Remittances Review
January, 2024
Volume: 9, No: 1, pp. 2425-2448
ISSN: 2059-6588(Print) | ISSN 2059-6596(Online)

Received: 10 January 2024, Accepted: 15 February 2024
DOI: https://doi.org/10.33282/rr.vx9il.104

Green finance: Impact of green finance on green SCM: Mediation impact of Green Innovation

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Abstract

In Pakistan's changing economy, the study examines environmentally responsible financing, supply chain management, and innovation. It examines natural resource-based perspective theory and green finance, GSCM, and innovation. The study uses convenience sampling to acquire quantitative data from 500 green SCM and green finance practitioners. Green finance, innovation, and SCM are linked, according to SPSS and AMOS studies. Green innovation mediates the interaction between green financing and green SCM. Green finance investments

may encourage sustainable supply chain management through creative initiatives. In assessing measurement model reliability and validity, the study emphasizes discriminant validity and confirmatory factor analysis. The findings can help politicians, corporations, and scholars promote sustainability and environmental responsibility in economic development.

Keywords: Green finance, green SCM, Green Innovation, environment, growth

Introduction

Pakistan has recently become the new economic gateway for the world's economy, having recently achieved substantial success in its economic development. On the other hand, extensive growth is associated with several serious challenges, including high energy consumption and significant pollution. According to Nureen et al.'s research from 2023, carbon footprints have a significant impact on climate sustainability; as a result, investments are necessary for pollution management and the promotion of green development. Environmental management systems (EMSs) have become increasingly popular in Pakistan (Pattinson et al., 2023). These systems enable businesses to examine and monitor environmental concerns more effectively (Nureen et al., 2023). Previous research has demonstrated that accredited environmental management systems lead to higher environmental participation, accountability, and integrity levels. The ISO 14001 certification, introduced in 1996 (Sam & Song, 2022), has become the most frequently utilized environmental management system. Zhang et al. (2023) describe businesses that have achieved ISO 14001 accreditation can reduce harmful emissions. Zhang et al. (2023) demonstrated in the outcomes of their research that the application of EMSs has a positive association with environmental performance. The responsibility for ensuring the long-term health of the environment can be placed just as squarely on the shoulders of governments or businesses.

In contrast to traditional forms of finance, businesses in Pakistan have accepted ISO 14001 certification to promote environmentally responsible growth in the country. This paper establishes a connection between environmentally responsible supply chain management and environmentally responsible financing. The phrase "green finance," described "the collection of economic activities that revitalize the environment and optimize resource usage" (Sam & Song, 2022, p.22). Because it encompasses maintenance of energy, the production of safe energy, environmentally responsible transportation and environmentally responsible building projects, suppose the word "green" is the only descriptor considered. In that case, this refers to those actions that result in less pollution, the preservation of natural resource and accomplishment sustainable green development (Nureen et al., 2023).

Green finance has been considered to be one of the roots of optimization of structure of economy (Gonzalez-Astudillo & Laforte, 2020). Therefore, Green finance can enable entrepreneurs to adopt green supply chain product distribution through green initiatives, to make products available in such a way as to enhance supply and chain mechanism costs, and to promote products in a more effective manner that will win consumers (Lin et al., 2020).

In two different senses, green finance acts as a driving force in reforming the growth of supply chain management. To begin, it makes available the required money for environmentally friendly technologies, ultimately resulting in a friendlier supply chain to the environment. This involves investing in renewable energy sources, establishing efficient transportation systems, and adopting initiatives to reduce waste. Second, green finance encourages corporations to adopt a more holistic approach to supply chain management, which involves considering their operations' effects on the surrounding environment. This change in mentality leads to incorporating sustainability goals into overall corporate strategy, resulting in lower carbon

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emissions and a more negligible environmental impact. The significance of green financing is emphasized by Liu & Lai (2021) in entire transition of SCM towards greater environmental sustainability.

Green innovation has significantly impacted relationships in the past few years, transforming how businesses interact with their partners, customers, and suppliers (Huang & Zhang, 2021). Green innovation also supports supply chain management and green finance, enabling businesses to provide more overall services and increase profits. How can businesses encourage environmentally friendly practices in areas such as green finance and supply chain management (including)? Additionally, environmentally responsible innovation should be incorporated to impact society positively. In addition, Gonzalez-Astudillo & Laforte (2020) state more complicated theoretical framework may necessitate further explanations. The empirical level of our study follows the same lines of inquiry to investigate the existing gap.

Yang and Roh (2019) used an empirical research approach to investigate how green finance companies raise additional capital to support firm's green supply chain management (SCM) strategy, which benefits the company and the environment without having a detrimental effect on profitability. As a result, the study poses problems such as how can we produce and generate more green finance for an environment that delivers green supply chain management to make efficient profit? Prior research has predominantly examined impacts of green financing on financial outcomes and its influence on profitability of firms (Zhang et al., 2021). However, our study aims to understand better the methods and mechanisms that green finance companies use to create more funding expressly to support green supply chain management. By focusing on this particular facet, by contributing to current body of literature and providing new insights, we hope to effectively reconcile their environmental responsibilities with preserving their profits.

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The remaining parts of our paper are organized in this manner. First, comprehensive analysis of underlying concepts underpins ongoing studies in green financing, supply chain management, and innovation. The next step is constructing a conceptual model of the existing relationship to describe it empirically. The discussion part of the publication provides a comprehensive explanation of our model. The conclusion of this study provides some lessons for managers and a summary of our work. We also recommend exciting new topics for future research, which will bear fruit.

Literature Review

Natural resource -based view theory

The findings of Singh et al. (2020) suggested that an "internally oriented" approach might not be sufficient due to the difficulty of establishing exterior relationships. Even though the author is aware of the difficulties posed by natural and social factors, she believes that the author's contention that a company's competitiveness and strategy are determined by its support environmentally friendly practices capacity. The natural Resource-Based View (RBV) theory, theoretically proposed by Wernerfelt (Fahim & Mahadi, 2022), incorporates three distinct methodologies to help companies improve their sustainability practices. These methods are pollution prevention, product stewardship, and a vision statement for sustainable growth by lowering CO2 emissions and showing sustainability commitment. It has been observed that a company's competition level is determined by its capabilities and resources. The theory in question further reinforces RBV theory, which posits that organizations could increase their competitiveness through reduction of environmental obstacles. According to Pattinson et al. (2023), RBV theory has several problems that must be addressed. It disrupts the connection between a firm and its surroundings in several ways to demonstrate this. Natural resources,

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expertise, and lower levels of pollution are all factors that contribute to business success. An organization's capability, pollution control practices, and resources (Nureen et al., 2023) relating to environment.

Green Finance and Green SCM

Scholars have extensively studied green SCM and green financing (Liu & Lai, 2021). However, there are varying opinions on the connection between the two issues, as highlighted in studies by Khan et al. (2021). It remains unclear whether green finance positive or negative effect on green SCM. Businesses can contribute to green supply chain management while also having the potential to benefit from the long-term viability of green investments if green finance practices are implemented (Liu & Lai, 2021). This is because organizations are encouraged to enhance their relationships with financial institutions, investors, and other businesses due to the application of green finance practices. Because of this, the organizations are tasked with ensuring and monitoring the innovative financial products and technology that assist green efforts. Examples are blockchain for transparent supply chains and fintech solutions for sustainable finance. In addition, businesses must invest in developing their internal capacity and competence in green finance. This involves ensuring that employees know about environmental concerns and green SCM practices. In addition, the linkages between and will boost GSCM performance (Zhang et al., 2021). Education about and compliance with new green finance and sustainability rules is essential. Aside from enhancing the green SCM, the application of green SCM practices ensures that stakeholders are engaged, including investors, consumers, and the community, to understand their expectations regarding sustainability and environmental responsibility (Luo et al., 2020). Implementing a green finance strategy, such as creating an investment portfolio, offers investors comprehensive knowledge of the risks and possibilities associated with climate change

(Wu & Kung, 2020). In addition, it encourages the effective utilization of available resources and helps organizations comply with applicable environmental legislation by implementing efficient GSCM (Sadiq et al., 2022). Hence, proposed that:

H1: Green Finance factor affects Green SCM.

Green SCM, green finance, and green innovation.

GF and GI have two significant themes that can help businesses acquire capital for investment in green projects (Agrawal et al., 2023). Additionally, green innovation can assist businesses in creating innovative technologies that can help reduce energy consumption and waste (Falcone, 2020). The management of environmentally friendly supply chains can also assist firms in cutting waste and improving operational effectiveness. In addition to this, it can assist businesses in gaining a competitive advantage by addressing customers' desires for environmentally friendly products. The use of green finance can also assist businesses in lowering their carbon footprints and increasing their levels of sustainability. In addition to this, it can assist businesses in luring and retaining the best possible employees. According to Luo et al.'s research from 2020, green finance can also give firms access to cash, investors, and new sources of revenue. It can also lead to financial savings for businesses by allowing them to cut their energy bills. Green finance may assist businesses in several ways, including gaining access to new markets and developing stronger partnerships with various stakeholders. In addition, it improves a company's reputation, which leads to increased sales since customers are more willing to acquire goods and services from enterprises with a positive reputation and are committed to sustainability. For instance, green finance can make it possible to have access to cash for environmentally responsible investments in areas related to climate change.

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Green finance can promote financial stability and mitigate climate change risks. Green bonds can help climate-conscious firms get capital. They may be protected from harsh weather and other climate change-related losses. A more sustainable economy can be assisted by green finance. It could incentivize businesses to invest in renewable energy and practice environmental responsibility. Green financing, the company's main source of funding, meets customer demand and promotes ecologically responsible supplier practices. Green money supports projects that improve the environment (Zhang et al., 2021). Corporate management should prioritise green financing as a crucial aspect of implementing sustainable practices such as renewable energy and green transportation. The relationship between green finance and green supply chain management must be examined to understand the financial mechanisms that encourage environmentally friendly supply chain operations. It could include subsidies, incentives, and green financial instruments like green bonds and loans. Green finance can also fund green infrastructure development. Green money can also be used to reward sustainable firms and encourage them to invest in green technology. Rewards may encourage businesses to engage in green practices, creating a positive feedback loop. More importantly, green finance practices provide jobs and boost economic growth, which can boost economic prospects. Green finance reduces energy costs, saving businesses money (Sadiq et al., 2022).

Implementing green practices can help companies attract and retain top talent, as people are more likely to work for sustainability-oriented organizations. This can give businesses a competitive advantage in today's tight labor market. For instance, a case study of a leading fashion store proved that by working with financial institutions, they could invest in environmentally friendly production methods and drastically cut their carbon footprint. This was

made possible because of the reduction in their energy use. This was made possible because green innovations enhance the positive correlation with green finance (Tseng et al., 2019). Furthermore, green finance influences SCM (Gilchrist et al., 2021). Consequently, it was proposed that:

H2: Green finance significantly affectsgreen innovation practices

H3: Green innovation practices significantly affect green SCM.

Green Innovation as Mediation

Green innovation serves as a powerful mediator of the connection between green finance and green supply chain management. The implication of green innovation has potential to improve GF and generate sustainable SCM. Green Finance can provide the necessary capital to invest in green technologies and processes, allowing businesses to innovate. Furthermore, Green Finance can also help businesses to incentivize suppliers and customers to shift to more innovative practices. Green Finance can be used to encourage companies to adopt GSCM practices and to reward them for doing so. Green Finance can also create new markets, such as green bonds and carbon markets, which can provide a source of capital for green investments. Finally, Green Finance can also incentivize governments to take action on environmental issues. This can be done through tax breaks for companies promoting green practices or incentivizing businesses to make environmentally friendly SCM (Tseng et al., 2019).

Green finance can also fund research into new green technologies, which can help further reduce emissions and promote sustainability (Lin et al., 2020). This can create a positive feedback loop, where more green investments lead to more green technology and further reduce emissions. Green Finance can also incentivize businesses to reduce their emissions by investing in green

technologies, providing a more positive economic return. This can create a more circular economy, where resources are used more efficiently, and pollution is reduced. This, in turn, can encourage even more businesses to invest in green technologies, creating an ever-growing cycle of positive economic, environmental, and social benefits. Thus, investing in green finance is essential for creating a GSCM and green innovation in prosperous future (Agrawal et al., 2023). Green finance and it investment is crucial to creating GSCM and innovative practices. Hence, proposed that.

H 4 Green Innovation positively mediates relationship concerning GF and GSCM.

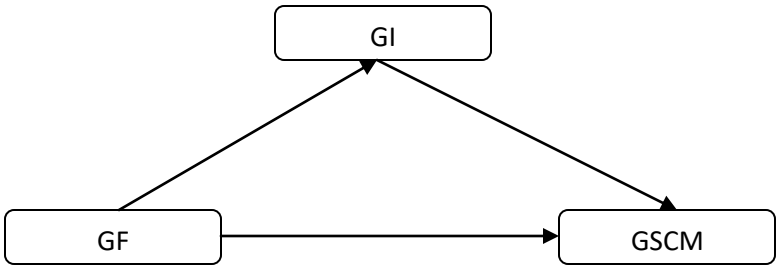

Figure 1 Conceptual framework

Methodology

This research was a quantitative study, and the data for it were collected through convenience sampling and the distribution of questionnaires to 500 participants in Pakistan who were engaged in GSCM and who utilized GF technologies. Convenience sampling is a method that can be utilized to collect data for various reasons, some of which have been indicated by the experts themselves (Lin et al., 2020). Since many experts have used a similar strategy in relevant research, this method could be used to gather data for various reasons. According to Huang and Zhang 2021, convenience sampling technique that gives researchers the flexibility to collect data in a way that is easier for them or in a way that is most practical and efficient. The term for this

kind of sampling is "convenience sampling." According to a study conducted in 2020 by Kalyar and colleagues, convenience sampling makes it easier for researchers to feel at ease when gathering specific data from a wide range of individuals. In addition to that, it allows for the data to be given symmetry.

Because of this, the vast majority of researchers prefer to collect data by using a strategy known as convenience sampling (Ullah et al., 2022). Also, volunteers ask for assist us in any way they could with collecting data from the many cities in Pakistan. We sent out 500 questions beginning in March 2023 and ending in June 2023, and we received back 495 completed surveys for a response percentage of 82.5% overall across the board. In addition, following the removal missing information questionnaires, the final analyses utilizea total of 382 questionnaires. We used a paper copy of questionnaires & questionnaires online link through usage of Google Forms. Both of these methods were utilized in order for us to be successful in achieving this objective (Lin et al., 2020). The English to Urdu translation from was completed with assistance of four experts who could communicate fluently in both English and Urdu. AMOS was utilized in procedures prior to measurements and structural modeling.

Development Questionnaire

Green finance (GF) consists of a 5 items measure (such as, economic, environmental, and social dimensions) developed by (Zheng et al., 2021). A sample items include ‘Many new environmental materials and manufacturing technologies are introduced in rapid succession’. A five items scale for measuring GSM was adopted from (e.g. Lee et al., 2014). A sample items was ‘Commitment of GSM from senior managers’. Finally, the fourscale for measuring GI was adopted from (Meidute-Kavaliauskiene et al., 2021). A sample items was ‘Our organization would circumspectly deliberate’.

Data analysis

Data analysis techniques

The SPSS and AMOS software packages were utilized predominantly to obtain findings. The researchers employed various ways to generate the findings in alignment with the study objectives. The initial step in analyzing the respondent profiles involved the application of the descriptive statistics analytic approach. The researchers conducted Pearson's correlation analysis to assess the relationships between variables, while Li et al. (2022) provided a decision criterion range of -1 to +1 for interpreting the results of this investigation. Greater numerical values show more substantial positive impact, whereas lowest values suggest less pronounced correlation. CR & AVE utilize validity of measurement model. Four measures were employed to evaluate the study's validity (Zheng et al., 2021). These measure include CR>.7, AVE >.5, Cronbach Alpha value exceeding 0.7, factor loading exceeding 0.5. Furthermore, the researchers investigated AVE for certain construct was greater than construct correlations and all other variables, for determining discriminant validity. Measurement of CLF involved equalizing the variations between standard loadings, including the CLF, and the standard loadings without the CLF. The SEM approach implemented correlations routes and, conduct empirical testing, drawing upon prior pertinent studies conducted by Li et al. (2022). The structural equation modeling (SEM) model's fit was evaluated using the SRMR. SRMR results below 0.08 are considered acceptable by Hu & Bentler (1999). Present study SRMR score of 0.06 is deemed to be adequately suitable.

Data analysis:

Table 2 shows the metrics and structures used to evaluate latent variables. According to the findings, three variables were investigated: four of which were independent variables, one of which was a dependent variable, and four of which served as mediators. The table describes each

standard deviation and mean value; such values are considered normal when alpha is greater than 7 and AVE is more significant than 0.5, both of which gradually indicate the correctness of the results (Fornell & Larcker, 1981a). In addition, the mean and standard deviation results are summarized below.

Discriminate validity

Fornell and Larcker (1981b) proposed technique of discriminant validity as a useful tool for observing discrimination between different latent components. Chen et al. (2022) recommended measuring this validity by comparing the outcome values of AVE-square roots with the correlation of the succeeding latent variable. Ullah et al. (2022) believe AVE-square roots must be higher than future inter-correlations among latent components. Previously, experts used these tools to analyze the validity and reliability of variables in green finance and green SCM-related research (e.g., Fahim and Mahadi, 2022; Zheng et al., 2021; Tseng et al., 2019). In green finance and green SCM research, this strategy determines validity/reliability of variables. Table 4 presents the correlation matrix, demonstrating correlation matrix can be found here. Correlations developed by Pearson were utilized to perform computations necessary to determine link between variables in question. Pearson correlation models were utilized to determine whether or not two latent variables are correlated with one another. According to Nureen et al. (2023), higher values indicate a more significant beneficial effect, while lower values indicate weaker link (see Table 5).

Analysis of confirmatory factors (also known as CFA) CFA are shown in Table 6, which includes values of AVE, FL (Factor Loadings), and construct dependability as assessed by CR (Composite dependability). Hair et al. (2017) also describes findings should be examined validity using outcome values greater than 0.5 for both AVE and FL, while for CR, these values should

be greater than 0.7. Table 3 shows values of FL and AVE, as well reliability and validity of constructs.

Structure equation modeling

SEM values in Table 1 verify direction of relationships between specific variables or hypotheses as assumed. It provides a structural model for examining path relationships between variables (Hu & Bentler, 1999). To be considered an accurate SEM model, certain model fit indices must be used. Hu and Bentler (1999) recommend SEM models with CMIN/DF, RMSEA, CFI,and, TLI. All the recommended qualified criteria exist in specific range. The technique has been used by various experts in studies regarding Green Finance, Green SCM, and Green Innovation.

Table 1 Step1-Confirmatory factor analysis

Items	CMIN/DF	RMSEA	CFI	TLI
1. Green Finance (GF)	2.93	0.04	0.97	0.97
2. Green SCM (GSCM)	2.525	0.06	0.94	0.95
3. Green Innovation (GI)	2.42	0.05	0.96	.97
Model fit index	1.56	.04	096	0.97

Note: TLI= Tucker–Lewis Index, Cmin/Df= chi-square/ degrees of freedom; CFI= comparative fit index, RMSEA= root mean square error of Approximation

Table 2 Descriptive Analysis

	M	**S.D**	**GF**	**GSCM**	**GI**
GF	3.23	1.76	(.87)		
GSCM	3.10	1.46	.243	(.76)	

PR	3.65	1.67	.530	.350	(.86)

Structural model and Hypotheses results

We investigated model links using covariance-curve estimation and structural equation modeling. The analysis yielded f-value, which suggests that no non-linear connections at all. More, various tests were performed to ensure structural model and data matched one another. According to the analysis findings, all the fit index values are by the established requirements; this indicates structural model and, data sufficiently matched (Najmi et al., 2020). There is a considerable influence on the GSCM brought about by the path coefficient of the variables GF (β = 0.41). As a result, proposal H1 was approved. GF affects GI (β =0.47 and a significance level of 0.01), and GI substantially affects GSCM (β = 0.29, significant). As a result, we went ahead and accepted H2 and H3. The mediating effects of GI on the connection between GF and GSCM were also evaluated and accounted for. According to the findings, the GI (β = 0.13, p-value = 0.01) is a complete mediator of the relationship between GF and GSCM. As a result, we decided to adopt H4. Table 5 displays the hypothesized pathways as well as the validity of the hypotheses.

Table 3 CR, AVE & factor loadings

Construct	**items**	**F.L**	***α***	**CR**	**AVE**
GF	GF1-GF8	.07-.08	.91	0.92	0.83
GSCM	GSCM-1-GSCM-10	.08-.09	.97	.97	0.94
GI	GI1-GI12	.08-.09	.96	.95	0.95

Table 5 Direct & Indirect Effects

Hypothesis	Paths	*β*	*t*	Results
Direct Effect				
	GF-GSCM	.41	11.95	***
	GF-GI	.47	7.58	***
	GI-GSCM	.29	10.27	***
Indirect Effects				
	GF-GI-GSCM	.13	6.56	Partial mediated

Discussion-

The following study discovers interconnectedness of GF, green SCM, and GI relating to Pakistan's economic development. The introduction sets the stage by highlighting the environmental challenges accompanying growth and impact of environmental management systems, specifically ISO 14001 certification, in addressing these challenges. The study focuses on how green finance can drive the transformation of supply chain management towards sustainability, emphasizing the importance of investing in sustainable technologies, practices, and innovation (Andries & Stephan, 2019).

The literature review provides a comprehensive overview, drawing on natural RBV view theory and discussing relationships among green finance, GSCM, and green innovation. Research builds on existing knowledge by proposing hypotheses that link these variables and introducing mediation-role of green innovation among green finance and GSCM (Ozili, 2021). Moreover, conceptual framework illustrates the proposed relationships, with green innovation mediating

between green finance and GSCM. The methodology section details the data collection process, sample size, and analysis techniques, demonstrating a rigorous approach to examining the proposed relationships.

Data analysis results support hypotheses, indicating that GF significantly influences GI and GSCM. Additionally, GI acts as mediator, strengthening the relationship between green finance and GSCM. The study contributes valuable insights into strategies and mechanisms employed by green financing firms to support GSCM while maintaining profitability. The findings emphasize the interconnectedness of these variables and highlight green innovation role as catalyst for sustainable supply chain management. The discussion could further delve into the practical implications of these results for businesses and policymakers in Pakistan. For example, the study could explore specific green financing mechanisms that have proven effective in promoting green supply chain practices and innovation (Seman et al., 2019). In conclusion, study contributes to literature on green finance, supply chain management, and innovation. The research also offers practical insights for businesses seek to balance environment responsibility & profitability by providing empirical evidence of the interplay between these factors in Pakistan's economic development.

Practical Implications:

The study's findings offer important implications for researchers. Organizations operating in Pakistan can strategically integrate green finance into their operations to promote sustainable practices within the supply chain. This includes securing financial support for eco-friendly projects and initiatives aligned with environmental protection and resource optimization, thus enhancing overall performance. The study highlights correlation among ISO 14001 certification

& environmental performance, suggesting that obtaining or maintaining such certification can be a strategic move for companies looking to improve their environmental engagement, accountability, and integrity, thereby contributing to green supply chain management. Additionally, the study suggests that increasing the budget allocated to green finance can lead to improved environmental performance through initiatives such as investing in renewable energy sources like solar power. Companies are encouraged to explore partnerships and projects aimed at reducing harmful emissions and promoting cleaner energy alternatives. Furthermore, the study identifies areas such as cleaner energy, emissions reduction, efficient transportation systems, and well-trained staff as crucial aspects in assessing eco-friendly projects for the development of green supply chain management in Pakistan. To raise awareness among consumers, businesses should organize educational training, workshops, and seminars on green finance. The study also emphasizes the necessity for increased collaboration among businesses, government entities, and international organizations to maximize the significant impact of green finance. GSCM and green innovation are proposed as pivotal in overseeing, evaluating, and shaping major green finance activities. Finally, the study suggests that researchers, academics, analysts, and investors would benefit from a deeper understanding of green finance adoption and its implications for GSCM and green innovation.

Managerial Implications:

This study provides insights into interconnectedness of green finance (GF) with circular economy, offering potential guidance for policymakers in formulating effective decision-making and action-oriented policies. Implementing a green finance model within an economy can enhance a firm's strategic planning and reduce resource consumption associated with implementing Green Supply Chain Management (GSCM) policies. The integration of green

finance and effective SCM is inherently linked from an environmental perspective, as green finance necessitates a holistic understanding of the entire supply chain, from production to consumption. Additionally, green finance strategies must consider the environmental impacts of SCM and tailor approaches to specific SCM contexts to be effective. It is imperative for these strategies to also account for social and economic impacts of SCM, as highlighted by Nureen et al. (2023). Incorporating green finance into business practices has become crucial in today's corporate landscape, enhancing organizational goodwill. However, this study has notable limitations that warrant consideration in future research endeavors. Firstly, the sample size is confined to a single country, limiting generalizability. Future research should aim for larger and more diversified samples for strong evidence across different economies. Moreover, this research lacks the integration of moderating variables between green finance and GSCM, suggesting a need for exploration in subsequent studies. Given the early stage of inquiry, further research should explore the effects of green finance on GSCM and innovation behavior across different businesses, employing varied methodologies and settings. To further our understanding and emphasize relevance of green financing and GSCM in variety of business environments, longitudinal studies in range of contexts—including the industrial sector and rural areas—are required.

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