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Green Supply Chain Management Efforts of First-Tier Suppliers on Economic and Business Performances in the Electronics Industry

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Abstract: Green supply chain management (GSCM) has a necessary goal of performing a firm's social and environmental responsibilities, and SMEs employ GSCM practices with constrained resources. SMEs need to determine which areas they need to concentrate their limited resources to result in positively noticeable economic outcomes. This study aims to identify what GSCM practices would influence economic and business profitability for first-tier suppliers in the electronics industry. Specifically, this examines whether internal environmental management (IEM), green purchasing (GP), cooperation with customers (CC), and eco-design (ECO) have a role in enhancing an organization's economic performance (ECP) and business performance (BP). Survey data from 193 South Korean electronics firms were collected to test the proposed model. The survey responses were analyzed using structural equation modeling (SEM). The results of the present study showed that IEM, CC, and ECO of the responding SMEs had direct positive influences on ECP. Moreover, economic performance has a statistically significant influence on BP. However, GP did not show a significant relationship with ECP. This study investigated first-tier suppliers within the electronics industry and identified what GSCM practices would be important in improving the performances of SME manufacturing companies.

Keywords: green SCM; internal environmental management; green purchasing; cooperation with customers; eco-design; economic performance; business performance; sustainability

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1. Introduction

"Extreme weather won't be the only climate-related threat to supply chains in the years ahead" said the analysts of McKinsey & Company [1]. Regulatory and institutional pressures regarding environmentally conscious practices are forcing companies to deal with environmental risks and threats. Financial losses triggered by environmental changes threaten the long-term sustainability of firms. Investors also distance themselves from companies without proper environmental, social, and corporate governance (ESG) practices. Customers' voices are ever crucial in this digital age, and they request companies to take on challenges: re-innovate the entire value chains and provide environmentally friendly products and services. Therefore, eco-friendly corporate practices are being adopted in managing the supply chain, and governments are instituting various regulations to curb activities harmful to the environment [2,3].

Nations at all economic levels recognize the emergent and dire need to deal with environmental issues for all global citizens. At the COP26 in Glasgow in November 2021, over 190 world leaders met and renewed their bow to keep the tap on the degree of global warming to no more than 1.5 °C compared to the preindustrial era. The current cumulative pledges to contain the temperature rise are insufficient to meet the necessary but ambitious environmental goal [4]. Such an environmental goal cannot be achieved without the

cooperation among all economic entities and the stakeholders under the guidance of local and global organizations and governments [5].

Green supply chain management (GSCM) is a trend to be environmentally responsible as well as a move to reduce climate risks and grab opportunities for corporate sustainability. Regulatory and ethical pressures urge corporations to set organizational climate targets tightly and use appropriate tools to measure progress towards the targets [6,7]. However, when firms pledge to achieve net-zero emissions from their operations, they easily overlook the activities of their suppliers, which could be potentially significant sources of pollution. According to Neil Rees, head of the ESG program in Agilent Technologies, logistics service providers and manufacturers in the upstream of the supply chain account for almost 90% of the company's carbon emissions [8]. Due diligence is progressively being required for corporates in doing businesses within many economic communities including the EU. In most industries, scope 3 carbon emission data must be disclosed by firms for regulators and investors. However, firms tend to have limited visibility into their greenhouse gas emission status across the entire supply chain [8]. As Bowcott et al. [1] point out, the roles of small and medium-sized enterprises (SMEs) in producing green(er) materials will be critical in greening the supply chain for the customer corporations. A sustainable stream of green(er) materials is only possible when the SMEs are effective in successfully employing green processes and creating profitability with their green practices. Curbing the negative environmental impacts on the entire supply chain is essential for the firms to achieve their environmental goals. Therefore, there is a dire need to understand suppliers that are categorized as SMEs due to the lack and importance of understanding of the group and the current research.

The current research focuses on SMEs, especially electronics manufacturers, which are first-tier suppliers for larger electronic corporates as well as focal companies with their own supply chains. As first-tier suppliers of large electronics firms, the SMEs under investigation strive to satisfy their ESG-compliant corporate customers with the GSCM practices. The majority of prior tier-based research on GSCM has examined companies in different tiers at the same time, ignoring a need to understand the tier-specific performance of GSCM practices. Suppliers categorized in different tiers could have a different priority on GSCM practices [9]. By the same token, same-tier suppliers would share a similar understanding regarding their GSCM practices [10]. Therefore, we will single out a group of first-tier suppliers in the electronics industry to understand the GSCM factors related to the supplier company side. This should be a significant contribution to academia filling the gap of tier-focused study of suppliers in GSCM. Additionally, this can enhance the understanding of suppliers management for ESG disclosures and GSCM practices. Most importantly, as focal companies, SME suppliers can further understand what are important GSCM practices leading their economic as well as business performance. Moreover, it would be an addition to the electronics industry with few empirical studies on topics related to sustainable supply chains [11].

Three pillars of sustainability, social development, environmental protection, and economic development, are the core of how companies have to deal with environmental issues. Competitive companies create economic advantages out of a given situation more actively, rather than considering environmental management only as a cost center and a burden. Some corporate examples are as follows: (1) treating the wastewater from the beer production creates methane power for Lagunitas Brewing Co., (2) designing water bottle packages to use less plastic reduces the cost of materials as well as of transportation for Dasani and Nestle, and (3) switching to renewable energy from more expensive fossil energy reduces cost for Alphabet Inc. and Facebook Inc. which belong to an industry consuming the energy the heaviest [12]. The majority of GSCM studies focus on the roles of each GSCM factor on multiple profitability measures. SMEs cannot distribute their limited resources in multiple areas to achieve multiple outcomes. SMEs typically are known to have limited resources in realizing the positive outcome for environmental GSCM adoption [13]; therefore, this research focuses only a few and material performance measures, economic

and business performance to point out what are GSCM performance measures to realize tangible and practical outcomes for SMEs. Economic profitability shows the reduction in costs, fees, and fines due to the adopted environmental practices by the focal company [14]. For customer corporations, securing green(er) materials is thought to be critical in reducing shortages and price volatility. By conducting a study on SMEs, the current research would like to identify key independent GSCM factors that will contribute to economic profitability and business profitability. To enhance the understanding of SMEs' green supply chain practices and to understand the first-tier suppliers' GSCM performance outcomes, we propose a research question as follows:

Research Question. *Will GSCM practices influence economic and business profitability for SMEs in the electronics industry?*

To answer the question, the current study tries to put a perspective on the existing GSCM research by applying it to SMEs in South Korea. South Korea is still in the early stage of GSCM adoption as with other developing countries. Therefore, SMEs' GSCM practices are recently adopted to meet both the due diligence efforts of the customer companies as well to comply with impending environmental and social laws. Therefore, this research will provide a direction for SMEs of developing countries in adopting environmental practices.

The current research is organized as follows. Section 2 reviews previous studies on GSCM practices and performances. The hypotheses are derived in Section 3, and research methods are described, including data collection in Section 4. After the analysis, results are summarized in Section 5, and the findings and implications of the study are discussed.

2. Literature Review

More countries are requiring the disclosure of corporate environmental, social, and governance (ESG) resports and companies are being evaluated on their socially responsible practices by multiple stakeholders [15–17]. Therefore, companies including small and medium-sized enterprises have to find strategic ways to deal with sustainable management of their entire operations. One stream of research is attempting to provide practical solutions for imminent industry-related issues related to sustainable supply chain management including supply chain network design [18], sustainable supplier selection [19–21], environmental transportation/routing [22,23], and reverse logistics [23]. Another stream of research is seeking the understanding of the current environment and the participants of a supply chain to provide strategic direction for sustainable operation.

This section first describes the development of sustainable supplier management and tier-related supplier management issues (Section 2.1) and shows the existing research on suppliers in green supply chain management (Section 2.2). Section 2.3 describes performance measures relevant for the current research. Finally, individual GSCM practices (Sections 2.4–2.7) are explained and reviewed to build a general background of the proposed research model in Section 3.

2.1. Sustainable Supplier Management and Tier-Dependenct Characteristics

Sustainable supplier management is the concept based on sustainable supply chain management and the core idea that "social practices for suppliers do not develop in isolation, but instead must be connected with, and take into account, the nature of both the upstream and downstream portions of the supply chain" [24]. While there are many definitions of sustainable supply chain management depending on the persepective of the study [25], the definition of Carter and Rogers [26] is well-rounded and widely accepted, stating "the strategic transparent integration and achievement of an organization's social, environmental, and economic goals in the systemic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chains." While it is imperative to pursue the sustainable supplier management, it is not easy to identify suppliers farther downstream from the focal com-

pany. It is even more difficult to track their practices on their labors, the society, and the environment [27].

There are multiple approaches managers can take to manage sustainable supply chain. Ageron et al. [28] show that there can be active, reactive, pro-active, collaborative, or individual approaches for managerial approaches. Yang and Zhang [29] listed supplier selection, supplier monitoring, supplier development, and supplier collaboration as the supplier management practices influencing buyer–supplier performance. Choosing a sustainable supplier is an important step that can greatly reduce future supplier management efforts. Supplier selection is dependent not only on the economic factors but also environment as well as social criteria [11,19]. Criteria for focal companies to consider when selecting or evaluating suppliers include industry dynamics, dependency, distance, and transparency of supplier behaviors [19,28]. However, when established suppliers exist or when the focal firms have a weak buying power, the supplier management practice should focus on other practices than supplier selection. Sustainable supplier collaboration could influence buyer–supplier performance the greatest by cutting product development time and costs and reducing information asymmetry [29,30].

Managing suppliers differ by the tier group they belong to. Suppliers categorized in different tiers could have a different priority when deciding on their environmental, social, and economical strategies [9]. Some supplier management strategies can be adapted to the depth of the tier suppliers belong to. For example, auditing suppliers for their socially responsible practices is important for companies with longer supply chains with more tiers [24]. Similarly, managing supply chains using trust and open communication becomes harder as the number of tiers in the supply chain increases [27]. Same-tier suppliers would share a similar understanding of their environment and the position they would take to manage sustainable supply chain [10]. Additionally, the level of collaboration required to maintain the optimal relationship is dependent on the number of tiers and the types of suppliers [28].

2.2. Green Supply Chain Management

Multiple studies on GSCM have been examining different aspects of what companies do in terms of their green practices along their supply chain, which are the dimensionality of GSCM. Sarkis et al. [31] defined GSCM as "integrating environmental concerns into the inter-organizational practices of SCM including reverse logistics." All areas of the supply chains can be handled with environmentally friendlier practices such as products design, material procurement, green manufacturing, green delivery, and disposal of goods after consumption [32]. Fathollahi-Fard et al. [18] adopted red deer and whale optimization algorithms as new hybrid meta-heuristic methods to present sustainable supply chain network design solutions in the tire manufacturing industry. The vast majority of previous research points out different aspects of GSCM processes and dimensionality and sees each of the GSCM processes as a single construct. For example, Petljak et al. [33] saw GSCM processes to be composed of cooperation with suppliers, green purchasing, and green logistics. Some of the earlier research considers GSCM as a second-order factor with a multiple first-order factors. Zhu et al. [34] came up with a GSCM with five factors including internal environmental management, green purchasing, cooperation with customers, eco-design, and investment recovery by utilizing materials and equipment efficiently [35]. Lee et al. [36] and Zaid et al. [37] perceived GSCM to include two dimensions composed of internal GSCM management and external GSCM management. Internal GSCM management is relevant in meeting internal environmental targets under management supports utilizing the internal system and processes. External GSCM management goes beyond the boundary of the corporate umbrella into the upstream and downstream of the supply chain. Lee et al. [36] named internal environmental management and eco-design as two internal practices, and green purchasing and cooperation with customers as external practices. Zaid et al. [37] categorize GSCM into internal GSCM and external GSCM. The internal GSCM practices

are composed of eco-design and internal environmental management, and external GSCM practices as green purchasing, reverse logistics, and environmental cooperation.

This study adopts the GSCM processes of Lee et al. [36] and utilizes the first-order factors. Although some earlier research finds the GSCM performance to cover additional factors such as IR [34,35,38], we employ the commonly used and conceptually distinct factors, internal environmental management (IEM), eco-design (ECO), green purchasing (GP), and cooperation with customers (CC). For example, recent research often ignores IR probably based on the conceptual similarity to cost efficiency factors such as economic performance. The current research excluded IR and used economic performance as a cost efficiency measure.

2.3. Economic and Business Performances

During the 1990s, the productivity paradox [39] questioned whether a large investment in information technology could produce increased profitability or not. Referring to "Global Productivity: Trends, Drivers, and Policies" produced by the World Bank [40], technological progress is recognized as the driver of labor productivity. Similar tests are being carried out to see whether environmental investments such as GSCM, ESG, corporate social responsibility (CSR), and creating shared value (CSV) will bring recognizable environmental, operational, and business performances. Evidence of GSCM investment's profitability is demonstrated with multiple performance measures as follows.

Performance measures are considered important in operational, tactical, and strategic levels, and a firm should select a set of measures based on their characteristics and the purpose of using them. Hervani et al. [41] suggested three criteria in selecting GSCM performance measure: the GSCM adoption stages, the proactiveness in adopting the GSCM approaches, and interorganizational considerations. For example, having a proactive GSCM approach can adopt more green practices than what the laws or regulations require.

In the studies of GSCM, performance measures are typically used as dependent variables providing utilitarian justification for the implementation of green practices. Organizational performance is thought to be the final dependent variable that results from good environmental performance and economic performance [34,42]. According to Richard et al. [43], organizational performance comprises three outcomes of firms: financial performance such as return on investment (ROI), return on assets (ROA), and profits; market performance such as market share and market position; and shareholder return such as total shareholder return and economic value-added.

Green and Inman [42] define organizational performance as the "financial and marketing performance of the organization as compared to the industry average." Organizational performance is considered as the final dependent of GSCM, which will be highly related to economic as well as environmental performance. Green et al. [38] found that adopting GSCM practices in manufacturing firms can improve economic as well as environmental performances. Economic and environmental performance are found to influence organizational performance through operational performance. For this study, we use the term business performance (BP) instead of organizational performance since the latter can also be used as a comprehensive term including environmental, social, economic, marketing, operational, and logistics performance [44]. BP uses financial and marketing performance as indices, and it demonstrates a firm's financial performance and the firm's market valuation [45]. Financial performance is often measured using accounting tools such as ROI and return on sales (ROS) demonstrating BP along with market performance. Market share and market growth are frequently used market performance indexes and are important measures of GSCM BP. For the organization's sustainable efforts across the entire GSCM to benefit the focal company and all its stakeholders, greener products need to be sold. Therefore, marketing performance, a predictor of product adoption, will be one key performance factor of GSCM effectiveness

Among different performance variables, ECP is chosen as the mediator between individual GSCM factors and BP. Environmental performance and ECP both discuss cost

and risk reduction, and we adopt ECP due to its comprehensive usage in small and medium-sized manufacturing companies.

SMEs are significantly less engaged with environmental practices compared with large-sized companies, and the sustainable practice of SMEs is a less researched area [13]. Entrepreneurs of SMEs tend to be cash-strained and lack the necessary skills and knowledge to integrate sustainable practices into their manufacturing systems. The limitations faced by SMEs bars them to make enough investment to realize economic outcomes [13,46]. SMEs lack environmental strategies due to their limited financial resources and the incapability of implementation practices [45]. Other difficulties SMEs face include the lack of long-term organizational vision, the lack of environmental awareness and training, the inability to obtain innovation, and the absence of skills in managing external stakeholders [47]. However, considering the number and the portion of the total workforce in SMEs and the diverse products and resources they create in the ecosystem, it is critical to investigate the issues of SMEs' sustainable practices [13].

SMEs have three reasons as to why they can/must adopt environmental practices: (1) SMEs collaboratively work with other stakeholders such as customers and suppliers to achieve their environmental goals, (2) SMEs are facing pressure to practice GSCM activities from the industries, the suppliers, and the government, and (3) SMEs, as is the case in the current research, are often an important constituent of other firms' supply chains [48]. Sustainable efforts in SMEs create opportunities and values, definite competitive advantages. Simpson et al. [49] discussed that having good environmental practices can build competitive advantages for SMEs. Based on the resource-based view, the capability to involve diverse stakeholders is not easily imitable by others. Therefore, the ability to involve all stakeholders along the supply chains for environmental practices demonstrates the SME's strategic capabilities. According to Xu et al. [50], industry standards can promote collaboration and control among participants along the supply chains. In turn, efficient supply chains can positively influence the environmental performances of all the firms involved. With the increasing attention to sustainability, large corporations are under a lot of pressure to ensure their supply chain participants' environmental practices. Not only the financial profitability, but financial investors also investigate the ESG soundness of the firms for the investment decisions [16]. ESG evaluation criteria include value-adding activities of the firms concerning their stakeholders, one of the groups being suppliers who are often SMEs.

In the context of SMEs, ecopreneurship is a word describing "profit-oriented and environmentally concerned at the same time" [51], and ecopreneurs are concerned with environmental means to create economic values. Even with limited resources, knowledge, and skills, SMEs can achieve positive outcomes. Some enabling characteristics of the positive outcomes include the traits of CEOs/owners and flexibilities. SMEs are under a significant influence of the owners' environmental values, and owners of SMEs consider themselves to be more environmently friendly compared to their peers [52]. Therefore, SMEs have the flexibility to get involved in innovative and sustainable activities, leading to positive financial outcomes [52].

2.4. Internal Environmental Management

Environmental management (EM) describes a set of management activities dealing with environmental issues faced by a company [53]. EM spans from reducing negative environmental impacts from companies' processes and products to increasing economic as well as social welfare, and it can be categorized into internal environmental management (IEM) and external environmental management (EEM). EM is considered to be IEM when environmental activities are related to the products, processes, and activities internal to the focal company; while, EEM covers activities involving entities such as upstream, downstream, and other external entities of the focal company's supply chain.

Organizational internal capabilities related to IEM are comprised of organizational innovation and organizational performance, influencing the organization's decision to

adopt innovative practices for better environmental and business performances [41]. Those internal capabilities are organizational resources, capacities, organizational structure, and procedures, and they dictate how an organization deals with changes and challenges. Along with the organizational structure allowing environmental innovation, knowledge regarding products, materials, markets, and available technologies are necessary to drive product innovation. Internal knowledge base with necessary technical skills and competencies, and organizational culture enabling self-assessment and implementation of a new system are critical drivers of GSCM internal capabilities [41]. Interfunctional collaboration, total environmental quality management, and other necessary environmental management practices and programs are also important for IEM [34,35,54].

IEM is related to setting the organizational goals in line with sustainability, and the goals are supported with the mid-level and senior-level managements' wills [54]. Top management can emphasize GSCM implementation with a strong priority, bring necessary measures, assess and reward to reinforce green management, and put all the resources to strengthen green practices [41]. Ethical leadership is to bring employees' internal and external citizenship behaviors which would bring employee's ethical behavior towards all stakeholders including other employees, suppliers, partner companies, and customers [55]. Ethical leadership and employees' citizenship behavior would create an ethical atmosphere and positive work attitude creating a ground for better business performance [55,56].

2.5. Green Purchasing

Suppliers form "the first echelon" among all members in the supply chain affecting corporate profitability and a lot of research is carried out in the area of sustainable supplier [20]. The role of procurement within an organization should be considered strategic for multiple reasons, including economic and compliance issues. A large portion of a manufacturing firm's expenses is typically spent on purchasing. Purchasing costs account for 40% to 70% of the sales [42], implying that a small reduction can be significant savings for the company. More environmental requirements and laws are codified by the nations, transnational organizations, and industrial associations. Additionally, the reliance on outsourcing makes it crucial for the focal company to align with suppliers strategically. Finally, social and environmental pressures urge the focal company to "due diligence" in the legal and voluntary compliance of their CSR activities. Therefore, purchasing can be considered one crucial area of CSR activities [57]. Ethical purchasing approaches are well expressed in a concept called purchasing social responsibility, which covers aspects of the environment, human rights, philanthropy, safety, and diversity [58].

Green purchasing (GP) describes corporate efforts in minimizing negative externalities impacting the environment in the selection and procedure of acquiring products and the services required for the operation of the business. GP is used interchangeably with the terms such as "green procurement" and "sustainable procurement". In corporate green management, GP directs its focus of controlling pollution to preventing pollution [59] in ways including: a reduction in pollution in inbound logistics; reduced environmental impacts of the procured material; reduction in energy consumption and emission while processing the procured materials; and eco-efficiency of the products using the procured material(s). These GP activities can be performed as follows [60]: demanding greener products to suppliers, selecting suppliers using greener practices (e.g., ISO standardization, waste and emission reduction), and collaborating with suppliers for greener performances (supplier training, selection of greener and waste reduction processes). Not all activities influence the GP outcomes positively. Laari et al. [61] found that not all supplier-related activities translate into positive environmental or financial outcomes.

2.6. Eco-Design

The manufacturing industry is mainly responsible for making ecological, socially conscious, and still economically profitable products [62,63]. Performance, usage, production, and disposal after-life will be all affected by product design, potentially influencing

70% of manufacturing costs [64]. Therefore, eco-design (ECO) is a term relevant to sustainability [65] and implies ecological improvement or development of a product. The term eco-design has the same or similar connotation as "design for environment" and "design for sustainability," the latter being considered as an evolved stage of ECO. According to Rocha et al. [66], ECO implies technical innovation, redesign of products, and reorganization of the functionality of products at the basic stage and aims to reduce products' environmental impacts. However, at a more advanced level, technical as well as social innovations are sought after in the product design process. The social, environmental, and economic impact of products are assessed at the global level, and the needs of a product are revisited. Therefore, ECO is the designing of a product with the consideration of minimizing the environmental impacts during the entire lifecycle of the products [54]. The value of an ECO product is evaluated through the lifecycle analysis of the product. There are two very similar concepts that look at the ECO for the lifespan of a product: eco-design methodology using life-cycle assessment and sustainable consumption. ECO looks at how product design will influence the environment as early as the design stage. The life-cycle methodology comes up with the total environmental impact of a product during the product's life cycle [67].

Along with sustainable consumption, designing for sustainable behavior is an important part of ECO concerned with the reasons and the manners of product users' interaction with the products [68]. Therefore, the influence of ECO assumes the market acceptance of the products which requires products to meet consumers' needs and requirements [69]. While the effectiveness of ECO will be initially shown as the focal company's cost effectiveness; however, the final evaluation of ECO should be demonstrated with a strong competitive position with the market.

2.7. Cooperation with Customers

Organizations' interactions with other entities are typically explained with a supply chain and network-oriented view. Stakeholders along the line of a corporate supply chain or connected with the company's network links can influence the innovative product design, manufacturing, usage, and much more. The key stakeholders of the involvement process would be the customer group. The end-users are the ones who finally access the value of the ECO products via money vote. Customers can be involved with green management practices by collaborating with the companies and monitoring what the company does [61]. Environmental collaboration with customers is involved with product design, green delivery, and communication of environmental roles. Customers' monitoring activities include monitoring green practices and requesting green certification, selecting environmentally sound suppliers, and requesting environmental.

Environmental collaboration with customers positively influences the firm's financial performance [61]. A study on shipper logistic service providers shows that external GSCM with customers influences financial performance, especially when environmental proactivity is greater [70]. Bask et al. [70] recognize that external customers' environmental motivation and internal environmental motivation are the two main reasons for adopting GSCM practices, and environmental proactivity will give rise to better financial performance. Definitions of the constructs adopted in this study are listed in Table 1.

Table 1. Construct definitions.

Construct	Operational Definition	References
Internal Environmental Management (IEM)	A set of management activities involved with evolving environmental sustainability as a fundamental organizational goal through support and commitment of mid-level and senior managers.	Aslam et al. [54]
Green Purchasing (GP)	Corporate efforts in minimizing negative externalities impacting environment in the selection and process of acquiring products and services required for the operation of the business.	Min and Galle [59]

Table 1. *Cont.*

Construct	Operational Definition	References
Cooperation with Customers (CC)	Cooperation with customer requires working with customers to design cleaner production processes that produce environmentally.	Green et al. [38]; Zhu et al. [34]
Eco-design (ECO)	Designing of a product so as to minimize the environmental impact of the product during the entire life of the products.	Aslam et al. [54]
Economic Performance (EP)	Economic performance related to the manufacturing plant's ability to reduce costs associated with purchased materials, energy consumption, waste treatment, waste discharge, and fines for environmental accidents.	Green et al. [38]; Zhu et al. [34]
Business Performance (BP)	Firm's financial and marketing performance reflecting the firm's green practices.	Um [45]; Green and Inman [42]

3. Hypotheses Development

This section proposes the research model and develops hypotheses based on existing studies.

IEM is a crucial activity related to the feasibility of GSCM implementation, the managements' GSCM supports as well as the internal green practice system [48]. The current research defines economic performance as "performance related to the manufacturing plant's ability to reduce costs associated with purchased materials, energy consumption, waste treatment, waste discharge, and fines for environmental accidents" [38]. ECP is conceptually similar to environmental performance since environmental performance measures whether environmental efforts minimize waste and reduce costs. Laari et al. [61] found a positive relationship between IEM and environmental performance, which relationship, therefore, should apply similarly with ECP. According to De Giovanni [53], IEM is found to be a strong and relevant driver of all three triple bottom lines (environmental, economic, and social) performances, and Fallahpour et al. [19] also suggested supply chain managers also try to develop a sustainable system supporting both social, economic as well as economic criteria for performance improvement. In a study on 207 manufacturing firms in Pakistan, environmental performance positively mediated the relationship between IEM and ECP [71]. IEM is an important enabler of GSCM [72]. IEM decreases the cost of materials purchased, costs related to energy consumption, waste treatment fees, and fines for environmental accidents. Therefore, we hypothesize as follows.

Hypothesis 1 (H1). *Internal environment management (IEM) will positively influence economic performance (ECP).*

Reducing waste and energy by green purchasing could result in big savings for the supply chain. Costs incurred in purchasing are 40% to 70% of a firm's sales [73]. Suppliers' socially responsible activities complying with environmental standards can trigger innovation and reduce the total cost within the entire supply chain [60].

Green purchasing is now preferred as a risk-aversion option. The environmentally conscious procurement is related to economic performance if buyer firms perceive it as a protection against possible economic losses resulting from non-compliance. Manufacturers observe that the suppliers conform to environmental compliance [48].

Economic performance offers practical justification for the implementation of green purchasing. Green et al. [38] propose that GSCM practices target waste reduction, and the adoption of green purchasing in manufacturing firms could improve economic performance. Chen [74] suggests that green procurement helps prevent pollution and eventually supports economic performance. Zaid et al. [37] pinpoint that green purchasing boosts net income and lowers the cost of products. Accordingly, the following hypothesis is suggested:

Hypothesis 2 (H2). *Green Purchasing (GP) will positively influence economic performance (ECP).*

Involving customers is conducive to suppliers' innovation by enhancing suppliers' new product development process and consequently expediting the release of the new products [75,76]. As such, process integration with customers affects goods and services delivered to the buyer firms and improves the suppliers' organizational effectiveness in terms of waste reduction, cost reduction, and enhanced firm performance.

Cooperation with customers (CC) in the context of GSCM is defined as the collaborative efforts between manufacturing firms and their customers in developing environmentally friendly design, cleaner production, green packaging, and a database system that might help reduce the negative environmental impacts within firms' supply chain activities [77–79]. Suppliers can also better understand customer expectations and requirements. Additionally, Theyel [80] specified that CC refers to working together with customers to determine and achieve environmental goals, which lowers harmful environmental effects, complies with customers' environmental standards, and informs the delivery of customers' requirements.

Empirical studies by Zhu et al. [81,82] show that green customer cooperation for successful GSCM systems implementation improves the environmental, operational, and economic performance of manufacturing firms. Along with a customer-oriented approach to supply chain management, green customer cooperation provides manufacturers with the opportunity to satisfy the green expectations from customers better than their competitors [83]. Thus, the following hypothesis is proposed.

Hypothesis (H3). *Cooperation with customers (CC) will positively influence economic performance (ECP).*

ECO aims to reduce a product's environmental impacts and influence the economic performance of manufacturing firms [72,84]. Additionally, ECO and CC bring ECP as demonstrated in industrial examples and academic research [85]. The design of products can directly reduce the cost of the materials [67], energy consumption [86], waste treatment [87], and environmental accidents [88], which are the key measures of the economic performance of GSCM. Moreover, the ECO product can only be valued when customers easily identify the advantages of the products, which leads to a sales increase in the products [67]. Integrating the ECO framework for both products and processes brings environmental and economic performances [89]. Therefore, the eco-friendly design will directly and positively influence economic performance. We hypothesize as follows.

Hypothesis (H4). *Eco-Design (ECO) will positively influence economic performance (ECP).*

A firm's primary goal is profitability, and it is pursued by the performances of stakeholders in the supply chain of the focal firm [90]. Therefore, GSCM's ultimate performance goal is achieving the primary goal, increasing the firm's profitability. The current research utilizes the term business performance (BP) to denote the firm's profitability, and BP is defined as "financial and marketing performance of the organization as compared to the industry average" by Green and Inman [42]. Financial performance is measured with financial measures, and is to be achieved with better environmental and operational performances. Environmental performance is concerned with minimizing costs involved with weak environmental positioning, increasing capability and better operational performance, and satisfying customers with efficient production processes characterized by robust products, flexible operation, on-time delivery, and others [52].

ECP is positively and significantly associated with business performance in multiple research [38,91]. For example, hotel employees' positive perception of implementing GSCM brings ECP and ECP, and, in turn, influences BP positively [92]. Green et al. [38] investigated whether ECP influences BP through operations by surveying plant managers in US manufacturing organizations. Similar to the results from Zhu et al.'s [34] research on the Chinese manufacturing industry, practicing GSCM and green information systems

brings ECP, and ECP indirectly leads to BP through operational performance. Therefore, we assume that ECP would positively influence BP and we propose H5.

Hypothesis (H5). *Economic performance (ECP) will positively influence business performance (BP).*

4. Research Methodology

This section presents descriptive statistics based on the collected data from the survey. The responding firms' basic background information will be presented in Section 4.1, followed by the measurement development in Section 4.2, the illustration of the data collection process in Section 4.3, the non-responses bias in Section 4.4, and the measurement assessment in Section 4.5.

4.1. Description of Data Sources

Table A1 (in Appendix A) represents the characteristics of the responding firms as well as respondents' job titles and work experience. All the firms fit the classification of small and medium-sized enterprises (SEMs) as targeted. Here is the distribution: 118 firms (61.1%) are with greater than 50 and less than or equal to 200 employees, 49 firms (25.4%) with greater than 200 and less than or equal to 400 employees, and 26 firms (13.5%) with over 400 and less than or equal to 500 employees.

The respondents' job titles ranged from the top/senior executives to employees, and middle manager (71.5%) is the most frequently reported job title in charge of GSCM. This may be viewed that the SMEs decided to have the GSCM practices under the supervision of at least the middle-level management team, a decision presenting their will to succeed in sustaining the GSCM practices. Additionally, three-fourths of the respondents (74.1%) have worked over five years, and over 37% among them have worked in the position over ten years.

The population of interest in this study is the supply chain managers of South Korean small and medium-sized electronic manufacturers that are mostly first or second-tier suppliers to major electric firms in South Korea. This study selected SME suppliers for the investigation because they are often regarded as the invisible link in the supply chains due to their lack of eco-friendly systems and competency that can adversely affect the economic performance and brand reputation of the customer companies [92–94].

There are two reasons for selecting the electronics industry. First, technologies in electronics change rapidly, and the product life cycles are short. These tendencies elevated environmental concerns and motivated a number of critical environmental regulations for this industry to be instituted globally. Second, the present study collected data only from a single sector to control any potential confounding factors, such as variation in economic conditions or environmental regulations. The electronics industry is an excellent candidate to monitor GSCM and has a group of participants suitable to observe their supply chains.

4.2. Measurement Development

To develop a measurement model for GSCM practices, we adopted 18 measurement items pertaining to current GSCM practices from Zhu and Sarkis [35] and 8 items in total for the measurement of economic and business performances from Zhu et al. [34]. The measurement items were reviewed by Korean SCM experts to ensure that the items developed and tested in Chinese industries can also be operationalized in South Korea. This procedure confirmed the content and face validity of our measurement items that are organized into a survey questionnaire to be administered to manufacturing firms in South Korea. The questions were asked using a five-point Likert scale (1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree).

4.3. Data Collection

Our survey team acquired the list of 756 companies in the electronics industry from the Korea Investor Service (KIS). According to the Korean Ministry of SMEs and Startups,

electronics manufacturers with a revenue of less than 85 million USD a year are classified as SMEs, and all of the companies met this guideline. Our staff contacted individual companies on the list by phone and briefly explained the purpose of our research. The questionnaire was administered to the SCM managers from who we received their verbal consent. The survey team contacted the managers again to verify their receipt of the questionnaire and then explained how to rate each questionnaire item in detail. When unanswered items were found in a returned questionnaire, follow-up telephone calls were made to complete the survey. Finally, we have collected 193 usable responses. The methodology adopted to guide the process of this study is illustrated in Figure 1.

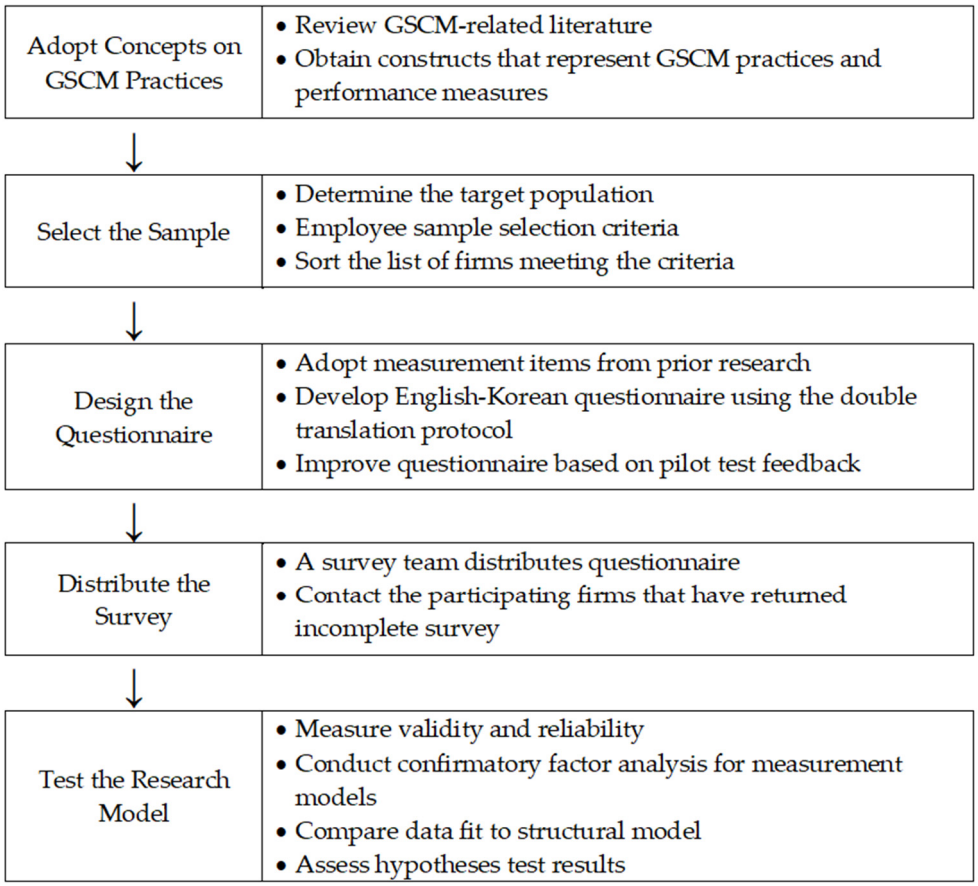

Figure 1. Methodological framework.

4.4. Non-Response Bias Analysis

To examine a 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 such as the number of employees between early and late responses [95]. The *t*-test results do not indicate statistically significant differences between the compared sets, and, thus, the results suggest that the responded group represents an unbiased sample.

4.5. Measure Assessment

This study examined the psychometric properties of our reflective scales using a confirmatory factor analysis (CFA). First, we included all reflective latent variables in a single multifactorial 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 the robust maximum likelihood estimation (MLR) in Mplus Version 7. Specifically, we adopted a two-step model building approach in which the measurement models were examined

before testing the structural model. All models were identified by setting the means of all latent factors to 0 and latent factor variances to 1. Then, we estimated all item intercepts, item factor loadings, and item residual variances.

All factor loadings and the factor covariance were statistically significant. As reported in Table 1, standardized factor loadings for all items ranged from 0.623 to 0.974. R^2 values for the amount of item variance accounted for ranged from 0.194 to 0.308. This result suggests that the factor loadings were significant. Furthermore, the overall fit indices of our model (χ^2/d.f. = 1.87, CFI = 0.931, SRMR = 0.083, RMSEA = 0.067) are acceptable [96].

5. Results

In the previous section, the methodological framework was suggested, and the data were collected accordingly. This section examines the reliability and validity of the research, and statistical analysis of the data followed by the discussion of the results with respect to the hypotheses testing.

5.1. Measurement Model

The means and standard deviations of all measurement items assessed in this study are given in Table 2. Before proceeding to analyzing the reliability/validity of the study and hypotheses testing results, the descriptive statistics need to be discussed to better understand the results of the study. In terms of internal environmental management, both the top management teams and middle managers of the Korean SMEs have a solid commitment to GSCM (IEM4: average = 4.44; IEM5: average = 4.55). In this regard, the firms are taking GSCM practices very seriously to maintain environmental compliance and auditing programs (IEM2: average = 4.47). This factor is particularly critical for the relationship with their buying firms that tend to select suppliers with good environmental compliance records. In this line of thought, supplier firms make efforts to meet the requirements of their customers. Our survey responses also show that the average of all items for cooperation with customers is high. Additionally, the items related to reducing energy usage and materials show high averages (e.g., ECO1: average = 4.54; ECO4: average 4.62).

Table 2. Summary of measurement results, standardized factor loadings, reliability, and convergent validity.

	Constructs and Measurement Items	Mean	S.D.	Factor Loading	t-Value	Reliability and Validity
	Internal Environmental Management					α = 0.857; CR = 0.888;
IEM1	In our firm, environmental management systems exist	4.13	0.739	0.739	18.752	AVE = 0.541
IEM2	Our firm keeps environmental compliance and auditing programs	4.47	0.606	0.767	21.451	
IEM3	Our firm maintains cross-functional cooperation for environmental improvements	4.27	0.766	0.730	18.425	
IEM4	Senior managers show commitment of GSCM	4.44	0.701	0.819	27.236	
IEM5	Mid-level managers support GSCM	4.55	0.598	0.858	29.145	
	Green Purchasing					α = 0.882; CR = 0.879;
GP1	Environmental audit for suppliers' internal management	4.47	0.770	0.764	21.013	AVE = 0.647
GP2	Suppliers' ISO 14,001 certification	4.50	0.793	0.734	18.719	
GP3	Eco-labeling of our products	4.49	0.740	0.827	28.725	
GP4	Cooperation with suppliers for environmental objectives	4.50	0.753	0.885	37.444	
	Cooperation with Customers					α = 0.894; CR = 0.909;
CC1	Cooperation with customers for eco-design	4.45	0.831	0.716	18.720	AVE = 0.717
CC2	Cooperation with customers for cleaner production	4.49	0.764	0.893	45.892	

Table 2. *Cont.*

	Constructs and Measurement Items	Mean	S.D.	Factor Loading	t-Value	Reliability and Validity
CC3	Cooperation with customers for green packaging	4.51	0.782	0.869	39.752	
CC4	Cooperation with customers for developing environmental database of products	4.46	0.775	0.896	47.210	
	Eco-design					α = 0.774; CR = 0.857;
ECO1	Design of products for reduced consumption of material/energy is important	4.54	0.847	0.755	18.815	AVE = 0.546
ECO2	Design for Disassembly (DFD) is important	4.11	0.999	0.700	15.575	
ECO3	Design of products for reuse/recycle is important	4.21	0.971	0.623	11.852	
ECO4	Design of products to avoid use of hazardous products and/or their manufacturing process is important	4.62	0.760	0.665	13.986	
ECO5	In the design of products, life cycle assessment (LCA) is important	4.30	0.909	0.848	25.254	
	Economic Performance					α = 0.854; CR = 0.950;
ECP1	Decrease in cost for materials purchasing	3.79	0.946	0.838	36.938	AVE = 0.828
ECP2	Decrease in cost for energy consumption	4.11	0.858	0.974	154.256	
ECP3	Decrease in fee for waste treatment	4.10	0.913	0.969	144.688	
ECP4	Decrease in fine for environmental accidents	4.35	0.872	0.850	39.855	
	Business Performance					α = 0.921; CR = 0.945;
BP1	Better asset utilization	4.00	0.888	0.788	26.316	AVE = 0.699
BP2	Stronger competitive position	4.21	0.840	0.789	26.551	
BP3	Improved profitability	4.00	0.872	0.941	75.753	
BP4	Overall improved organizational performance	4.02	0.859	0.929	68.747	

The unidimensionality of our constructs was assessed using confirmatory factor analysis (CFA). All fit indices satisfy cutoff limits. CFI is above 0.9, and SRMR and RMSEA are below 0.08 [95]. Cronbach's alpha and composite reliability of the constructs exceeded the threshold value of 0.70 [97,98]. These confirm that the theoretical constructs present adequate reliability.

Convergent validity was examined by conducting CFA. As exhibited in Table 2, all items in their respective constructs have statistically significant factor loadings greater than 0.60, and the t-values are greater than 2.0. The average variance extracted (AVE) values exceed the widely recognized rule of thumb, 0.50 demonstrating the convergent validity [97].

Discriminant validity is evaluated by comparing the correlation between a construct and the squared root of AVE. Discriminant validity identifies whether the AVE for each multi-item construct is greater than the shared variance between constructs [97]. The square roots of AVEs of all constructs should be greater than the correlations between any individual pair, as reported in Table 3 [97]. Additionally, this study performed the cross-loading method for all factors. As illustrated in Table 4, the results of the cross-loading method reaffirm the discriminant validity of our constructs.

Table 3. Discriminant validity: Fornell Larcker criterion.

Construct	IEM	GP	CC	ECO	ECP	BP
IEM	**0.736**					
GP	0.335	**0.804**				
CC	0.287	0.635	**0.847**			
ECO	0.200	0.247	0.293	**0.739**		
ECP	0.230	0.243	0.316	0.330	**0.910**	
BP	0.360	0.480	0.363	0.338	0.710	**0.836**

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

Table 4. Discriminant validity: cross-loading method.

Construct	IEM	GP	CC	ECO	ECP	BP
IEM1	**0.665**	0.064	−0.002	0.078	0.192	0.078
IEM2	**0.751**	0.077	0.059	0.032	0.069	0.032
IEM3	**0.778**	0.161	0.150	0.124	0.050	0.161
IEM4	**0.819**	0.196	−0.028	0.050	0.132	0.197
IEM5	**0.824**	0.094	0.119	0.108	0.048	0.108
GP1	0.380	**0.717**	0.104	0.169	0.039	0.104
GP2	0.398	**0.711**	0.036	0.036	0.122	0.036
GP3	0.152	**0.820**	0.130	0.182	0.122	0.152
GP4	0.284	**0.814**	0.114	0.194	0.100	0.115
CC1	0.206	0.138	**0.708**	0.215	0.184	0.207
CC2	0.206	0.106	**0.851**	0.220	0.121	0.107
CC3	0.122	0.077	**0.806**	0.370	0.038	0.077
CC4	0.108	0.107	**0.867**	0.245	0.126	0.107
ECO1	0.106	0.003	0.049	**0.804**	0.048	0.106
ECO2	0.110	0.107	0.047	**0.815**	0.029	0.110
ECO3	0.183	0.118	0.124	**0.751**	−0.064	0.124
ECO4	0.119	−0.026	0.119	**0.699**	0.170	0.120
ECO5	0.193	0.106	0.086	**0.786**	0.170	0.087
ECP1	−0.030	0.212	0.139	−0.115	**0.790**	0.139
ECP2	0.058	0.137	0.074	0.106	**0.836**	0.074
ECP3	0.060	0.117	0.038	0.058	**0.813**	0.061
ECP4	0.065	0.019	0.029	0.322	**0.666**	0.029
BP1	0.160	0.165	0.069	0.029	0.158	**0.787**
BP2	0.261	0.019	0.186	0.174	0.019	**0.711**
BP3	0.140	0.125	0.166	−0.030	0.138	**0.858**
BP4	0.163	0.170	0.131	0.093	0.168	**0.830**

5.2. Structural Model

We examined the relationships between constructs by testing the proposed model using SEM. The results are summarized in Figure 2 and Table 5. The results of our empirical examination present that three of the four GSCM practices have statistically significant relationships with ECP. As shown in Table 4, IEM, CC, and ECO have positive, significant effects on ECP. These results provide support for H1, H3, and H4 (H1: β = 0.143, t = 1.834; H3: β = 0.197, t = 1.913; H4: β = 0.145, t = 1.899). However, the effect of GP on ECP shows no statistically significant result (H2: β = 0.120, t = 1.107), hence H2 is not supported. In regards to explanatory power, this model explains 19.4% of the variance in ECP. The investigation on the relationship between ECP and BP shows a strong positive association (H5: β = 0.555, t = 10.322). Thus, H5 is also supported, and the model explains 30.8% of the variance in BP.

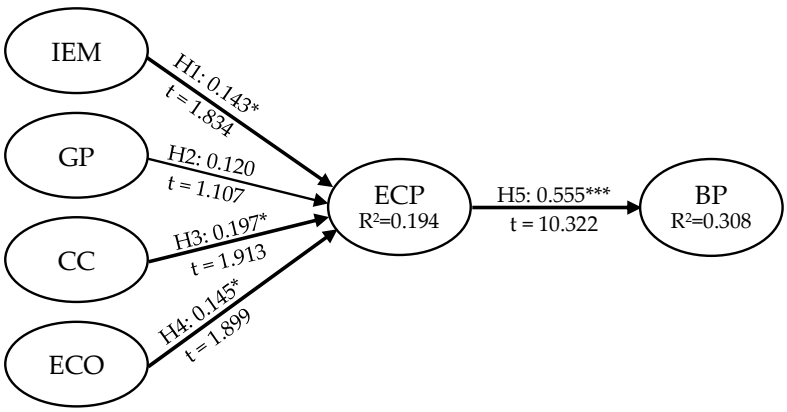

Figure 2. Results of hypothesized research model; *** $p < 0.001$; * $p < 0.05$.

Table 5. Comparison of hypotheses test results.

	Hypotheses	Standardized Coefficient (t-Value)	Results
H1	Internal Environmental Management → Economic Performance	0.143 (1.834) *	Supported
H2	Green Purchasing → Economic Performance	0.120 (1.107)	Not Supported
H3	Cooperation with Customer → Economic Performance	0.197 (1.913) *	Supported
H4	Eco-design → Economic Performance	0.145 (1.899) *	Supported
H5	Economic Performance → Business Performance	0.555 (10.322) ***	Supported

Fit indices: χ^2 = 537.603 (d.f. = 287), χ^2/d.f. = 1.87, CFI = 0.931, SRMR = 0.080, RMSEA = 0.067. *** $p < 0.001$; * $p < 0.05$.

6. Discussion

Internal environmental management was positively related to the ECP (H1). This is in line with De Giovanni [53], where internal environmental management demonstrated a strong relationship with all three attributes of the triple bottom line. Internal environmental efforts are now generally regarded to have a positive impact on economic performance. Corporate social responsibility is performed under the umbrella of ESG these days. Larry Fink, the CEO of BlackRock, the leading global asset and risk management company, said they would not invest in companies that do not adopt ESG strategies or companies with high climate risk [99]. He also said the firm would double its offerings of ESG ETFs in a few years. The financial industry's backing of the ESG movement is based on the idea that environmentally conscious companies would perform better in the long run.

The environmental performance, a non-financial indicator, improves along with opportunities for resource utilization and cost reduction. Nike has cut 3.5 million pounds of waste since 2012 by reducing raw materials going into each shoe. Nestle SA reduced material and shipping costs but increased recyclability by designing plastic bottles ultra-thin and using recyclable materials [12]. Additionally, investors analyze and evaluate companies using ESG criteria. Mike Winterfield, founder of Active Impact Investments mentioned that companies desiring to get investment should have business models making them profitable regardless of government intervention [100].

Better financial performance is expected when top management supports internal environmental management and gets the employees involved. Utilizing transformation leadership theory, Waldman et al. [101] stressed that intellectually stimulated leaders strived to balance performance goals and environmental responsibilities. Velte [102] also found the significant moderating effect of CEO power on the relationship between ESG achievement and financial performance. Internal GSCM practices are composed of eco-design and internal environmental management as dimensions, and they are found to have a significant influence on economic performance [37].

The current study found that green purchasing was not related to economic performance (H2). This is in line with De Giovanni [53] showing a weak relationship between external environmental management and economic performance. Collaboration with suppliers for GSCM and suppliers' efforts for the environment were not directly related to economic performance. We assume that for the current research participants, the level of collaboration with suppliers did not reach the threshold in achieving economic performance. Additionally, survey participants are first-tier suppliers that provide parts to large electronics corporations, and their suppliers are second-tier suppliers. Second-tier suppliers will face less direct pressure for green practices and have fewer available resources to spare for green practices. Since the parts procurement market is extremely competitive, the focal companies barely meet the price, quality, and environmental requirements to pursue further GSCM practices such as collaborating with their supplier firms. Within the relationship between parts suppliers and the final product manufacturer, the latter typically

have the authority to make a purchasing decision, bring in suppliers for cooperation in assembling parts [9]. Therefore, it seems that survey companies might not have the chance to realize economic profits through green purchasing. Evaluation of the first-tier suppliers themselves is highly dependent on how they manage their own suppliers.

Cooperation with customer firms was positively related to economic performance (H3). Interorganizational sharing of knowledge and process integration results in enhanced collaboration and control between participants in the supply chain, bringing the positive environmental performance of firms [50]. H3 was partially supported with a p-value of less than 0.05. Customers' opinions on GSCM, such as cleaner production and green packaging, may play an essential role in creating eco-friendly finished goods. Reflecting customers' opinions potentially increases revenues by creating products appealing to customers' needs and consequently support economic performance. Because their customers are large electronics companies, the suppliers would be inclined to take into account customer tastes to maintain the partnership.

Eco-design was positively related to economic performance (H4). Internal GSCM practices are comprised of eco-design and internal environmental management as dimensions, and they are found to have a significant influence on economic performance [37]. Eco-design is a concrete and practical environmental effort that focuses on the finished goods, and this study found that eco-design was a factor strongly impacting economic performance. Companies can generate profits only when customers purchase their products or service. Eco-friendly or green design attracts green consumers' attention, and industries are forced to be sustainably innovative [103].

The government should invest in companies abiding by ESG criteria and practices. However, these efforts should be based on the profitability of the company. From a company's point of view, generating profits via cost reduction is still a priority. Therefore, one of the most important elements of successful GSCM could be eco-friendly design, which is an environmental effort focusing on finished goods attracting customers. The cost can be lowered when reusability, remanufacturability, and design for disassembly are considered from the development stage. For example, recyclability of a product could be helped with modular design as Yang et al. [104] suggested. Achieving eco-design along with the consideration of efficiency will have a positive impact on economic performance [105].

Economic performance was strongly related to business performance (H5). Li et al. [106] stressed that effective SCM practices help secure the competitive advantage of the supply chain and improve business performance of participating companies. The result of H5 showed the significant impact of cost reduction on the overall business performance of electronics firms. It is expected that the economic performance achieved by environmental efforts will help retain the competitive position and asset utilization, subsequently resulting the sustainability of the companies and their supply chains. The Chinese SMEs' efforts to achieve cost reduction and quality improvement also support the result of our study. As the Chinese government has initiated promotional plans for SMEs, Chinese SMEs experienced various challenges. They concentrated on relationship management and cost reduction, and quality improvement facilitated competitiveness according to Singh et al. [107]. As the relationship between environmental practices and economic performance moves from an intervening one to a complementary one over time [12], there seems to be a growing perception that proactive and systematic responses to the environment reduce corporate risks such as waste treatment fees and accident fines, and eventually make the supply chain more sustainable.

Previous research shows a conflicting result as well. For example, Green et al. [38] found that adopting GSCM practices in manufacturing firms can improve economic as well as environmental performances. Economic and environmental performances influence BP through operational performance, but they found economic performance did not directly influence BP. According to Junaid et al. [108], green managerial innovation brought positive firm performance in the Pakistan manufacturing industries while green process innovation negatively impacted firm performance. The assumed reason for the difference is that the

costs involved with manufacturing processes and operations procedures outweigh the extra profits gained from the process innovation. Conflicts related to green innovation on business performance might be relevant to the type of innovation the focal company is involved. Therefore, to see the full implication of GSCM, a research model should include process performance along with economic and business performance. Additionally, green innovation can reach positive firm performance by practicing green managerial innovation rather than green process innovation.

The current research on first-tier suppliers demonstrated that internal environmental management practices, close cooperation with the customer companies, and eco-design would bring economic performance as well as business performance. Singling out these first-tier characteristics should guide customer firms on how to manage their first-tier characteristics separate from their second-tier and tiers further from them. Moreover, the environmental pressure passed down from the customer companies leads the first-tier suppliers to benefit from their GSCM activities economically. However, there are no significant relationship benefits between the first-tier and second-tier suppliers. This demonstrates that the success of GSCM might rely upon managing suppliers farther up the supply chain.

7. Conclusions

This study examines the effects of GSCM practices on economic performance and business performance of SMEs in the electronics industry. This study singled out a group of SMEs who are subcontractors of large companies under compliance pressure with a strong motivation to innovate. Findings of the study are as follows: (1) internal environmental management, cooperation with customers, and eco-design influence the economic performance of SMEs, first-tier suppliers of large electronic corporations positively, (2) green purchasing did not have any significant relationship with economic performance of the focal companies, and (3) economic performance has a positive influence on business performance of the firms.

The implications can be drawn in several major ways. First, investigating only first-tier suppliers as the focal companies of their own supply chains is academically significant, filling the gap of tier-specific GSCM supplier research. The first-tier group demonstrated that close customer connections, innovative design ideas, and internal management practices result in positive economic benefits and business performance. Building tier-specific characteristics should also help large corporates to practice their due diligence in their supply chains which are progressively instituted as enforceable laws.

Second, this study revealed that corporate environmental efforts are linked to performance providing evidence for corporate sustainability. Now corporate environmental efforts go beyond nominal activities as part of public relations strategies to improve the company's image and pursue sustainable goals positively, influencing economic and business performance.

Thirdly, this research should further strengthen the relationship between SMEs' GSCM practices and economic as well as environmental benefits. The current research on the GSCM practices and positive business performance can boost SMEs' adoption of green practices producing positive environmental impacts. Additionally, expectations on positive economic as well as business performance can induce voluntary adoption of GSCM activities helping with customer corporation's due diligence compliance.

And finally, this study compared the impact of environmental efforts with suppliers to those with customers. In the Korean electronics market, cooperation with customers is operated in the form of collaboration between small partner companies and their suppliers and is found to have a significant effect on financial performance. In addition, the electronics industry requires continual adoption of innovative processes compared to other sectors, and it is expected that the industry would adopt the environmental requirements of customers easier. The partnership between the suppliers and manufacturing firms within South Korean electronics industries is affected by factors such as profit sharing, mutual trust,

information sharing, and participating in decision-making which factors can be considered to improve the relationship with suppliers [109].

This study has a couple of limitations. One, this study analyzed the Korean electronics industry only. Further studies could investigate GSCM impacts on performances in other sectors or in the electronics industry of other countries to generalize our findings. Second, this study focused on two types of performances. Other performance measures such as efficiency, environmental, or ESG performance could be investigated to accommodate varying needs. Especially ESG performance is emerging as a critical dimension for predicting corporate sustainability.

For future studies, other ESG performance measures could be tested with SMEs' GSCM practices. Moreover, firm size (small vs. medium) or external environmental factors could be factored in studying GSCM performance studies. For example, the firm size (small vs. medium) or firm's governance type can be used as crucial moderation factors for further analysis. Studying different tier groups of suppliers will also be academically meaningful and strongly suggested for future studies. The current research on GSCM are moving from finding determinants of various ESG-related performances towards finding the most sustainable suppliers using various analytical techniques based on various criteria. What the future research can pursue to complement the current trend would be examining whether there are tier-specific features affecting the selection of sustainable suppliers.

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Appendix A

For the characteristics of the responding firms, see Table A1.

Table A1. Characteristics of the responding firms.

Characteristics	Frequency	%
A. Respondents' Job Titles		
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

Table A1. *Cont.*

Characteristics	Frequency	%
D. Industry Classification of the Customer Firms (multiple answers)		
Electronics	193	
Telecommunication	7	
Automobile	2	

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