reduced	2.83	1.064	3.81	0.940
OE6	Our firm has delivered greater value to our customers	3.40	1.006	4.31	0.860
<i>Relational Efficiency</i>					
RE1	An increased respect for the skills and capabilities of customers	3.43	1.059	4.32	0.872
RE2	An improved level of honesty	3.45	1.035	4.32	0.846
RE3	More open sharing of information with our customers	3.37	1.013	4.28	0.857
RE4	A more effective working relationship with our customers	3.39	1.021	4.27	0.844
RE5	An enhanced commitment to work with our customers in the future	3.40	1.006	4.30	0.847
RE6	An overall more productive working relationship with our customers	3.41	1.017	4.31	0.848
<i>Business Performance</i>					
BP1	Better asset utilization	3.02	0.989	4.00	0.888
BP2	Stronger competitive position	3.27	0.987	4.21	0.840
BP3	Improved profitability	3.08	1.052	4.00	0.872
BP4	Overall improved organizational performance	3.07	1.011	4.02	0.859

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