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The Relationship between Environmental Innovation, Sustainable Supply Chain Management, and Financial Performance: The Moderating Role of Environmental, Social and Corporate Governance

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ABSTRACT

Academics and professionals frequently relate the success of environmental, social, and corporate governance (ESG) performance to a company's financial performance. Due to their potential to reduce a company's sustainability challenges, environmental innovation and ESG have attracted considerable attention in the business environment and academia. This study aims to investigate the relationship between environmental innovation, ESG, sustainable supply chain management, and firms' financial performance based on the resource-based view and stakeholder theory. We used lagged annual data from the Thomson Reuters ASSET 4 database between 2012 and 2021. The data consists of 223 firms that are headquartered in the United Kingdom. The Ordinary Least Squares (OLS) method tests relationships and the Two-Stage Least Squares (2SLS) method tests for endogeneity. Combining ESG factors, both integrated and embedded, the findings show that environmental innovation, sustainable supply chain management, and ESG activity positively influence business value and financial performance. Our findings are significant for regulators, academics, and managers interested in green innovation, ESG ratings, and financial performance. Politicians and the board of executives are given information on the company's and nation's potential future development. This study offers empirical support for the use of ESG performance in the UK to advance proactive green innovation and further green development.

Keywords:

ESG, Environmental innovation, Sustainable supply chain management, Financial performance

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Business corporations have become more worried in recent years about their innovations' effects on the environment. Businesses are working to find an appropriate, long-term solution to these environmental problems. The fourth industrial revolution was sparked by huge sustainable technical advancements that sought to reduce environmental risk in various ways. One of the sustainable methods to reduce environmental risk is environmentally friendly innovation. As implied by the study by Ryszko (2016), businesses must adopt environmentally friendly innovations to reduce environmental risks. It is observed that during the COVID-19 epidemic, the ecologically friendly innovative projects grew a lot. It is understood that corporations must tackle it proactively. Surprisingly, the Sustainable Development Goals (SDG) 2030 plan of the United Nations had already begun and supported environmentally friendly innovations. The plan had 17 objectives for proactive environmental innovation (EI) activities. Literature that emphasizes the significance of innovations in sustainability and the circular economy is growing. Due to the epidemic, there has been a greater focus on the industry's involvement in EI. Some of the main factors influencing the industry's embrace of EI are financial benefits, sustainable business solutions, reduced manufacturing waste, and technology without pollution. This is consistent with the economic, social, and environmental pillars of sustainability. The proactive aspects of EI, such as its product, process, and technology, are closely connected to the circular economy. The circular economy is believed to be related to fundamental ideas of waste and pollution reduction. Therefore, product, process, and technical EI all contribute to a circular economy by guaranteeing that environmental pollution and waste are decreased during the manufacturing process for businesses.

Businesses and consumers are conscious of environmental issues in the information age. They are aware of the current business model as a result of these problems. Currently, most businesses use the traditional business model, resulting in emissions of 37 billion tons of CO₂, 8 million tons of solid waste, and a 2.5% increase in energy demand in 2018 (De Amorim et al., 2018). As a result, the existing business model must be changed in favor of a proactive sustainable business model. Most studies on EI that have been done on a reactive level have included the Financial Performance (FP) of a corporation as a component (Johl & Toha, 2021). There is not much research available that focuses especially on environmental preventive measures. The association between proactive EI projects and a company's FP has received very little attention up to this point. The association between proactive EI and a firm's FP must therefore be studied in depth. Some researchers have found Environmental, Social, and Governance (ESG) activity improves firm performance (Buallay, 2019; Broadstock et al., 2021). Modern academic and business research has examined the influence of ESG approaches and procedures on firm FP. Yet, there are insufficient investigations in the ESG literature regarding the effect of ESG activities on the firm's FP (Garcia et al., 2017). This paper investigates the moderating role of the firm's ESG activities on the influence of EI and SSCM on the FP. In support of stakeholder theory, this study aims to determine whether the ESG operations and performance scores of environmentally sensitive corporations have a positive link with the corporate FP. This study additionally investigates Supply Chain Management (SCM) and sustainability issues that have only recently risen in interest in SCM sustainability practices in businesses. To improve the long-term performance of the companies and the supply chain as a whole, SCM is the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a specific company

and across businesses within the supply chain (Mentzer et al., 2001). The supply chain encompasses the transportation of products and data from raw materials to end users. In other respects, SCM incorporates these operations through enhanced interactions with supply chains to achieve a Competitive Advantage (CA). Sustainable Supply Chain Management (SSCM) refers to incorporating a sustainability-based management strategy throughout the supply chain process (Seuring et al., 2008, p. 17). Ahi and Searcy (2013) proposed a new definition of SSCM, which they defined as the voluntary integration of economic, environmental, and social considerations with important inter-organizational business systems designed to efficiently and effectively manage the material, information, and capital flows associated with the procurement, production, and distribution of goods or services to meet standards. Administrative decisions about sustainable supply chains have received special attention as an essential aspect for accomplishing environmental objectives (Martínez-Jurado & Moyano-Fuentes, 2014; Vezzoli et al., 2015; von Geibler, 2013). As evidenced by Lozano et al. (2015), businesses are increasingly attempting to integrate issues of sustainability into their business plans.

In the literature, many studies have examined the correlation between SSCM and performance in organizations. The results indicate a largely positive relationship, although the relationship's course is still unknown (Zhu et al., 2013). Few of these studies employed publicly available data, even though many of them used questionnaire surveys to acquire their data (Paularj et al., 2017). Furthermore, because time series are rarely used in research, the majority of studies fail to account for how a relationship changes over time (Özbay, 2021). Using panel data, this study investigates the relationship between EI, ESG, SSCM, and FP. As the first study to use panel data to examine the relationship between EI, ESG, SSCM, and FP in firms in the United Kingdom, the study also intends to advance the literature and serve as a model for other research. The study's next part is divided into sections that include the theoretical background, literature review, and hypothesis. Section 3 then introduces the research methodology. Section 4 includes a discussion of the findings, the data analysis, and the results. The study's limitations, contribution, and future research directions are covered in the conclusion part.

Theoretical Basis and Research Hypothesis

Environmental Innovation and Firm Financial Performance

Innovation means bringing something new into existence. The fourth industrial revolution, which focused on innovation and sustainability, expanded on the third industrial revolution's introduction of EI. In the 1987 United Nations publication "Limits to Growth by the Club of Rome and Brundtland", environmental sustainability was underlined as an essential strategy for conserving limited resources for both current and future generations (Johl & Toha, 2021). The best way to make use of scarce resources must be demonstrated, and that approach must be discovered. EI, according to Kemp and Pearson (2007, p. 7), is "the production, assimilation, or exploitation of a product, production process, service, or management, or business method that is novel to the organization and results, throughout its life cycle, in a reduction of environmental risk, pollution, and other negative impacts of resource use compared to relevant alternatives." According to organizations like the Organization for Economic Co-operation and Development (Data, 2005) and researchers Kemp and Pearson (2007) and Mannan (2022), the three primary elements of EI are products, processes, and technology.

When investing their savings in a company, investors research the company's past, present, and projected future FP. Numerous studies have examined a company's FP while emphasizing its bottom-line performance. The FP of a firm is thus acknowledged as a crucial performance measure of EI (Bitencourt et al., 2020; Hojnik et al., 2016; Przychodzen & Przychodzen, 2013). According to Przychodzen and Przychodzen (2013), EI is positively correlated with an organization's FP in Poland and Hungary. Just accounting-based measurements like Return On Assets (ROA) and Return On Equity (ROE) were employed for the company's financial results. They asserted that spending on EI gave the corporation a higher return on its assets and equity. According to the findings, the expansion of EI requires substantial financial resources. Even though companies will have significant cash reserves, they won't be able to benefit from EI if they don't make strategic decisions instead of reacting to spending decisions. Moreover, Ryszko (2016) and de Jesus Pacheco et al. (2017) made the same claim concerning EI using the same accounting indicators. Similar to Przychodzen and Przychodzen (2013), Santos et al. (2017)'s work in Brazil also found a positive relationship between EI and FP. However, Santos et al. (2017) employed market-based measurements like Tobin's Q rather than accounting-based indicators. They suggested that market-based interventions lead to more effective results than accounting-based ones. They continued by providing examples of the social and environmental perspectives on EI. It can be argued that businesses will have better financial outcomes if they are proactive with their EI initiatives. A study from China by Tseng and Bui (2017) further demonstrated the link between EI and improved business performance. Interestingly, they found that the impacts of EI were mostly dependent on a firm's performance and employed managerial concern as a moderator variable linking EI and firm performance. They hired 188 distinctive Chinese manufacturing companies. Additionally, they employed both market-based and accounting-based measures. For proactive EI activities, one can argue that managerial considerations are more crucial than procedures for evaluating a company's FP. Yet, just a few studies have discovered a link between EI and a firm's FP (Santos et al., 2017; Rodríguez-García et al., 2019). According to the study by Santos et al. (2017), EI and financial success have a negative relationship from a social perspective. de Azevedo Rezende et al. (2019) claim that there is no connection between EIs and a company's first-year financial success. The analysis was limited by the spending year for EI. These results imply a connection between EI and financial success. In a meta-analysis of 64 observational studies, EI and firm performance were found to be positively correlated in 55% of the studies, to have no effect in 30% of the studies, and to be negatively correlated in 15% of the studies (Bitencourt et al., 2020).

According to the literature, the empirical analyses conclude conflicting results exist between EI and a company's financial success (Hizarci-Payne et al., 2021). Other than this, there haven't been many studies on proactive EI and FP. In light of this, the conclusion is ambiguous and requires further research. For this reason, this study contributes to this gap in the literature by measuring the direct effect of EI on the FP and the indirect effect of the supply chain on the FP of the firms. The suggested conceptual framework in this study uses proactive EI as its independent variable. In this theoretical structure, a firm's FP is the dependent variable. Tobin's Q ratio metric is used to assess the firm's FP. Firm age, size, and leverage are regarded as the study's control variables.

The Resource-Based View Theory (RBV), which has been endorsed by earlier researchers like the authors of Ryszko (2016), García-Granero et al. (2018), and Munodawafa and Johl (2019) was employed in this research to explain the relation between proactive EI and firm FP. A management paradigm for controlling a firm's strategic resources is known as the resource-based view. A company will typically employ strategic assets to acquire a long-term CA over its rivals. Furthermore, the RBV directs administrative attention to the company's internal assets to identify advantages, talents, and skills that will give the company a CA over its rivals. In light of this, it is asserted that RBV is the most pertinent theory in the disciplines of EI and firm performance.

Along with the demand from stakeholders, businesses are connected to major environmental issues. The majority of earlier research that was done concentrated on primary data. There are a few studies that concentrate on panel analysis using secondary data that is readily available (Johl & Toha, 2021). Through the use of a secondary dataset and the encouragement of proactive EI, this study fills the current research gap. This study recognized the environmental challenge and EI as two of the most prevalent issues that most corporate organizations are aware of and worried about. However, rather than taking a proactive approach to these issues, they take a reactive one. This study's goal is to discover the connection between proactive EI and firm FP.

The influences of public action and regulation, market-driven demand, and internal procedures influenced by management systems for the environment are all examined in a large body of research on the factors that determine EI (Carrion et al., 2013). On the other hand, the ability of the diffusion of EI to significantly improve environmental performance has been almost taken for granted in the policy and scientific debate, whereas the issue of the efficiency of EI in achieving environmental goals has received less attention from empirical studies. The relationship between economic growth and environmental quality is also examined by Yin et al. (2015), who demonstrate that technical advancement (as gauged by research and development expenditures) controls CO₂ emission dynamics. Other assessments that concentrate on the causes of CO₂ emissions take into account a range of variables, including innovation, that are expected to affect the level of emissions. To achieve this aim, Cole et al. (2013) analyze the United Kingdom and Japan manufacturing sectors, especially at the firm level, and discover that EI, as measured by research and development (R&D) expenditures, turns out to be a significant factor in the reduction of CO₂ emissions. Additional contributions emphasize the importance of keeping current with the latest environmental technologies and practices in order to increase environmental performance. Within this field of study, Kortelainen (2008) creates a dynamic framework to evaluate environmental efficiency using a Data Envelopment Analysis (DEA)-based Environmental Performance Index (EPI) and frontier efficiency strategies. An EPI is calculated based on 20 EU countries from 1990 to 2003, and the overall changes in environmental performance are further divided into changes in relative environmental efficiency and a shift in the frontier due to environmental technical change, with the latter results verifying to be the primary driver of environmental performance improvement. Similar conclusions are reached by Beltran-Estevé and Picazo-Tadeo (2015) when they analyze the transport sector in 38 countries between 1995 and 2009, considering unique environmental factors.

Building on these initial contributions, this study develops the initial research hypothesis that will be put to the test in the sectoral empirical analysis for enterprises in the United Kingdom. Thus, the study hypothesis is that:

Hypothesis 1 (H1): Environmental Innovation has a positive effect on Financial Performance.

Environmental, Social, and Governance Activities and Firm Financial Performance

ESG management aims to eliminate the negative effects of attaining economic prosperity in today's human society and ensure the long-term viability of the human community. Within the ESG pillars, ESG management fulfills this purpose in addition to increasing an organization's FP. Recent worldwide concepts include the Paris Climate Agreement, RE100, and the EU Carbon Border Tax (Carroll, 1991). Global corporations use green management strategies to reduce carbon emissions, while financial institutions like Blackrock focus on ethical investing (BlackRock, 2020). The Sustainability Accounting Standards Board in the United States and the Sustainability Standards Board of the International Financial Reporting Standards Foundation recently adopted disclosure standards for data related to ESG (Kim et al., 2015). Numerous studies have been made to determine how corporate efforts in ESG areas influence the FP of a company. Recent publications have examined the correlation between ESG management and the FP of businesses. For instance, Friede et al. (2015) conducted a meta-analysis of 2,200 prior studies on the relationship between ESG and a company's FP and reported that 48% of the total sample concluded that the relationship produced positive results. According to Sohn (2016), there is a positive correlation between the financial attributes and the economic performance of CSR-engaged companies in Korean society. However, other studies (Kwak et al., 2022) revealed unfavorable, negative, or blended relationships. Friedman (1970) initially claimed that corporations' sole social responsibility is to maximize shareholder profit. According to Friede et al. (2015), 11% of the sample showed that ESG had a negative influence on the firm's FP, 23% showed a neutral impact, and 18% exhibited a mixed impact. Kwak et al. (2022) examined if there would be a distinction between ESG and non-ESG funds as well as the connection between the liquidity and performance of Korean funds. The investigation showed a negative correlation between both, and ESG did not affect fund flow. They discovered that Korean ESG fund investors concentrated more on non-financial assets than on making a profit. It is acknowledged that the findings of previous studies are incompatible and that additional research is required. According to the stakeholder theory (Freeman & Medoff, 1984), businesses should consider the interests of all parties involved in the operation in addition to providing value and profit for proprietors or investors. In addition, making investments in ESG activities enables a company to gain a CA in the market and improve its FP. ESG management corresponds with Freeman and Medoff's (1984) stakeholder theory. Therefore, the fundamental value promoted by ESG should be maximizing a company's FP. This study, therefore, introduces the following hypothesis:

Hypothesis 2 (H2): Environmental, Social, and Governance activities have a positive effect on Financial Performance.

The interaction effect of Sustainable Supply Chain Management between Environmental Innovation and a Firm's Financial Performance

Sustainable innovation is the process by which sustainability issues (environmental, social, and financial) are included in business processes, from idea development to R&D and commercialization, according to León-Bravo et al. (2019). According to Kusi-Sarpong et al. (2019), sustainable innovation is the introduction of novel or modified manufacturing methods, techniques, systems, organizations, and products to decrease environmental harm. Technology developments specifically geared toward sustainability are known as EIs (Grasselli et al., 2020); these advancements have drawn much attention in the recent ten years (Gligor et al., 2019; Li et al., 2020). The two fundamental components of EIs are (1) the innovation's effect on the environment, whether positive or negative and (2) the innovator's motivation for launching the innovation (product or service) while considering how it would affect the environment (Barbieri & Santos, 2020). One key factor contributing to SSCM is EI (Fehrer & Wieland, 2021). According to Confente et al. (2020), EI integrates ecological concerns into products and manufacturing processes to generate SSCM, ultimately satisfying the end users' ecological needs (stakeholders, customers, and manufacturing organizations). The application of EI is expanded by SSCM (Farooque et al., 2019). Industrialization is causing significant environmental problems for SMEs, particularly when it comes to managing supply chains (Chin et al., 2015). An advanced level of industrial pollution is produced by hazardous emissions and poisonous packaging materials (Sezen & Cankaya, 2013). According to Costantini et al. (2017) and Liu et al. (2018), SSCM is a useful strategy for reducing these and other environmental risks. This EI (Dewick & Foster, 2018), which is founded on sustainability (Lee et al., 2020), blends elements of the environment and common supply chain operations. According to Hojnik and Ruzzier (2016), SSCM encompasses green distribution, production, and procurement. According to Kock (2017), EI and SSCM strategies can both result in positive outcomes from a sustainability perspective (Li et al., 2020).

According to Golicic and Smith (2013), one of the theories that is most frequently used to explain the relationship between SSCM practices and corporate performance is the RBV. Although it has long been acknowledged in the literature that CA relies on cooperation between organizational capabilities and dynamic environmental conditions, RBV is a relatively new theory that looks at the connections between firm assets, skills, and CA (Hart, 1995). The notion holds that a firm's capabilities are determined by how its numerous resources are managed and combined. If the resources are valuable, distinctive, and cannot be replaced in an analogous way, businesses may offer a CA (Golicic & Smith, 2013). Hart (1995) asserts that RBV, on the contrary, disregards the difficulties and limitations assigned by the environment. So, he came up with Natural RBV, based on the premise that future CA will be characterized as "capabilities that support ecologically sustainable economic activity." The three interconnected strategies that Natural RBV needs to be strategic are pollution avoidance, product governance, and sustainable development, while "key resources and capabilities also affect the ability of the organization to preserve its CA" (Hart, 1995). According to natural RBV, specific characteristics must be possessed by an ability or resource in order to produce a CA over time. For instance, to be valuable and irreplaceable, socially complex, or uncommon. To put it another way, if a company based its sustainability strategy on distinctive resources or

competencies, this external focus could strengthen and distinguish its position as a result of the benefits of an excellent reputation.

Environmental supply chain strategies are receiving more attention from businesses in both developed and developing nations (Esfahbodi et al., 2016). As a result, businesses adopt SSCM through social and environmental initiatives that involve everyone in the supply chain (Wang & Dai, 2018). The strategic value of SSCM for businesses is one of the main causes of this rising attention to it. The future problem of creating a sustainable global economy makes having a sustainable supply chain strategy more and more crucial, as Markley and Davis (2007) point out. In order to have successful supply chain partnerships, businesses should assess the influence of the supply chains they use on their social, environmental, and FP (Markley & Davis, 2007). Numerous studies have also examined the connection between SSCM and business FP (Golicic & Smith, 2013). These studies reveal that SSCM methods can raise employee morale, consumer goodwill, and sound managerial practices by strengthening stakeholder interactions. In other words, firm performance positively correlates with environmental and social responsiveness. On the other side, stakeholders like customers, employees, non-governmental organizations, governments, and other regulatory authorities constantly pressure today's businesses to adopt social and environmental practices (Amjad et al., 2017). Additionally, they are pressing businesses to better control the environmental effects of their supply chains (Paulraj et al., 2017). Businesses that reject these forces risk damage to their reputation (K. Roehrich et al., 2014). In order to draw more attention to SSCM procedures, stakeholders' internal and external pressures are a crucial additional aspect.

Given that they support a connection between corporate capabilities and CA, resource-based theories are viewed as being suitable for explaining the correlation between SSCM and corporate performance (Golicic & Smith, 2013). RBV and Natural RBV place emphasis on combining resources and describe how doing so might enhance capabilities. It argues that companies frequently invest in SSCM and other corporate social practices when they have additional funds. This point of view typically rests on the notion that firms can only take part in Corporate Social Responsibility (CSR) programs if their financial well-being and financial resources are sufficient. Businesses with limited resources, however, tend to pull back on their CSR efforts. Ortas et al. (2014) studied the relationship between SSCM and FP for a sample of 3,900 organizations covering 2004-2011 using multivariate measures of SSCM performance and FP. They found a typical two-way correlation between company margins and revenue but a one-way causal relationship between SSCM performance and profitability. They also found that FP measures had an impact on an organization's SSCM performance in times of crisis and stability. Their findings are consistent with the concept of spare resources as a consequence. Good management practices and taking part in CSR efforts build relationships with important stakeholders based on good management theory, which is based on the stakeholder perspective (Freeman & Medoff, 1984). Strong stakeholder bonds reduce expenses and risks, give companies a competitive edge and a better reputation, and improve corporate performance (Waddock & Graves, 1997). For instance, moral motivation, productivity, and satisfaction can all be increased by a positive employee relationship. In addition, considering societal challenges and customer expectations could result in more positive perceptions of the business. These might increase revenue while cutting stakeholder management costs (Waddock & Graves, 1997). A company's decision to engage in social and environmental practices is affected by a

variety of factors, including the hope that doing so will foster better communication with all company stakeholders, promote ethical business practices, and boost FP by making better use of resources. According to K. Roehrich et al. (2014), reputational risk is essential for implementing social and environmental initiatives like SSCM. Earlier studies have frequently highlighted the strategic importance of business social and environmental responsibility practices. In order to reduce reputational risk and strengthen their company image, businesses prefer to advance socially or environmentally friendly practices (Godfrey, 2005). Consequently, the majority of businesses are under pressure to enhance their environmental performance (Pagell et al., 2004). Stakeholder pressures are thus significant driving factors for SSCM procedures. According to institutional theory, a corporation engages in organizational practices as a result of outside pressures. For instance, laws and regulations have increased environmental awareness in both developed and developing nations. Additionally, rising market and consumer expectations and demand also push businesses to adopt more responsible social and environmental policies (Sarkis et al., 2011). When examining the connections between Green Supply Chain Management (GSCM) practice, environmental performance, and economic performance, Zhu et al. (2007) took into account three moderating factors: competitive institutional (internal) pressures, regulatory constraints, and market pressures. According to their findings, adopting ecological design practices results in decreased organizational and economic gains when there are market pressures, whereas institutional forces have no obvious effect on economic performance and either do not improve it or make it worse. Similarly, Zhu et al. (2013) investigated the mediating impact of internal and external GSCM practices on the interaction between institutional pressures and organizational performance using data from 396 Chinese manufacturing businesses. They found that while GSCM techniques have a limited direct impact on economic performance, they can indirectly enhance it. Similar to Zhu et al. (2013), Paularj et al. (2017) investigated the mediating influence of organizational SSCM on corporate performance by considering moral motivations as a crucial driving force. They investigated how SSCM practices affected the link between corporate performance and relational, moral, and functional factors (environmental and FP). Additionally, they found that SSCM fully mediates the effects of both relational and moral factors on performance. They also found a positive link between SSCM practices and company performance. Numerous studies have demonstrated that environmental and social practices, regardless of whether they rely on the RBV theory, stakeholder theory, or good management theory, improve the FP of businesses. Golicic and Smith (2013) did a meta-analysis of 31 studies with 77 independent effect sizes to determine the total effect of environmental supply chain practices on business performance. They found a direct link between environmental supply chain practices and metrics of market, operational, and accounting-based business performance. Many studies show a direct or indirect positive relationship between SSCM and FP; however, some studies suggest a conflict. For instance, Kim and Rhee (2012) employed structural equation modeling to examine how the GSCM's important success factors affected the balanced scorecard performance of 249 Korean businesses. They found that a number of significant GSCM factors and the FP were in conflict with one another.

Similarly, Esfahbodi et al. (2016) examined the association between SSCM and environmental and cost performance in novel economies by comparing Chinese and Iranian firms. Even though there is a significant negative correlation between SSCM practices and cost

performance, their findings indicate that SSCM practices promote environmental performance. Similar to Paulraj et al. (2017), Amjad et al. (2017) investigated the mediating effects of SSCM on the incentives and performance of organizations. Nonetheless, they discovered a negative direct relationship between SSCM and FP and demonstrated that SSCM practices substantially mediate the interaction between organizational objectives and performance. The findings of research examining the association between SSCM and FP may therefore vary considerably. As stated previously, despite the fact that multiple studies have demonstrated that SSCM enhances business FP, the connection between the two is still unclear. That is, numerous studies indicate that SSCM practices improve business efficiency, profitability, and market value (Tamayo-Torres et al., 2019), decrease costs (Zailani et al., 2012), and lower risk (Prasad et al., 2020). Other research (Wang & Dai, 2018) failed to find evidence of a statistically significant relationship between the two variables or that SSCM enhances FP (Ortas et al., 2014). Several additional studies have found that SSCM practices, particularly in the short run (Wang & Sarkis, 2013), may result in higher expenses (Esfahbodi et al., 2016) and a potential competitive disadvantage (Kim & Rhee, 2012). In light of these contradictory results, the study is guided by the following hypothesis:

Hypothesis 3 (H3): There is a significant positive interaction effect of Sustainable Supply Chain Management between Environmental Innovation and a firm's Financial Performance

Method

The aim of the study is three-fold: (1) to investigate the effect of EI and SSCM on the FP; (2) to examine whether the firms' ESG performance moderates the influence of EI and SSCM on the FP, and (3) to investigate the endogenous effect of SSCM on the EI and ESG. The sample of the study is made up of firms that are exchanged in the United Kingdom. ESG, EI, SSCM, and FP data are collected from the Thomson Reuters Asset4 database. The firms included in the sample were non-financial companies that were located in the UK. The sample consists of industries such as basic materials, customer cyclical, customer non-cyclical, real estate, energy, healthcare, technology, and industrials. After careful consideration, 232 firms have the required data sufficiently. Therefore, the sample consists of 232 firms from the UK. Similar studies have used the Thomson Reuters Asset4 database to test the proposed relationships (Nirino et al., 2019; Nirino et al., 2021). Financial and insurance firms should be excluded from the sample as they can have different financial information, and comparison with other firms would be misleading (Doni et al., 2019; Nirino et al., 2021). In addition, all firm-year observations with missing variables and less than five firm-year observations are removed. Thus, these firms are excluded from the sample, leaving 2,012 panel observations between 2012 and 2021.

Corporate governance and company-specific criteria have both been selected as the study's control variables. This study followed earlier ones by including control factors such as firm age (Wong & Zhang, 2022), company size (Nirino et al., 2021; Shaukat et al., 2016), board size (Hafsi & Turgut, 2013), and companies' leverage (Limkriangkrai et al., 2017). Due to the potential for economies of scale in socially and environmentally responsible investment, firm size has been determined by total assets (Elsayed & Paton, 2009). Tobin's Q is used as the dependent variable since it is a market-based value that also captures investors' expectations (Awaysheh et al., 2020). The market worth of the company to its value in the accounting record,

as well as the cost of replacing company assets, are represented by Tobin's Q. Tobin's Q is a market-based performance indicator that is proactive and reflects investor opinion on market valuation, as opposed to accounting-based performance measurements, which are historical (Azimli, 2023). Tobin's Q is frequently utilized in the ESG literature and is more resistant to earnings management; therefore, it is employed as a proxy for financial success (Azmi et al., 2021; Bennouri et al., 2018; Nekhili et al., 2021). In Table 1 below, descriptions of each variable are presented.

Table 1

Description of Variables

Independent Variable	Source	Description
Environmental Innovation	Datastream	A score of environmentally innovative activities and practices. (0-100)
Sustainable supply chain management	Datastream	A score of environmentally friendly supply chain management practices. (0-1)
ESG Performance	Datastream	A weighted average of the ESG scores (0-100)
Environmental Performance	Datastream	The relative sum of category weights for three dimensions: resource use, emissions and waste reduction, and innovation (0-100)
Social Performance	Datastream	The relative sum of category weights for four dimensions: Workforce; Human rights; Community and Product Responsibility (0-100)
Governance Performance	Datastream	The relative sum of category weights for three dimensions: Management and oversight; Shareholders' rights and CSR strategy (0-100)
Dependent Variables		
Tobin's Q	Datastream	Market value divided by the total assets
Control Variables		
Leverage	Datastream	Debt to equity ratio
Size	Datastream	The natural logarithm of total assets
Board Size	Datastream	The natural logarithm of the number of directors
Firm Age	Datastream	Current year minus incorporation year

Firms that have at least five years of non-missing Total Assets (TA), Market Value (MV), Cash Flows (NS), Tobin's Q ratio (TQ), Environmental Score (E-score), Social Score (S-score), and Corporate Governance Score (CG-score) data were included in the sample. The final sample consists of 223 firms from the United Kingdom. The ESG, environmental score, social score, governance score, and environmental innovation score take a value between 0 and 100. Sustainable supply chain management takes a value of 1 for companies adopting sustainable supply chain management and 0 for companies that do not adopt it. Tobin's Q is the market value of companies divided by the total assets. Size is the natural logarithm of the total assets. Board size is the natural logarithm of the number of directors. The firm age is the current year (2023) minus the incorporation year of the companies.

Results

The empirical analysis begins with estimating several baseline models to confirm the positive impact of ESG and EI performance on Tobin's Q. The baseline model is as follows:

$$\text{Baseline Model: } Tobin's Q_{i,t} = \beta_0 + \beta_1 ESG_{i,t-1} + \beta_2 EIS_{i,t-1} + \beta_4 LEV_{i,t} + \beta_5 Size_{i,t} + \beta_6 Age_{i,t} + u_{i,t}$$

where i is a firm, t is time, *Tobin's Q* is Tobin's Q ratio, ESG is the aggregate score of environmental (E), social (S), and governance (G) sub-components, EIS is the environmental innovation score, Size is the natural logarithm of assets, LEV is the leverage ratio and Age is the incorporation year, u is the regression errors. To make sure that the data are publicly accessible at the time Tobin's Q is measured, we lag accounting variables by one period following Lins et al. (2017), given that financial reports are made publicly available with a lag.

Table 2 shows the descriptive statistics for the variables used in this study.

Table 2

Descriptive Statistics

	<i>M</i>	<i>Median</i>	<i>SD</i>	<i>N</i>
ENV	49.53	48.76	23.91	2012
AGE	37.99	26	29.14	2012
BS	8.87	9	2.15	2012
DTE	1.36	0.53	8.27	2012
SSCM	0.66	1	0.47	2012
ESG	55.34	55.7	17.90	2012
GDP	0.01	-0.00	0.06	2012
TOBINQ	2.81	0.84	20.99	2012
SIZE	21.86	21.69	1.52	2012
SOC	55.53	56.4	20.81	2012
GOV	60.46	62.97	20.45	2012
EIS	25.41	8.555	31.10	2012

Note. This table reports the descriptive statistics for the variables.

Table 3 shows the correlation matrix between variables.

Table 3

Correlation Coefficients

	ENV	AGE	BS	DTE	SSCM	ESG	GDP	TOBINQ	SIZE	SOC	GOV	EIS
ENV	1											
AGE	.08***	1										
BS	.36***	.01	1									
DTE	-.01	-.05	-.01	1								
SSCM	.55**	.06**	.23	.03	1							
ESG	.85**	.08**	.40**	.01	.53**	1						
GDP	.06**	.00	.05**	-.02	.03	.07**	1					
TOBINQ	-.03	-.01	-.10	-.01	-.04	-.10	-.01	1				
SIZE	.57**	.02	.57**	.00	.36**	.61**	.02	-.08	1			
SOC	.69**	.06**	.37**	.02	.45**	.88**	.05**	-.10**	.56**	1		
GOV	.37**	.08**	.22**	.03	.27**	.67**	.07**	-.11**	.35**	.41**	1	
EIS	.62**	.16**	.21**	-.04	.30**	.48**	.03**	-.06**	.34**	.33**	.23**	1

OLS regression analysis is used to estimate the relationship between ESG factors and FP. We run separate regressions for each sub-score (environmental, social, and governance) and the FP variable (Tobin's Q). We control for firm size, industry, leverage, and macroeconomic factors in all regressions. To address endogeneity concerns, we also use 2SLS regression for robustness. We run separate 2SLS regressions for each instrumental variable (board size and SSCM), controlling for firm size, industry, leverage, and GDP. The results showed that control variables have a significant effect on the dependent variable of the model. Table 4 illustrates the findings of the OLS technique. Estimations included the time and industry effects. The results of the study confirm the positive impact of environmental innovation score and ESG on the market valuation of firms. In model 1, the results have stated that EI ($\beta = .002, p < .05$) and

ESG ($\beta = .004, p < .05$) performance positively affect companies' market value (Tobin's Q). In model 2, ESG dimensions were tested, and the results suggested that each dimension has a positive and significant effect on the market value of firms. Environmental performance has a positive influence on the market value of firms ($\beta = .004, p < .05$). Social performance has a positive influence on the market value of firms ($\beta = .004, p < .05$). Governance performance has a positive influence on the market value of firms ($\beta = .003, p < .05$). Environmental innovation performance has a positive influence on the market value of firms ($\beta = .001, p < .05$). Therefore, hypothesis 1 and 2 were accepted. In model 3, the effect of the aggregated ESG was tested individually. The results showed that ESG performance has an effect on the market value of firms ($\beta = .005, p < .05$). Lastly, in model 4, the moderating effect of sustainable supply chain management and environmental innovation on the market value of firms has been tested. However, the moderating effect is found to be insignificant. Therefore, we failed to accept hypothesis 3.

Table 4*Baseline Model*

Dependent Variable Tobin's Q Ratio				
	1	2	3	4
Lagged Tobin's Q	.930**	.928**	.927**	.850**
Size	-.240**	-.040**	-.230**	-.210
Age	.001**	.001**	.002**	-.003
Leverage	-.004**	.000	-.004**	-.007
ESG	.004**		.005**	
EIS	.002**	.001**		
Env		.004**		
Soc		.004**		
Gov		.003**		
Board Size	.001**	.008**		
SSCM	.013	.013		
SSCM*EIS				.003
N	1,803	1,803	1,803	
Adj. R-Squared	.25	.255	.244	
Industry Dummies	Yes	Yes	Yes	
Year Dummies	Yes	Yes	Yes	
Crisis Dummies	Yes	Yes	Yes	

To address the endogeneity problem, one of the two techniques uses a two-stage least squares (2SLS) panel regression (Wintoki et al., 2012). This could result from missing factors that have an impact on both the dependent variable and one or more independent variables. One often employed technique for examining the relationship between financial variables is two-stage regression analysis (2OLS). By using the explanatory variables' prior values, the autocorrelation issue between the dependent variable and one or more independent variables is eliminated throughout the estimation process. When there is an endogeneity issue, which develops when the independent variables are correlated with the regression equation's error term, two-stage least squares (2SLS) regression analysis is an estimation method used to estimate the relationship between a dependent variable and one or more independent variables. Because many financial variables are connected and impacted by circumstances outside the researcher's control, endogeneity is a prevalent issue in the field of finance. As presented in Table 5, board size has been used to test for endogeneity in ESG in model 1. SSCM was used to test the endogeneity in EI in Model 2 and Model 3. The results did not imply a significant

change in the proposed relationships as they were tested with the OLS. Thus, hypothesis 1 (EI positively affects FP) and hypothesis 2 (ESG positively affects FP) were both accepted.

Table 5

Robustness Tests: 2SLS for Endogeneity

Dependent Variable Tobin's Q Ratio	1 (BS instrument)	2 (SSCM instrument)	3 (SSCM instrument)
Lagged Tobin's Q	.901***	.662**	.967**
Size	-.602**	-.335*	-.047**
Age	-.003**	-.014	-.001**
Leverage	.004	.026*	.001*
ESG	.096**	-.13*	
EIS	-.017**	.169*	.016**
Env			-.015**
Soc			.005**
Gov			.04
N	1,817	1,817	1,817
Adj. R-Squared	.24	.22	.20
Industry Dummies	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes
Crisis Dummies	Yes	Yes	Yes

Discussion

Due to climate change and growing environmental pollution, firms' attention to sustainability concerns has grown dramatically in recent years (Ying & Xin-gang, 2021). According to institutional theory (Meyer & Roman, 1991), social incentives to do so are another reason why businesses are becoming more interested in sustainability concerns. This has promoted adopting more environmentally friendly manufacturing practices (Kotze et al., 2010) and creating business models that adhere to the latest ESG standards. EI, such as green innovation or environmentally friendly design, is a component of innovation in general and is one of the strategies for fostering the growth of an environment that is sustainable (Ahmad et al., 2021; Ilyas & Osiyevskyy, 2022; Nicol, 2021). Additionally, green innovation supports the growth of sustainable businesses since it may have a favorable effect on a company's financial, social, and environmental performance (Hashemi et al., 2015). Due to the dearth of studies on corporate green innovation strategies, it can be difficult to offer direction and recommendations to relevant groups.

In this study, the impact of ESG and EI on the FP of listed United Kingdom companies has been evaluated. The findings indicate that both EI and ESG may positively impact a firm's FP. RBV theory, institutional theory, and stakeholder theory can all be used to explain the positive effects of EI and ESG on a company's financial performance (Prakash, 2002). Process and product innovation are both considered green organizational resources by RBV (Cheng et al., 2014). Because green process innovation is process-oriented and green product innovation is product-oriented, businesses that apply these two complementary discoveries will have a greater competitive advantage. As suggested by these theories, by incorporating the interests of external parties rather than just the firm's financial objectives, green innovations will help a firm win the trust and support of external institutions and key stakeholders (Prakash, 2002). A specialized instrument for achieving sustainable development is green innovation. At this level, organizations seeking to become more competitive are seen to greatly benefit from ethically driven green innovation. It presents a chance to minimize conflicts of interest, increase information confidence in users, and strengthen the firm's social standing. This is clarified by

the notion that innovation's extent has an impact on the company's performance and financial outcomes. The findings show that there are positive and significant associations between the overall ESG performance of firms and Tobin's Q, demonstrating that stronger ESG performance has a positive effect on profitability and contributes to the growth in the market value of these corporations, which supports the stakeholder theory (Freeman & Medoff, 1984). The fact that ESG performance has a positive impact on businesses' FP shows that growing and investing in ESG activities can be profitable.

In keeping with the findings of several empirical investigations, the findings of this research show a positive linear relationship between SSCM and FP. This study has made some contributions to the literature on sustainable supply chains. To begin with, many empirical studies have used questionnaires in the literature rather than employing openly accessible and objective data to analyze managers' perceptions of organizational performance (Wang & Sarkis, 2013, p. 874). One of the few studies using publicly accessible, objective data from the Thomson Reuters Asset4 database is this one. Moreover, the time effect has only been taken into account in a few studies (Ortas et al., 2014; Tamayo-Torres et al., 2019). As the first study using panel data to explore the relationship between SSCM and FP in United Kingdom-based enterprises, this study adds to the body of literature.

Conclusion and Recommendations

Building on the resource-based view of the firm and stakeholder theory and using lagged annual data on 223 United Kingdom firms, this study examines the relationship between the ESG performance, EI, SSCM, and corporate FP of corporations of United Kingdom companies, whether the firms' ESG performance moderates the influence of EI and SSCM on the FP, and the endogeneity effect of SSCM on the EI and ESG.

The results indicate that ESG performance promotes EI significantly. Strong ESG performance indicates a company's commitment to implementing environmentally conscious and creative innovations, leading and motivating firms to increase investments in innovation, and employing energy-efficient and sustainable development strategies. This aligns with stakeholder theory, which suggests that companies with strong ESG performance can decrease agency costs and increase innovation. The modern stakeholder-based corporate governance system necessitates those businesses not only safeguard the interests of shareholders but also consider a variety of external stakeholders from the perspective of corporate governance. Companies that practice ESG may get the approval of various stakeholders for future growth, receive the outside resources needed for growth, increase business productivity, and set up the conditions for innovation activities (Bostian et al., 2016). When businesses achieve ESG objectives, they can take into account the requirements of management, enhance their ESG rating, and better protect their interests, enabling managers to prioritize long-term business growth over short-term performance associated with their interests. When conducting innovation-related actions, businesses may attract more partners, share data and assets, and incur expenses and hazards if they consider the interests of internal and external stakeholders. Consequently, achieving social responsibility objectives and conducting environmental preservation and administration can satisfy the demands of all stakeholders and strengthen ties between businesses and stakeholders, thereby assisting businesses in acquiring the resources necessary for technological innovation and enhancing their overall CA. When considering

shareholder and consumer interests in company operations, businesses have to improve resource utilization efficiency, decrease resource consumption, and boost product efficacy. This business strategy is identical to technological innovation in production and administration. Consequently, the enactment of ESG can motivate businesses to engage in novel endeavors. According to Isabel Pereira Esteves et al. (2018), businesses may lower their energy use while offering high-quality services through innovation in products and procedures to meet the needs of stakeholders. Consequently, fulfilling the needs of stakeholders may act as a drive for innovation. EI is seen as a means of achieving sustainability, mitigating risks, and gaining a competitive advantage for companies.

The results indicate that the total ESG performance of environmentally sensitive companies has positive and statistically significant relationships with Tobin's Q, suggesting that higher ESG performance contributes positively to the increase in the market value of these corporations. The impact of ESG performance on the market valuation of environmentally conscious companies supports the stakeholder theory. The positive relationship between ESG performance and the FP of environmentally conscious corporations suggests that investing in and expanding ESG operations and activities can bring financial benefits and promote environmental and social sustainability. This research aims to encourage the management of environmentally conscious corporations to adopt more efficient and effective ESG initiatives, given that ESG performance can maximize both profitability and market value. Although the empirical literature generally points to a positive relationship between SSCM and FP, this relationship remains equivocal. While some results indicate an unclear or insignificant relationship between SSCM and economics or FP, others demonstrate a negative relationship. Such discrepancies may be due to variations between data sets about industry categories, firm sizes, the number of samples, and customer behavior (Ortas et al., 2014). In addition, the model's analysis and performance criteria can influence the outcomes (Wang & Sarkis, 2013). However, the findings of this research indicate a linear association between SSCM and FP, which is aligned with the findings of a large number of studies. Developing the ESG skills and competencies of SCM professionals is an assured way to improve business productivity and sustainability. As much as 90 percent of greenhouse gas emissions and other environmental impacts are attributable to the supply chains of consumer corporations, according to a report by McKinsey & Company. As a result, the supply chain has significant potential for attaining significant sustainability performance advancements. ESG is the foundational framework for attaining sustainable development, and it represents the practice and performance of businesses regarding ESG factors. The key to minimizing carbon emissions is strengthening ESG management and green development in the supply chain. It is also an unavoidable trend for businesses to develop green supply chains in the future. Even though few previous studies have incorporated ESG for evaluating green supply chain performance, ESG has become an integral part of financial reporting for publicly held businesses around the globe. The evaluation model incorporating ESG for green supply chain performance can fill a research gap and provide a fresh perspective to global SCM, listed companies, and stock markets. In addition, it can raise enterprises' awareness of ESG. With effective ESG, procurement and supply chain professionals can identify and quantify their company's most pressing sustainability issues, as well as increase resilience by mitigating disruption, legal, and other buying-related threats. A recent survey by Avetta revealed that the greatest barrier to incorporating ESG practices into

the supply chain was a lack of internal understanding of the significance of ESG issues within the supply chain, which was followed by a lack of supplier understanding of ESG issues. Supply chain professionals at all levels must develop their sustainability capabilities for optimal business outcomes. The ESG perspective enables the leadership to rethink the supply chain. Viewing the value chain as an interactive ecosystem instead of a linear process with waste and negative externalities can help businesses reuse materials and resources. These modifications can result in significant expense reductions for businesses, as well as improved community health and the preservation of a valuable resource. ESG-oriented SCM requires the establishment of a chain of custody that documents the movement of a product throughout the value chain, ensuring the authenticity of products at every stage. It also necessitates cooperation with suppliers; educating suppliers on this and other governance issues reduces the likelihood of counterfeiting. The importance of ESG cannot be overemphasized. These professionals will outperform their peers and capture more value in the supply chain if they possess these tools and skills. Businesses and the world require ESG-educated executives to guide the transition to a sustainable society. The study's findings have implications for the companies. Sustainability practices in activities enhance the company's Tobin's Q, so managers of all businesses should prioritize sustainable activities to improve their FP. To increase shareholder value, businesses must procure materials from suppliers who have been certified as environmentally compliant. Companies must prioritize energy, water, and raw material conservation to improve their FP. Transporting raw materials from the closest feasible supplier is an additional activity that businesses must prioritize.

Limitations and Future Research

Despite its conceptual and empirical contribution, this study has several limitations. This study examines the EI, ESG, and SSCM activities of United Kingdom companies. As the economic consequences of environmental actions vary by country, we expect that future research will attempt to replicate our findings in other regions and countries to test their generalizability.

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