

The Impact of Supply Chain Transparency and Reciprocity on Supply Chain Performance: Greenwashing as a Mediator

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ABSTRACT

This study investigates the impact of supply chain transparency and reciprocity on supply chain performance, with greenwashing serving as a mediating variable. Drawing on stakeholder theory and signaling theory, the research explores how firms' efforts to disclose information and maintain reciprocal relationships may paradoxically lead to unintended sustainability-related misrepresentations. A survey was conducted among managers from Taiwan's top 2,500 manufacturing firms, and structural equation modeling (SEM) was employed to examine the hypothesized relationships. The results reveal that both supply chain transparency and reciprocity positively influence supply chain performance. However, greenwashing plays a significant mediating role, suggesting that while transparency and reciprocity can enhance performance, they may also increase the risk of symbolic sustainability practices. The findings contribute to a deeper understanding of the dual-edge effects of transparency in supply chain management and offer managerial insights into balancing visibility with authenticity.

Keywords: Supply chain performance, supply chain transparency, reciprocity, greenwashing, Taiwan.

INTRODUCTION

Supply chain performance (SCP) is critical for modern enterprises, as it reflects their ability to effectively meet customer demands. It involves optimizing the flow of goods, information, and finances across the entire supply network. SCP refers to the efficiency and effectiveness with which supply chain processes and activities are executed to achieve organizational goals and meet customer expectations, emphasizing optimal resource utilization and alignment with strategic objectives (Mentzer *et al.*, 2001). Traditional assessments have focused on cost minimization, lead time reduction, and delivery reliability. However, with increasing complexity and globalization, the scope of evaluation has expanded to include sustainability, agility, and innovation, underscoring SCP as a strategic tool for enhancing competitive advantage (Beamon, 1999). While core indicators such as cost efficiency, inventory turnover, and on-time delivery remain essential, growing attention has been paid to customer satisfaction, environmental impact, and supplier collaboration. The adoption of digital technologies—such as artificial intelligence (AI), blockchain, and the Internet of Things (IoT)—has further enhanced supply chain visibility, disruption prediction, and real-time decision-making (Ivanov & Dolgui, 2021). These developments highlight the increasingly strategic role of SCP in achieving long-term organizational success (Christopher, 2016).

To explore the factors that influence SCP, this study draws upon multiple perspectives. Table 1 summarizes prior studies on the determinants of SCP and reveals that most existing research has concentrated on areas such as information systems (Qrunfleh & Tarafdar, 2014), agility (Baah *et al.*, 2021), and supply chain elasticity (Zhao *et al.*, 2023). Some studies have also addressed customer perspectives, inter-organizational relationships, and the importance of information sharing among supply chain members (Cadden *et al.*, 2013).

However, relatively few studies have simultaneously examined the effects of supply chain transparency, reciprocity, and greenwashing on SCP. While transparency and reciprocity can enhance trust and collaboration among partners, thereby improving overall performance, the presence of greenwashing behaviors may undermine these benefits by damaging credibility and stakeholder trust. To address this research gap, the present study focuses on investigating the interplay between supply chain transparency, reciprocity, and greenwashing, and their collective impact on supply chain performance.

To verify this research model, first we examine how supply chain transparency, reciprocity, and greenwashing could affect the innovation generation. And then we look into how the innovation generation affects supply chain performance in supply chains. We conduct an empirical study on manufacturing firms and their partners in Taiwan's supply chains.

The rest of this paper is organized as follows. The next section demonstrates a brief review of innovation generation and supply

chain performance in supply chains, and section 3 presents the research model and hypothesis development. The data collection method and research design are described in section 4, and the study findings are presented in section 5. Finally, Section 6 provides a discussion of the results and Section 7 concludes the paper and offers directions for future research.

GREENWASHING AND SUPPLY CHAIN PERFORMANCE IN SUPPLY CHAINS

Institutional theory offers a compelling framework for understanding how organizations respond to external pressures in their environments, particularly in the context of sustainability and corporate responsibility. Rather than acting solely out of efficiency motives, firms are often influenced by broader institutional forces that shape their behavior. DiMaggio and Powell (1983) identify three primary mechanisms of institutional isomorphism: coercive, mimetic, and normative. Coercive isomorphism arises from legal mandates, government regulations, or industry-specific requirements that pressure organizations to conform. Mimetic isomorphism occurs when firms face uncertainty or ambiguous goals and respond by imitating the practices of perceived successful peers or competitors. Normative isomorphism, meanwhile, develops through professional education, training, and socialization, leading to shared norms and values across organizations.

Within the supply chain context, these institutional pressures do not affect only the focal firm but are also transmitted across upstream and downstream partners (Bae *et al.*, 2024). As a result, suppliers, manufacturers, and buyers may feel compelled to align with prevailing sustainability expectations, whether those stem from regulations, certifications, customer demands, or industry norms. In this environment, firms may adopt symbolic practices—such as greenwashing—to appear compliant with sustainability standards without implementing substantive changes. Greenwashing, in this sense, can be seen as a form of symbolic conformity to institutional demands, enabling organizations to maintain legitimacy, secure access to critical resources, and preserve their positions within the supply network.

However, while such practices may provide short-term legitimacy, they also risk eroding stakeholder trust if exposed. This makes greenwashing not only a firm-level ethical concern but also a system-level phenomenon shaped by the institutional logic of the supply chain. Understanding how institutional isomorphism drives symbolic versus substantive sustainability behavior is therefore essential for developing more robust governance mechanisms and promoting genuine sustainability practices throughout the supply chain (Pinheiro *et al.*, 2025).

THE RESEARCH MODEL

Figure 1 shows the research model. It begins with resources complementary, social responsibility involved and dynamic capability and then proceeds to the mediating variable which in turn affects sustainable supply chain performance. As already mentioned, the mediating variable is innovation generation. Four hypotheses were tested with respect to this model. Each hypothesis is indicated by the letter H and a number. The arrows explain the hypothesized relationships and the plus signs represent positive relationships.

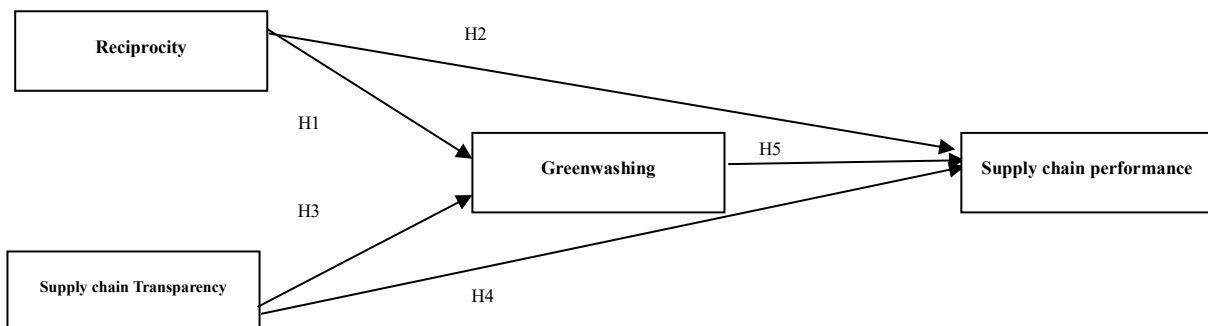


Fig. 1. The research model

Reciprocity

Social Exchange Theory (SET) posits that social interactions are essentially a series of exchanges involving both tangible resources and symbolic benefits, such as knowledge, respect, and reputation (Chang *et al.*, 2015). In the context of supply chains, reciprocity refers to the exchange of resources and benefits between partners based on a shared perception of fairness. Such interactions often involve uncertainty in terms of timing and returns (Blau, 1964). When one party fails to reciprocate the contributions of another, it can trigger a crisis of trust, ultimately damaging long-term relationships (Akhavan *et al.*, 2015). Conversely, consistent and ongoing reciprocal behavior strengthens social ties and enhances supply chain performance and partner satisfaction (Johnson and Sohi, 2001).

However, reciprocity can also be misused. In sustainability-related issues, for example, firms may engage in “greenwashing” by falsely presenting reciprocal cooperation or emphasizing environmental and social contributions that are not genuinely implemented. While such behavior may temporarily earn the trust and resources of partners or consumers, the eventual exposure of these misrepresentations can severely damage organizational reputation and supply chain relationships. Greenwashing undermines the trust-based rules of exchange and erodes social capital among supply chain partners, turning reciprocity from a

positive asset into a potential risk. Furthermore, greenwashing can lead to doubts about the integrity of exchanges, and may trigger moral pressure or negative emotions—especially when a partner realizes that their efforts have not been equally reciprocated. Thus, strengthening transparency and accountability mechanisms in supply chain governance is essential to preserving the authenticity and positive value of reciprocity and preventing its erosion by deceptive practices. Based on the above, we propose the following hypothesis:

H1: Reciprocity is negatively associated with greenwashing.

Previous research has indicated that reciprocity not only directly enhances collaborative behaviors among supply chain members but may also exert indirect influence through inter-organizational collaboration mechanisms (Wu *et al.*, 2014). When partners embrace a spirit of reciprocity and openly share resources and knowledge, it facilitates cross-organizational coordination and information integration, thereby enabling the supply chain to respond more effectively to environmental changes. Such collaborative relationships improve operational efficiency and innovation capacity, while also fostering shared goals and mutual commitment—ultimately strengthening overall supply chain performance. Based on this reasoning, we propose the following hypothesis:

H2: Reciprocity has a positive effect on supply chain performance.

Supply Chain Transparency

Supply chain transparency is considered a key mechanism to discourage greenwashing (Chai *et al.*, 2025). By increasing the visibility of firms' operations and sustainability practices, transparency exposes companies to greater external scrutiny from stakeholders such as regulators, NGOs, and consumers. This heightened visibility raises the risks and potential reputational costs of making exaggerated or false environmental claims. As a result, firms are more likely to align their sustainability communication with actual practices.

Supply chain transparency also reinforces accountability and reduces the opportunities for symbolic environmental actions that lack substantive impact. In this way, it can serve as a deterrent to deceptive sustainability claims and support the integrity of supply chain relationships. Based on this reasoning, we propose the following hypothesis:

H3: Supply chain transparency is negatively associated with greenwashing.

Supply chain transparency is widely regarded as a critical factor in enhancing supply chain performance. When firms openly share information about their operations, sourcing, and sustainability practices, it facilitates trust, coordination, and timely decision-making among supply chain partners (Sègbotangni, Laguir, & Gupta, 2025). Transparency reduces information asymmetry, improves risk management, and enables faster responses to disruptions or market changes. Moreover, greater visibility across the supply chain enhances process integration, fosters collaboration, and supports continuous improvement.

These benefits collectively contribute to improved efficiency, responsiveness, and resilience—key dimensions of supply chain performance. Therefore, firms that invest in transparency are more likely to achieve superior operational and strategic outcomes. Based on this reasoning, we propose the following hypothesis:

H4: Supply chain transparency is positively associated with supply chain performance.

Greenwashing

Lyon and Maxwell (2011) define greenwashing as the selective disclosure of favorable information by retailers while withholding unfavorable details. Others emphasize the critical role of transparency in mitigating the adverse effects of greenwashing. In particular, their study highlights that retailers' decisions to disclose supplier information can enhance overall supply chain transparency.

Scholars further confirm that increasing supply chain transparency can effectively reduce greenwashing behavior. More greenwashing typically indicates that suppliers are predominantly low-ESG performers rather than genuinely sustainable, high-ESG suppliers. According to previous research, suppliers with strong ESG performance are better equipped to maintain supply stability during major disruptions, such as the COVID-19 pandemic, thereby contributing positively to supply chain performance. In contrast, suppliers with lower ESG scores are more vulnerable to instability and supply failures. Therefore, when firms are misled by greenwashing and overestimate the sustainability of their suppliers, it can negatively affect overall supply chain reliability and efficiency. Based on this reasoning, we propose the following hypothesis:

H5: Greenwashing is negatively related to supply chain performance.

RESEARCH METHOD

To develop the survey instrument, a pool of items was identified from the literature to measure the constructs of the research model. Data from a survey sample were collected to assess the instrument's validity and reliability, and to test the hypothesized relationships of the research model.

Content Validity

All the measures of the survey instrument were developed and modified from literature. Where appropriate, the way the items were expressed was adjusted to the context of supply chains, as shown in Table 2. The respondents were asked to answer

the questions using a seven-point Likert scale, where 1 represented ‘strongly disagree’ and 7 represented ‘strongly agree’. The questionnaire was translated into Chinese following Brislin’s (1970) two-step method. The translated Chinese questionnaire was compared with the original English version by native Chinese IS professors to ensure content validity.

Pre-Test and Pilot-Test

A pre-test was conducted using a panel of four academic experts and four Ph.D. students, who evaluated the content and appearance of the survey questionnaire that comprised 25 items. Special efforts were made to ensure that the translated items were consistent with those in the literature. The respondents were asked to complete the questionnaire and provide comments on the wording, understand ability and clarity of the items, as well as its overall appearance and content. Only minor cosmetic changes were suggested, and no statements had to be omitted. After minor changes has been made, and following a further review by two more academic experts, the questionnaire was used to test our research model. The table below shows the 25 items, the corresponding constructs that were measured, and the reference sources.

Data Collection

This study targeted Taiwanese manufacturing firms listed in the 2024 edition of *The 2,535 Largest Manufacturing Corporations Ranked by Sales*, published by China Credit Information Service Ltd., a leading credit agency in Taiwan. The report, based on corporate data as of the end of 2023, was publicly released in June 2024. Prior to questionnaire distribution in March 2025, the operational status of each company was verified, as several firms had ceased operations due to various business challenges. This screening process resulted in a final sampling frame of 2,500 active manufacturing firms.

Questionnaires were distributed over a one-month period to these 2,500 manufacturers across Taiwan. The initial wave yielded 195 completed responses. To improve the response rate, follow-up phone calls were made to non-responding firms, resulting in an additional 125 responses. A total of 320 responses were collected through this two-stage process. After removing incomplete, late, or inconsistent submissions, 315 valid responses remained for analysis. Most respondents were senior executives—such as CEOs, company directors, and managers with cross-functional responsibilities—ensuring the reliability of the data collected. The final effective response rate was 12.69%.

Table 3. Profile of participating manufacturing firms

| Demographic profile | Number of firms | Percentage |
|--|-----------------|------------|
| Industry type | N=315 | |
| Electronics/communication | 82 | 26.03 |
| Optical and precision instruments industry | 28 | 8.89 |
| Transportation equipment and parts industry | 18 | 5.71 |
| Electrical machinery/machinery and equipment | 38 | 12.06 |
| Non-metallic mineral products | 5 | 1.59 |
| Basic metal industry and metal products industry | 38 | 12.06 |
| Electronic chemicals materials and products industry, rubber and plastics industry | 45 | 14.29 |
| Agricultural products and food industry | 16 | 5.08 |
| Textile industry | 12 | 3.81 |
| Others | 33 | 10.48 |
| Total sales revenue (New Taiwan \$) | N=315 | |
| Below \$1 billion | 135 | 42.86 |
| \$1.1 billion to below \$2 billion | 71 | 22.54 |
| \$2.1 billion to below \$3 billion | 15 | 4.76 |
| \$3.1 billion to below \$4 billion | 6 | 1.90 |
| \$4.1 billion to below \$5 billion | 10 | 3.17 |
| \$5.1 billion to below \$10 billion | 33 | 10.48 |

| | | |
|--------------------------------------|-------|-------|
| \$10.1 billion to below \$20 billion | 15 | 4.76 |
| \$20.1 billion to below \$50 billion | 17 | 5.40 |
| \$50.1 billion and above | 13 | 4.13 |
| Years of establishment | N=315 | |
| Less than 5 years | 0 | 0 |
| 6-10 years | 0 | 0 |
| 11-15 years | 2 | 0.63 |
| 16-20 years | 21 | 6.67 |
| 21-25 years | 32 | 10.16 |
| 26-30 years | 64 | 20.32 |
| Over 31 years | 196 | 62.22 |
| Position of respondent | N=315 | |
| Top managers | 186 | 59.05 |
| Position of respondent | 129 | 40.95 |

RESULTS

Structural equation modeling (SEM) using AMOS 19 was employed to examine the hypothesized relationships within the proposed research model. SEM enables the simultaneous analysis of multiple interrelated constructs, each represented by one or more observed indicators. This analytical approach involves two key components: the measurement model and the structural model. The measurement model defines the relationships between observed variables and their corresponding latent constructs, allowing the constructs to correlate freely. In contrast, the structural model outlines the hypothesized causal paths among the latent constructs, capturing the directional relationships specified by the theoretical framework.

Assessment of the Measurement Model

The measurement model was evaluated to determine the extent to which the observed variables effectively captured their respective latent constructs. A total of 20 items were subjected to confirmatory factor analysis (CFA) to assess their dimensionality and psychometric properties. All items exhibited significant and substantial factor loadings on their intended constructs, indicating strong convergent validity. As each item demonstrated satisfactory performance, all were retained in the final measurement model.

The chi-square test for the measurement model yielded a significant result ($\chi^2 = 358.251$, $df = 214$, $p < 0.01$). However, the chi-square to degrees of freedom ratio (χ^2/df) was below the recommended threshold of 2.0, indicating a good model fit (Bentler, 1990). The significant chi-square result was not unexpected, given the well-documented sensitivity of this statistic to sample size (Jöreskog & Sörbom, 1993). To account for this limitation, additional fit indices less affected by sample size were examined. These included the goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), normed fit index (NFI), and root mean square error of approximation (RMSEA). Following established guidelines (Jöreskog & Sörbom, 1993; Hair *et al.*, 1998), model fit is considered acceptable when GFI and AGFI exceed 0.80, CFI and NFI exceed 0.90 and 0.80 respectively, and RMSEA approaches 0.06. The measurement model demonstrated an overall acceptable fit (GFI = 0.841; AGFI = 0.851; CFI = 0.726; NFI = 0.700; RMSEA = 0.040).

Construct reliability was assessed using composite reliability (CR). All CR values ranged from 0.875 to 0.906, surpassing the recommended threshold of 0.60 (Bagozzi & Yi, 1988), confirming strong internal consistency among the constructs. Additionally, the average variance extracted (AVE) for each construct exceeded the benchmark value of 0.50, indicating that the amount of variance explained by each construct was greater than the variance due to measurement error (Jöreskog & Sörbom, 1993; Hair *et al.*, 1998).

Table 4. Assessment results of the measurement model

| Construct | Items | Standardized loading | Standardized error | t-value | CR | AVE |
|---------------------------|-------|----------------------|--------------------|-----------|-------|-------|
| Supply chain performance | SCP1 | 0.603 | 0.028 | 11.142*** | 0.906 | 0.711 |
| | SCP2 | 0.865 | 0.178 | 19.059*** | | |
| | SCP3 | 0.934 | 0.170 | 21.757*** | | |
| | SCP4 | 0.927 | 0.172 | 21.458*** | | |
| Greenwashing | GR1 | 0.723 | 0.054 | 9.193*** | 0.885 | 0.572 |
| | GR2 | 0.766 | 0.038 | 8.121*** | | |
| | GR3 | 0.777 | 0.072 | 8.400*** | | |
| | GR4 | 0.752 | 0.075 | 8.448*** | | |
| | GR5 | 0.824 | 0.075 | 8.744*** | | |
| | GR6 | 0.631 | 0.074 | 9.088*** | | |
| | GR7 | 0.763 | 0.033 | 8.449*** | | |
| | GR8 | 0.519 | 0.045 | 8.869*** | | |
| | GR9 | 0.671 | 0.028 | 7.730*** | | |
| Reciprocity | RE1 | 0.758 | 0.044 | 8.546*** | 0.889 | 0.668 |
| | RE2 | 0.777 | 0.056 | 8.533*** | | |
| | RE3 | 0.769 | 0.074 | 8.388*** | | |
| | RA4 | 0.867 | 0.044 | 7.076*** | | |
| Supply Chain Transparency | SCT1 | 0.860 | 0.034 | 8.884*** | 0.875 | 0.678 |
| | SCT2 | 0.873 | 0.024 | 8.562*** | | |
| | SCT3 | 0.747 | 0.036 | 8.905*** | | |

*** denote significance at $\alpha = 0.001$

An assessment of discriminant validity between the constructs supported the model fit. To make sure the proposed model has discriminant validity, the root of average variance extracted for its construct should larger than correlations with other constructs (Hair *et al.*, 1998).

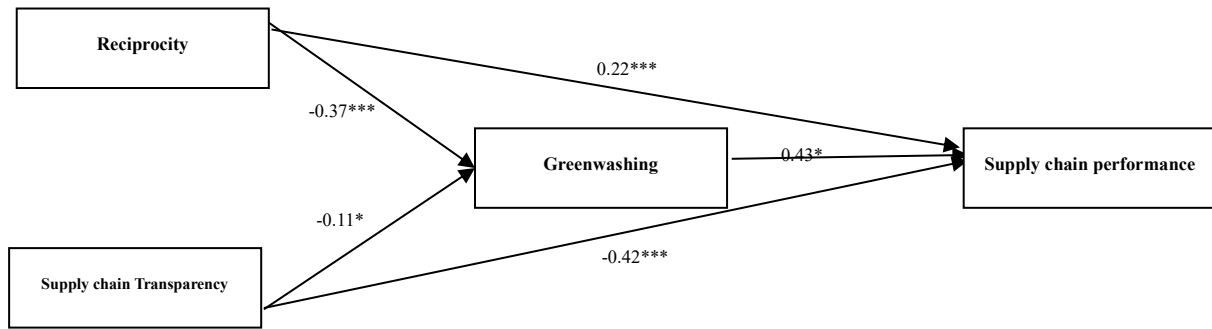
Table 6. Correlation matrix of the constructs

| | (a) | (b) | (c) | (d) |
|-------------------------------|-----------|-----------|-----------|-----|
| (a) Supply chain performance | 1 | | | |
| (b) Reciprocity | 0.570*** | 1 | | |
| (c) Supply chain transparency | 0.645*** | 0.659*** | 1 | |
| (d) Greenwashing | -0.088*** | -0.237*** | -0.155*** | 1 |

*** denote significance at $\alpha = 0.001$ respectively.

Hypotheses Testing

In the SEM analysis, the hypothesized relationships among the constructs were examined simultaneously using covariance-based structural equation modeling. Maximum Likelihood (ML) estimation was applied to estimate model parameters, based on the covariance matrix. This method is widely recognized as appropriate for theory testing and model validation (Jöreskog & Sörbom, 1993; Hair *et al.*, 1998). Figure 2 presents the structural model along with the standardized path coefficients. As shown, reciprocity significantly and negatively influences greenwashing ($\gamma = -0.37$, *** $p < 0.001$), and positively affects supply chain performance ($\gamma = 0.22$, *** $p < 0.001$). Supply chain transparency also shows a significant negative effect on greenwashing ($\gamma = -0.11$, * $p < 0.05$), and a strong positive effect on supply chain performance ($\gamma = 0.42$, *** $p < 0.001$). Additionally, greenwashing is significantly and positively associated with supply chain performance ($\gamma = 0.43$, ** $p < 0.01$), indicating that firms engaging in symbolic sustainability claims may still experience performance benefits, albeit potentially short-term.



*, ** and *** denote significance at $\alpha = 0.05$, $\alpha = 0.01$ and $\alpha = 0.001$ respectively.

Fig. 2. The Structural Model

DISCUSSION

Theoretical Implications

This study contributes to the supply chain management literature by addressing the relationship between ethical behavior and performance. Drawing on Social Exchange Theory (SET), it develops and validates a structural model encompassing reciprocity, supply chain transparency, greenwashing, and supply chain performance. The findings reveal that both reciprocity and transparency negatively influence greenwashing, supporting the SET perspective that exchange relationships are governed by moral norms and trust. This provides a complementary viewpoint to previous research that emphasized institutional regulations as a primary constraint on greenwashing, suggesting instead that relational governance can also serve as a safeguard against ethical risks.

Moreover, both transparency and reciprocity are found to have positive effects on supply chain performance, validating theoretical predictions regarding the performance-enhancing role of relational mechanisms. Interestingly, the results also show a positive relationship between greenwashing and performance, suggesting that symbolic actions may, under certain conditions, temporarily boost performance. This raises important questions for future research regarding the short-term benefits and long-term ethical costs of such behavior. Overall, the study offers a novel and integrated theoretical framework for understanding supply chain ethics and sustainability governance.

Managerial and Practical Implications

This study also provides meaningful guidance for practitioners. First, firms aiming to reduce the risk of greenwashing—either internally or among supply chain partners—should prioritize enhancing transparency and fostering reciprocal relationships. Practical measures include implementing digital traceability systems, disclosing regular sustainability reports, and conducting supplier sustainability audits to increase visibility and reduce the likelihood of symbolic or deceptive sustainability practices.

Second, as both transparency and reciprocity positively impact supply chain performance, companies are encouraged to adopt relationship-based supply chain management strategies such as long-term partnerships, shared goal setting, and incentive alignment. These practices can strengthen mutual trust and collaboration. Although greenwashing may temporarily enhance corporate image and performance, its long-term risks should not be overlooked. Firms are advised to invest in substantive sustainability efforts rather than rely on misleading claims, thereby achieving a true balance between social responsibility and business performance.

CONCLUSIONS AND FUTURE RESEARCH

Integrating Social Exchange Theory with the perspective of sustainable supply chain management, this study develops and empirically tests a comprehensive model that examines how reciprocity and transparency affect greenwashing and supply chain performance. The results support most of the proposed hypotheses, demonstrating that both reciprocity and transparency can effectively reduce greenwashing and enhance performance. However, the positive link between greenwashing and performance suggests that symbolic behavior may serve as a short-term performance driver in specific contexts. This finding invites deeper reflection on the ethical gray areas of corporate behavior and underscores the need for governance mechanisms that address both ethics and performance.

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