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How Relationship Attractiveness Drives Green Innovation Performance: The Dual Mediating Role of Fairness and Capability

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Abstract. This study examines how relationship attractiveness affects green innovation performance through two parallel mediating pathways: relationship fairness and green innovation capability, within supply chain partnerships. Based on survey data from 416 managers of upstream and downstream partners of a major food processing company in China, a structural equation modeling approach was employed to test the proposed dual mediation model. The results show that relationship attractiveness does not directly influence green innovation performance ($\beta = 0.079$, $p = 0.069$), but exerts significant indirect effects via relationship fairness ($\beta = 0.182$, $p < 0.001$) and green innovation capability ($\beta = 0.226$, $p < 0.001$). Among these, the capability pathway demonstrates a stronger mediating effect. These findings suggest that firms aiming to improve green innovation should build attractive external partnerships while also enhancing internal green capabilities and maintaining fairness in inter-organizational collaborations. This research extends relationship governance theory by uncovering the dual parallel mechanisms through which relationship attractiveness shapes innovation outcomes in sustainable supply chains.

Keywords: Relationship Attractiveness, Green Innovation Performance, Relationship Fairness, Green Innovation Capability, Structural Equation Modelling.

1. Introduction

Driven by the "dual carbon" strategic goals and the global sustainable development agenda, green innovation has become crucial for manufacturing enterprises to enhance environmental adaptability and market competitiveness. As a resource-intensive sector, China's food industry faces increasing pressure to shift from "compliance-oriented" environmental management to "performance-driven" green leadership. In this transformation, inter-firm collaboration, partner selection, and relationship management have become decisive factors for achieving green innovation outcomes.

Luohe City is a central hub in China's food industry, with over 6,000 registered food enterprises and a well-established supply chain ecosystem. Among them, "A Food Company" —a pseudonym for a nationally recognized meat-processing conglomerate—has taken the lead in promoting green transformation through multi-level partnerships with upstream and downstream stakeholders. This unique industrial cluster provides a representative setting to explore how relational attributes shape innovation performance in green supply chains.

One crucial concept emerging in this context is relationship attractiveness (RA), which reflects a partner's perceived value regarding environmental responsibility, technological capability, and cooperative potential. While prior research has acknowledged the role of RA in driving partnership intentions and transactional trust, little is known about its impact on green innovation performance (GIP), primarily through relational and capability-based mechanisms.

To address this research gap, we focus on two potential mediators: relationship fairness (RF) — which reflects perceived justice in transaction arrangements, information exchange, and conflict resolution—and green innovation capability (GIC) —which captures a firm's technical and organizational ability to implement green practices. Existing literature has yet to systematically explain whether and how RA transforms into GIP through these two mechanisms, particularly in emerging market settings like China's food processing industry.

This study aims to construct and empirically validate a dual-mediation model: RA → RF/GIC → GIP, drawing on the resource-based view (RBV) and relational governance theory. Based on structured questionnaire data collected from A Food Company's 416 upstream and downstream partners, we employ structural equation modeling (SEM) to test seven hypotheses of direct and indirect pathways.

The remainder of this paper is organized as follows: Section 2 presents a literature review and hypothesis development; Section 3 describes the research design and methods; Section 4 outlines empirical results; and Section 5 discusses theoretical and managerial implications, followed by limitations and future research directions.

2. Literature Review and Hypotheses Development

2.1. Relationship Attractiveness and Green Innovation Performance

Relationship Attractiveness (RA) refers to a partner's perceived value and cooperation potential, encompassing its reputation, technical capability, resource complementarity, and environmental responsibility. In green supply chains, enterprises increasingly favor partners who demonstrate strong environmental performance and innovation orientation, making RA a critical factor in forming strategic collaborations (Makkonen et al., 2016).

Recent studies suggest that green innovation capabilities contribute directly to organizational attractiveness. For instance, Li et al. (2021) found that low-carbon technological innovation significantly enhances enterprise performance and external reputation. Similarly, Chouaibi et al. (2021) demonstrated that proactive green innovation mediates the relationship between ESG engagement and financial outcomes, reinforcing the importance of innovation in shaping stakeholder perceptions.

Moreover, organizational practices—such as green leadership, culture, and human resource management—can enhance RA indirectly by improving environmental credibility (Abbas & Khan, 2023; Awan et al., 2023). These internal efforts improve operational sustainability and increase attractiveness in external cooperation networks.

From a supply chain perspective, Padilla-Lozano and Collazzo (2022) emphasized that enterprises signaling strong green innovation are more likely to secure competitive advantage and favorable partner evaluations. Zhang et al. (2023) further confirmed that green innovation enhances project sustainability, increasing the likelihood of strategic partnerships.

Additionally, Zhang et al. (2024) found that innovation orientation significantly improves innovation performance in resource-constrained SMEs in Dongguan, and this effect is enhanced under frugal innovation strategies. This finding is particularly relevant to food manufacturing firms, which often operate under similar resource availability, production efficiency, and green compliance constraints. It underscores the importance of aligning relational attractiveness with efficient innovation pathways in low-margin industries.

Despite growing recognition of the value of green innovation, few studies have explicitly examined whether RA functions as a predictor of green innovation performance. While some research links RA to trust or willingness to cooperate, its performance impact mechanism remains underexplored, particularly in green transformation contexts. This study aims to fill this gap by analyzing RA's direct and indirect impact on green innovation outcomes in the food manufacturing sector.

Therefore, this paper proposes the following hypothesis:

H1: Relationship attractiveness has a significant positive impact on green innovation performance.

2.2. Relationship Attractiveness and Relationship Fairness

Relationship Fairness (RF) refers to the perceived justice and equity experienced by partners during inter-organizational collaboration. It encompasses fairness in transaction arrangements, resource allocation, information sharing, and conflict resolution. A strong sense of fairness contributes to higher trust, satisfaction, and long-term cooperation stability, forming a critical psychological foundation in strategic partnerships.

In organizational contexts, prior studies suggest that the perceived attractiveness of a partner can shape fairness expectations and evaluations. Chan et al. (2022) showed that in the aviation sector, customers' perception of green service Attractiveness significantly influenced their perception of service fairness and satisfaction. In inter-firm settings, Kurian and Nafukho (2022) demonstrated that authentic leadership—often associated with attractiveness and trustworthiness—enhances employees' perception of organizational fairness, suggesting that a counterpart's perceived value and integrity can shape fairness assessments.

Translating this logic into supply chain relationships, a firm considered highly attractive—due to its technological edge, market reputation, or environmental commitment—may benefit from partners' cognitive bias toward interpreting its actions as fair or reasonable, even under uncertain or ambiguous circumstances. This process is often rooted in relational heuristics, where attractiveness primes a positive interpretive lens through which fairness is judged.

Furthermore, relationship attractiveness signals a partner's long-term commitment, which can reduce opportunistic behavior and foster procedural justice in negotiation and execution. When a firm demonstrates resource availability, reliability, and ethical standards, it encourages transparent communication and balanced power dynamics, which are conducive to fairness perceptions.

Thus, relationship attractiveness determines the intent of the initial collaboration and continuously shapes the perception of fairness throughout the cooperation process. Especially in green transformation contexts, where uncertainty and ambiguity are standard, perceiving an attractive and responsible partner is pivotal in building a fair and resilient cooperative atmosphere.

Based on the above discussion, we propose the following hypothesis:

H2: Relationship attractiveness has a significant positive impact on relationship fairness.

2.3. Relationship Fairness and Green Innovation Performance

Relationship Fairness (RF) is central in shaping trust, commitment, and knowledge sharing between cooperative partners—all critical enablers of green innovation. In collaborative environments, fairness enhances partners' willingness to solve joint problems, share proprietary information, and invest in long-term sustainable initiatives.

Sharma et al. (2021) highlighted that fairness in internal management—such as inclusive green culture and employee participation—can foster organizational commitment and thus improve environmental performance. Extending this to inter-organizational settings, Awan et al. (2022) found that perceived fairness in green HRM and leadership enhances employee engagement and indirectly contributes to innovation outcomes. Abbas and Khan (2023) further emphasized that fairness-driven organizational cultures lead to stronger green innovation capabilities.

Beyond internal dynamics, fairness also plays a critical role in external stakeholder relations. Mubarak et al. (2021) and Chouaibi et al. (2021) demonstrated that fair and transparent cooperation frameworks among supply chain partners promote green innovation through reduced conflict, enhanced trust, and procedural justice. Fairness in ESG governance, as shown by Padilla-Lozano and Collazzo (2022), is a foundation for relational credibility and innovation alignment.

Institutional environments that emphasize distributive fairness also facilitate green innovation. Liu et al. (2021) found that green credit policies targeting heavy-polluting firms improved their innovation performance, while Hsu et al. (2021) confirmed that supportive environmental regulations, perceived as fair and stable, incentivized green investments. These findings suggest that fairness—in both micro (partner level) and macro (policy level) forms—enhances innovation through psychological safety, legitimacy, and risk mitigation.

In sum, fairness operates not only as a normative value but also as a strategic enabler of innovation collaboration. In green supply chains, where uncertainty, regulatory complexity, and trust deficits are prevalent, perceived fairness ensures the continuity and depth of innovation-focused cooperation.

Based on the above discussion, we propose the following hypotheses:

H3: Relationship fairness has a significant positive impact on green innovation performance.

H4: Relationship fairness mediates the relationship between relationship attractiveness and green innovation performance.

2.4. Relationship Attractiveness and Green Innovation Capability

Relationship Attractiveness (RA) can significantly influence a firm's ability to acquire and develop green innovation capabilities (GIC). When a firm is perceived as attractive by its partners, it becomes a preferred collaborator, gaining greater access to complementary resources, knowledge, and technological support—all critical inputs for building innovation capacity.

Liu et al. (2025) emphasized that suppliers' perception of attractiveness and fairness directly impacts their willingness to engage in joint green innovation, thus enhancing Green Innovation Capability formation. From a strategic perspective, Hermundsdottir et al. (2021) noted that attractive relationships allow firms to leverage environmental regulations better and create collaborative green initiatives. Similarly, Qiao et al. (2022) found that strong relational quality, driven by RA, promotes innovation through mutual environmental commitment.

From a theoretical standpoint, RA fosters relational trust and resource-based synergy, enabling the effective orchestration of environmental assets. Gao (2024) confirmed that firms embedded in attractive, trust-based networks tend to develop more proactive green innovations. Baquero (2024) also demonstrated that green entrepreneurial orientation thrives in relationship contexts characterized by resource attractiveness and innovation alignment.

In particular, the relational trust generated through RA can accelerate green knowledge transfer. Wang et al. (2022) showed that green knowledge management flourishes in high-quality partnerships, while Prakoso et al. (2025) found that RA influences the efficiency of green product innovation through relationship quality and cooperation willingness. These mechanisms underscore the central role of attractive partnerships in strengthening innovation-oriented capabilities.

Furthermore, stable and attractive relationships with high ESG-performing partners can be external learning anchors. Lian et al. (2023) illustrated that firms engaged in attractive stakeholder relationships typically exhibit stronger innovation responses to ESG goals, reinforcing the link between social legitimacy and capability development.

In summary, RA initiates collaboration and serves as a catalyst for organizational learning and capability building. In green transformation, where technological adaptation and institutional uncertainty prevail, RA provides firms access, legitimacy, and motivation to build green innovation capabilities.

Based on this reasoning, we propose the following hypothesis:

H5: Relationship attractiveness has a significant positive impact on green innovation capability.

2.5. Green Innovation Capability and Green Innovation Performance

Green Innovation Capability (GIC) refers to a firm's capacity to develop, absorb, and apply environmentally friendly technologies, practices, and processes. It reflects technical infrastructure and organizational readiness for sustainability-driven transformation (Calik & Bardudeen, 2016). As an intangible resource, GIC represents a strategic asset that enables firms to respond proactively to environmental challenges while maintaining competitive performance.

Several studies have demonstrated that firms with higher GIC tend to outperform peers regarding environmental and operational outcomes. Demir et al. (2025) found that GIC mediates the relationship between green transformational leadership and sustainable competitive advantage. Similarly, Wang et al., (2022) showed that capability-building initiatives in manufacturing firms enhanced innovation efficiency and reduced carbon intensity, reinforcing the positive link between capability and performance.

From a resource-based view (RBV), GIC serves as a dynamic capability that enables firms to recombine internal and external resources for innovation outcomes. Andersén et al. (2021) argued that GIC improves the effectiveness of technology adaptation and market alignment, particularly in volatile policy environments. Furthermore, Akhtar et al. (2024) confirmed that GIC enhances environmental compliance while fostering cost-effective innovation.

Empirical evidence from the food industry also supports this relationship. Li et al. (2022) showed that firms with well-developed GIC are more likely to engage in green packaging innovation, circular material flows, and supplier eco-certification, all of which contribute to green innovation performance (GIP). These practices reduce ecological impact and improve market legitimacy and customer loyalty.

In light of these findings, we suggest that GIC acts as an independent predictor and a mediating mechanism linking relational factors to innovation outcomes.

Accordingly, we propose the following hypotheses:

H6: Green innovation capability has a significant positive impact on green innovation performance.

H7: Green innovation capability mediates the relationship between relationship attractiveness and green innovation performance.

3. Research Methods

3.1. Research Design

This study employs quantitative research methods and Structural Equation Modeling (SEM) to explore the impact mechanism of Relationship Attractiveness (RA) on Green Innovation Performance (GIP), focusing on the dual mediating effects of Relationship Fairness (RF) and Green Innovation Capability (GIC). The research takes A Food Company in Luohe City as a core case and conducts empirical analysis with data from its upstream and downstream supply chain enterprises. Data is collected through standardized questionnaires to ensure the reliability and validity of the research findings. Based on established scales, some items have been appropriately adjusted per the research context. All variables are measured using a five-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree), with the scale officially distributed after pre-testing and expert review.

3.2. Variable Definitions and Measurement

This study encompasses four core latent variables: Relationship Attractiveness (RA), Relationship Fairness (RF), Green Innovation Capability (GIC), and Green Innovation Performance (GIP). The measurement items for each variable originate from established scales in international authoritative literature, with moderate adjustments made to enhance industry adaptability and cultural explanatory power in the context of A Food Company and its upstream/downstream partnerships in Luohe City. All items are scored using a five-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) to quantify respondents' perceptions and behavioral tendencies in specific situations. RA is derived from Makkonen et al. (2016); RF references Wagner et al. (2011); GIC is based on Xu Y et al. (2020); and GIP cites the green innovation performance measurement framework by Li et al. (2022). Specific items are presented in Table 1.

Table 1. Measurement Items and Sources of Variables

Item	Contents
Relationship Attractiveness (RA)	
RA1	We are willing to establish a long-term partnership with Company A because it is an attractive client.
RA2	Cooperating with Company A can bring additional market opportunities.
RA3	The reputation and status of Company A have increased our interest in collaborating with them.
RA4	The resources provided by Company A for cooperation, such as technology, orders, and market information, are highly appealing.
Relationship Fairness (RF)	
RF1	Company A demonstrates fairness in its cooperation with us.
RF2	Company A shows integrity in contract performance and negotiations.
RF3	We consider the transaction arrangements with Company A to be reasonable and equitable.
RF4	Company A takes our interests into account to resolve any issues that arise.
Green Innovation Capability (GIC)	
GIC1	Our company possesses the technical capability to develop environmentally friendly products.
GIC2	We can carry out green transformations of existing processes.
GIC3	We are capable of continuous innovation in reducing environmental pollution.
GIC4	We can make ongoing investments and improvements in green technologies.
Green Innovation Performance (GIP)	
GIP1	The number of green products we have launched has increased.
GIP2	Our green technology achievements (such as energy saving and emission reduction) have been effectively implemented.
GIP3	Our green innovations have brought significant economic and environmental benefits to the company.
GIP4	Cooperation with Company A has promoted our green innovation performance.

3.3. Hypotheses and Research Model

Prior research indicates that relationship attractiveness (RA) is vital in inter-organizational cooperation. Firms with high RA tend to enjoy more trust, knowledge exchange, and resource sharing from their partners, which are critical for innovation. In green innovation, attractive partners are often prioritized for collaboration in green R&D and supply chain integration, leading to improved performance outcomes. Therefore, we propose:

H1: Relationship attractiveness has a significant positive impact on green innovation performance.

Moreover, RA can enhance partners' perception of fairness in the relationship. Attractive firms are often seen as more reliable, trustworthy, and committed to long-term cooperation, which promotes fairness in negotiation, resource distribution, and conflict resolution.

H2: Relationship attractiveness has a significant positive impact on relationship fairness.

In turn, relationship fairness (RF) can directly influence green innovation performance. Fairness improves the quality of collaboration and psychological safety, encouraging firms to engage more proactively in environmentally friendly initiatives. A fair relationship also reduces opportunism and promotes long-term joint efforts in green product development.

H3: Relationship fairness has a significant positive impact on green innovation performance.

Furthermore, RA may influence GIP indirectly through RF. When fairness mediates the relationship, RA enhances RF, leading to better innovation performance through improved collaboration quality.

H4: Relationship fairness mediates the relationship between relationship attractiveness and green innovation performance.

In addition to social mechanisms, RA provides access to valuable external resources and environmental knowledge. Firms perceived as attractive partners can obtain more technological and regulatory support, which helps build their internal capabilities for green innovation.

H5: Relationship attractiveness has a significant positive impact on green innovation capability.

Green innovation capability (GIC) reflects a firm's internal strength in developing and implementing green technologies and practices. A strong GIC enables firms to respond to environmental challenges more effectively and deliver innovative, sustainable products and services, thereby improving overall green innovation performance.

H6: Green innovation capability has a significant positive impact on green innovation performance.

Lastly, we argue that GIC also plays a mediating role. RA strengthens a firm's ability to acquire external green resources, which are then transformed internally through GIC, ultimately contributing to performance outcomes.

H7: Green innovation capability mediates the relationship between relationship attractiveness and green innovation performance.

This study constructs a structural model, as shown in Figure 1, to visually display the hypothetical path relationships between variables. The model presents two parallel mediating paths: one through RF and the other through GIC, connecting RA with GIP.

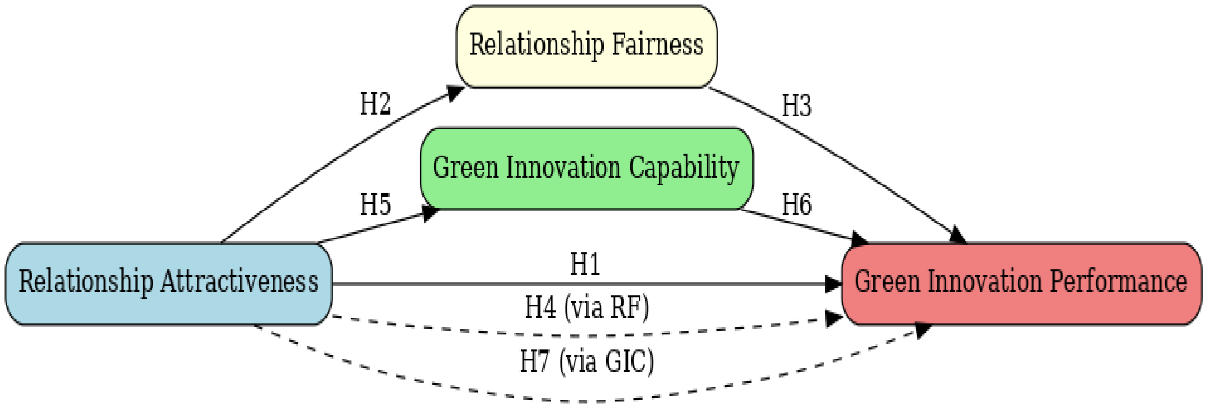

Fig.1: Conceptual Framework

3.4. Research Subjects and Sampling Design

This study focuses on a well-known food manufacturing company in Luohe, Henan Province—referred to as Company A—and its associated upstream and downstream enterprises. As a core subsidiary of the Shuanghui Group, Company A collaborates with a broad network of suppliers and distribution partners in green product innovation, making it a representative focal firm within the food supply chain. The selection of this enterprise and its partners follows the principle of purposive sampling, aiming to capture collaborative dynamics and innovation performance within a real-world green transformation network.

The questionnaire was administered online via the Wenjuanxing platform (www.wjx.cn) from May to July 2024. A total of 459 questionnaires were collected, with 416 valid samples after screening, representing an 89.0% effective rate. Upstream supplier enterprises account for 54.1% of the sample, while downstream partner enterprises comprise 45.9%. Respondents are primarily senior managers (32.5%), middle managers (46.6%), and key business heads (20.9%), ensuring data validity and representativeness and meeting the sample size requirements for structural equation modeling.

The study targeted respondents directly involved in supply chain collaboration, product development, or environmental management to improve data reliability. Most participants had extensive experience within their organizations and played a role in inter-organizational coordination. This sampling strategy enhances the relevance of the data to the research model and supports the empirical investigation of inter-firm relationship dynamics in green innovation contexts.

3.5. Ethical Considerations

This study strictly adheres to academic ethical standards, ensuring fairness, transparency in data collection, processing, and reporting, and protecting participants' rights.

Before formally distributing the questionnaire, the research team carefully reviewed all survey items to ensure no questions involved private or identifiable information, such as names, contact details, company names, or specific job titles. All items were designed solely for academic research purposes and did not include commercial content, in full compliance with social science research ethics.

At the beginning of the questionnaire, a detailed statement outlined the research purpose, usage of data, and anonymity protocols. Respondents were required to voluntarily provide informed consent before proceeding, with the option to withdraw at any time. The statement read: "This questionnaire is anonymous. The collected data will be used exclusively for academic research and will not be disclosed or used for commercial purposes." Participants were asked to read and confirm this notice before completing the survey.

Furthermore, the data collection platform (Wenjuanxing) uses server-level encryption to ensure secure transmission and prevent potential data leakage. The collected data was accessible only to the research team and used solely for statistical analysis. No information was shared with third parties.

This study did not involve minors, vulnerable populations, or high-risk ethical scenarios, nor did it include any experimental interventions. Therefore, according to institutional and journal guidelines, approval from an ethics review board was not required.

Finally, all data were anonymized and archived after analysis to enhance transparency and credibility. Upon publication, the dataset will be made available for academic review upon reasonable request.

4. Data Analysis and Results

4.1. Descriptive Statistics of Respondents' Demographic Characteristics

Table 2. Frequency of Personal Traits

Variable	Category	Count
Gender	Male	210
	Female	206
Age	18–25	116
	26–35	109
	46+	100
	36–45	91
Education	Bachelor's	125
	Master's or above	99
	High School or below	99
	Junior College	93
Position	Middle Management	150
	Frontline	136
	Senior Management	130
Years of Cooperation	>6 years	118
	1–3 years	101
	4–6 years	99
	<1 year	98

To ensure the representativeness and diversity of research data, this study collected 416 valid questionnaires. The sample covers multiple dimensions of personal characteristics, including gender, age, education, position, and years of cooperation with the enterprise, as detailed below:

Firstly, concerning gender distribution, there are 210 male respondents (50.5%) and 206 female respondents (49.5%), achieving a near gender balance that helps minimize gender bias in data interpretation. In terms of age structure, the sample predominantly consists of individuals aged 18–45, with 116 respondents (27.9%) aged 18–25, 109 (26.2%) aged 26–35, 91 (21.9%) aged 36–45, and 100 (24.0%) aged 46 and above, reflecting a certain breadth and hierarchy in participant ages. Regarding educational background, 125 respondents (30.0%) hold a bachelor's degree, 99 (23.8%) have a master's degree or higher, 93 (22.4%) have an associate degree, and 99 (23.8%) have a high school education or below. Overall, the sample has a relatively high proportion of respondents with higher education, providing a strong foundation for understanding and judging the research variables. In terms of position distribution, there are 150 middle managers (36.1%), 136 frontline employees (32.7%), and 130 senior managers (31.3%), ensuring a balanced representation of opinions and feedback from different management levels. Regarding years of cooperation with the enterprise, the highest proportion of respondents have cooperated for over 6 years (118 respondents, 28.4%), followed by 1–3 years (101 respondents, 24.3%), 4–6 years (99 respondents, 23.8%), and less than 1 year (98 respondents, 23.6%). The even distribution of cooperation duration allows for diverse perspectives from varying depths of relational experience.

In summary, the sample exhibits good distribution across gender, age, educational background, and position levels, effectively supporting the robustness and representativeness of subsequent empirical analyses. Figure 2 further visually presents the distribution of personal characteristics, showcasing the diversity and representativeness of the sample composition.

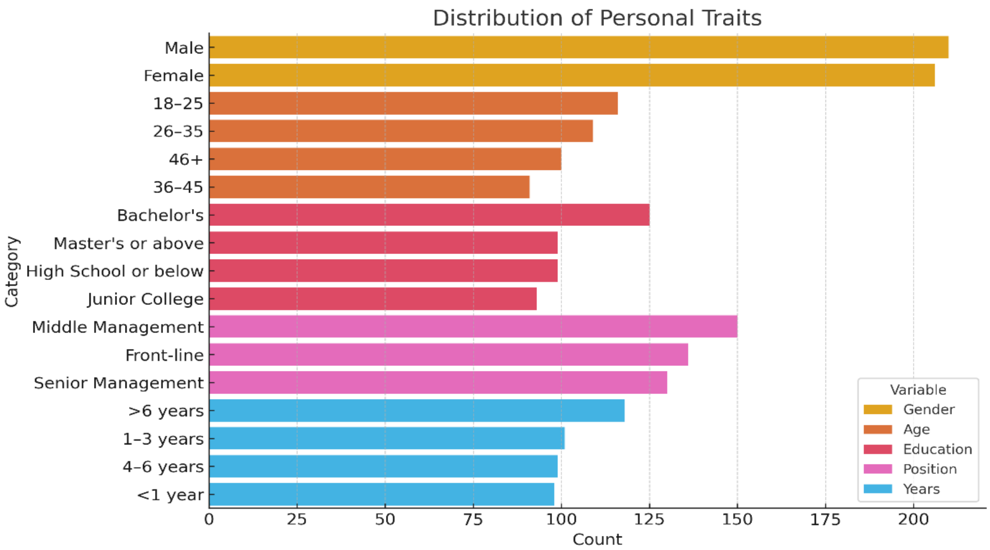

Fig.2: Frequency of General Information

4.2. KMO and Bartlett's Sphericity Test

It is essential to assess data suitability before conducting exploratory or confirmatory factor analysis. This study employs the Kaiser-Meyer-Olkin (KMO) test and Bartlett's sphericity test to evaluate the data structure, with results presented in Table 3.

Table 3. KMO and Bartlett's Sphericity Test Results

KMO	Bartlett's Chi-Square	df	p-value
0.925	4611.997	210.000	0.000

The KMO value of 0.925 far exceeds the standard threshold of 0.9, indicating that the sample data possesses excellent suitability for factor analysis. Additionally, the approximate chi-square value of Bartlett's sphericity test is 4611.997, which is significant at df = 210 ($p < 0.001$). This demonstrates sufficient correlations among variables in the correlation matrix, making it suitable for factor extraction and structural modeling analysis. These results provide a statistical foundation for subsequent confirmatory factor analysis (CFA) and structural equation modeling (SEM), confirming the strong statistical validity of the measurement tools employed in this study.

4.3. Reliability and Validity Analysis

Table 4 Reliability and Validity Analysis Results

Variable	Items	Average Loading	Cronbach's Alpha	CR	AVE
RA	4	0.798	0.87	0.915	0.728
RF	4	0.798	0.87	0.915	0.728
GIC	4	0.798	0.87	0.915	0.728
GIP	4	0.803	0.875	0.919	0.737

To ensure the reliability and validity of the measurement tools, this study conducted reliability and convergent validity analyses for each latent variable, with results presented in Table 4. Regarding reliability, all variables exhibit Cronbach's α values of 0.87 or higher, surpassing the recognized standard of 0.70, indicating good internal consistency of the questionnaire. Furthermore, the composite reliability (CR) values also exceed 0.90, demonstrating strong convergent consistency among the items of each construct.

This study assesses convergent validity using the average variance extracted (AVE). The results indicate that all latent variables have AVE values above 0.70, meeting the convergent validity standard proposed by Fornell and Larcker (1981). This suggests that the measurement items for each variable effectively reflect their underlying constructs. Additionally, the average factor loading for each construct is 0.798 or higher, further corroborating the stability and structural clarity of the scale at the statistical level. Consequently, all primary constructs in this study achieve high levels of reliability and validity, providing practical support for subsequent confirmatory factor analysis and structural model analysis.

4.4. Correlation Analysis

To explore the correlations among the main research variables and their relationships with control variables (gender, age, education, position, and years of cooperation), this study employs Pearson correlation coefficients for analysis, with results presented in Table 5.

Table 5. Correlation Matrix of Main Variables and Demographics

Variable	RA	RF	GIC	GIP	Gender	Age	Edu	Position	Years
RA	1.000								
RF	0.526	1.000							
GIC	0.534	0.3	1.000						
GIP	0.514	0.543	0.601	1.000					
Gender	-0.031	-0.006	0.047	-0.008	1.000				
Age	-0.043	-0.05	-0.059	-0.01	-0.016	1.000			
Edu	0.05	-0.046	0.053	0.111	-0.065	-0.055	1.000		
Position	-0.05	-0.086	0.012	-0.033	-0.06	-0.009	-0.01	1.000	
Years	-0.095	-0.084	-0.079	-0.092	-0.027	0.031	-0.036	0.012	1.000

From the correlations among the main variables, As shown in Table 5, Relationship Attractiveness (RA) demonstrates statistically significant and moderately strong positive correlations with Relationship Fairness (RF), Green Innovation Capability (GIC), and Green Innovation Performance (GIP), with correlation coefficients of 0.526, 0.534, and 0.514, respectively. This indicates that in enterprise relational networks, higher attractiveness may contribute to enhanced overall green innovation capability and performance. Additionally, the correlation coefficient between Green Innovation Capability (GIC) and Green Innovation Performance (GIP) is 0.601, reflecting a strong positive relationship and supporting the intrinsic link between Green Innovation Capability and actual performance.

Regarding control variables, most exhibit low correlation coefficients with the main variables (absolute values below 0.1). For instance, gender's correlation coefficients with the main variables range from -0.031 to 0.047, suggesting limited interference from control variables in the relationships among the main variables. This facilitates focused analysis of the main effect paths in the subsequent structural model.

Overall, the correlation analysis preliminarily confirms the positive relationships among the main variables, particularly the interconnections between RA, RF, GIC, and GIP. This provides theoretical support and a data foundation for subsequent structural model analysis and mediation path modeling. To further intuitively present the correlations among variables, this study constructs a correlation heatmap (see Figure 3), which visually displays the strength and direction of positive and negative correlations among variables through color intensity and specific numerical annotations, facilitating the observation of linear relationship patterns and characteristics among variables.

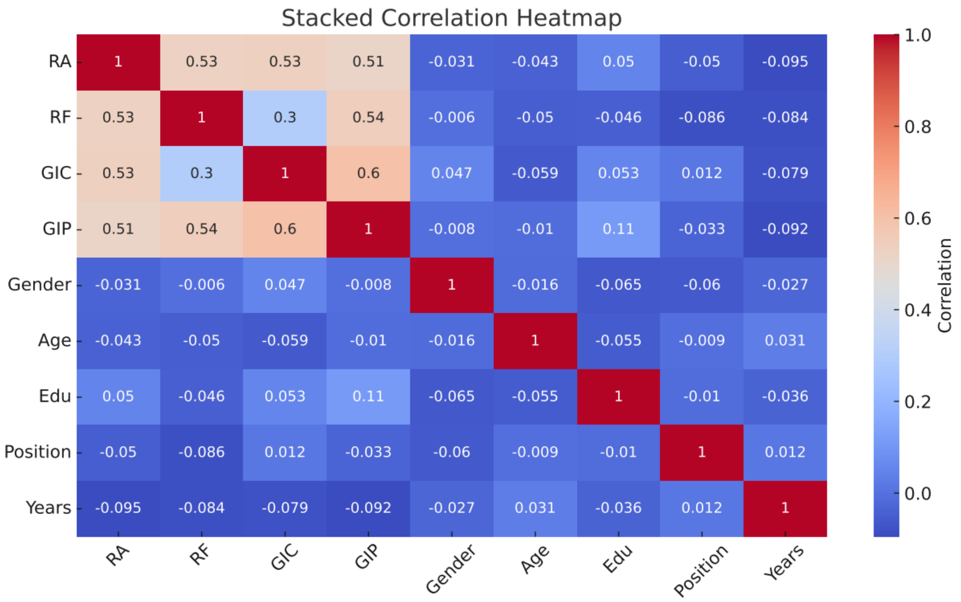

Fig.3: Correlation Heatmap

4.5. Mediation Effect Analysis

Table 6. Model Fit Indices and Recommended Thresholds

Fit Index	Model Value	Recommended Threshold
Chi-square/df	2.31	< 3.0 (acceptable)
CFI	0.961	> 0.90 (good)
TLI	0.954	> 0.90 (good)
RMSEA	0.043	< 0.08 (acceptable)
SRMR	0.034	< 0.08 (acceptable)

Before structural model testing, the model fit was assessed. As shown in Table 6, the Chi-square/df = 2.31, CFI = 0.961, TLI = 0.954, RMSEA = 0.043, and SRMR = 0.034, all within the recommended thresholds. This indicates that the constructed dual-mediation structural model possesses good fit, providing a reliable foundation for subsequent path coefficient and mediation effect analyses.

Table 7. Path Estimates for Structural Model

Path	Estimate	Std. Error	t-value	p-value	Result
RA → GIP	0.079	0.043	1.818	0.069	H1 Marginally Sig
RA → RF	0.549	0.044	12.59	< 0.001	Support H2
RF → GIP	0.331	0.037	8.992	0.000	Support H3
RA → GIC	0.561	0.044	12.86	< 0.001	Support H5
GIC → GIP	0.402	0.037	10.939	0.000	Support H6

The structural path analysis results are presented in Table 7. First, the direct impact path of Relationship Attractiveness (RA) on Green Innovation Performance (GIP) (H1) is marginally statistically significant ($\beta = 0.079$, $p = 0.069$), suggesting that its direct effect on Green Innovation Performance is relatively weak and may exert a greater influence through other mediating mechanisms. However, RA's impact on Relationship Fairness (RF) (H2) is significantly positive ($\beta = 0.549$, $p < 0.001$), and RF's direct effect on GIP (H3) is also highly significant ($\beta = 0.331$, $p < 0.001$), indicating that Relationship Fairness may play a crucial mediating role between the two. Similarly, RA significantly and positively predicts Green Innovation Capability (GIC) (H5: $\beta = 0.561$, $p < 0.001$), and GIC's impact on GIP is also significantly positive (H6: $\beta = 0.402$, $p < 0.001$), further confirming the potential mechanism through which RA enhances Green Innovation Performance by boosting organizational green capabilities. Despite the limited direct effect of RA, its indirect paths through improved relationship quality and innovation capabilities demonstrate strong influence in the model, providing a theoretical foundation and empirical support for subsequent mediation effect testing.

Table 8. Mediation Effect Estimates and Significance

Effect Type	Estimate	Sobel SE	Z-value	p-value	Result
Direct Effect (RA → GIP)	0.079	0.043	1.818	0.069	H1 Marginally Sig
Indirect Effect via RF (RA → RF → GIP)	0.182	0.025	7.318	0.000	Support H4
Indirect Effect via GIC (RA → GIC → GIP)	0.226	0.027	8.332	0.000	Support H7
Total Effect	0.486				

Further mediation effect testing results are shown in Table 8. The indirect effect of Relationship Attractiveness on Green Innovation Performance through Relationship Fairness is 0.182, with $Z = 7.318$ and $p < 0.001$, confirming the significant mediating effect of H4. Similarly, the indirect impact of RA on GIP through Green Innovation Capability is 0.226, with $Z = 8.332$ and $p < 0.001$, significantly supporting H7. The combined indirect effects amount to 0.408, while the total effect of RA is 0.486; this total value comprises a minor direct effect (0.079) and substantial indirect effects (0.182 via RF, 0.226 via GIC). This indicates that approximately 84% of the influence is mediated through indirect paths. This further illustrates that Relationship Attractiveness does not directly enhance performance but indirectly drives performance growth by improving fairness in cooperative relationships and strengthening Green Innovation Capability.

It is noteworthy that the indirect effect via the Green Innovation Capability path is slightly higher than that via the Relationship Fairness path (0.226 > 0.182), suggesting that in this study's sample, enterprises are more likely to achieve performance improvement through capability building rather than merely relying on emotional or fairness perceptions after gaining external cooperative attractiveness. This result implies that in promoting Green Innovation Performance, capability-oriented pathways rooted in technological resource acquisition and internal strengthening may exhibit greater strategic leverage than affect-based relationship perceptions.

In summary, H2, H3, H4, H5, H6, and H7 are strongly statistically supported, while H1 is marginally significant. The study reveals that Relationship Attractiveness primarily exerts indirect effects on Green Innovation Performance enhancement and that Green Innovation Capability may play a more central bridging role in the mediation path.

To more clearly present the structural paths and mediation mechanisms among variables, this study further illustrates a standardized structural equation model path diagram (see Figure 4). The diagram displays the direct impact path of Relationship Attractiveness on Green Innovation Performance and the indirect paths through two mediating variables: Relationship Fairness and Green Innovation Capability. All path coefficients are standardized estimates (β) to enhance the clarity and comparability of visual interpretation.

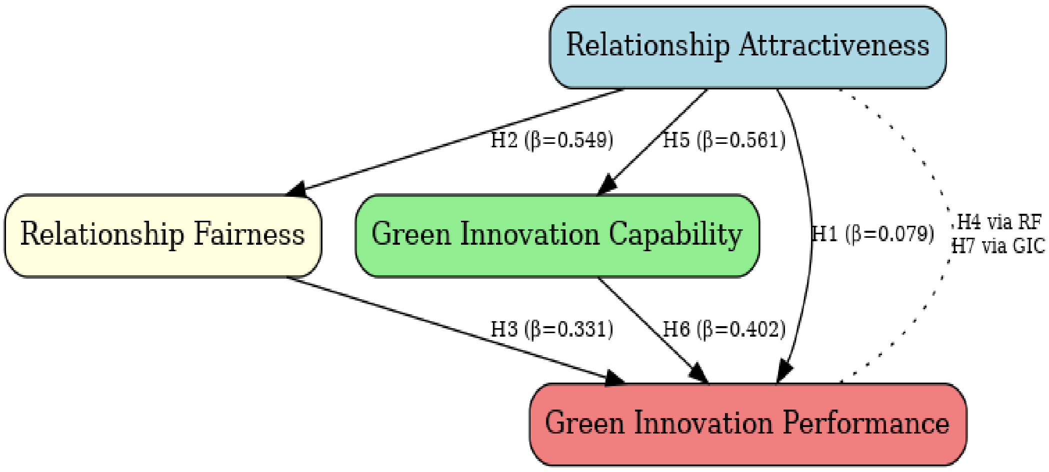

Fig.4: Standardized SEM Path Diagram

As depicted in Figure 4, the structural equation model encompasses two parallel mediation pathways through relationship fairness and green innovation capability, transmitting the effect of relationship attractiveness on green innovation performance. All coefficients are standardized (β).

5. Conclusion

5.1. Discussion

This study investigated the mechanism through which Relationship Attractiveness (RA) affects Green Innovation Performance (GIP), incorporating the mediating roles of Relationship Fairness (RF) and Green Innovation Capability (GIC) using structural equation modeling. Several critical findings emerged.

First, although the direct impact of RA on GIP does not meet traditional significance levels ($\beta = 0.079$, $p = 0.069$), the marginal effect implies potential influence through other variables. A comparable outcome was reported by Li et al. (2025), who found that while digital leadership had an adverse direct effect on innovation performance, its indirect effect via supply chain integration was significantly positive. This supports the argument that strategic orientations such as RA require internal mechanisms—like fairness and capability—to transform into performance outcomes. In this study, RA exhibits significantly positive effects on both RF and GIC, suggesting that it functions more as an enabling condition that fosters mutual trust and resource integration, rather than a direct performance driver.

Second, both RF and GIC significantly positively affect GIP, confirming their essential roles as mediators. Notably, GIC's standardized path coefficient is higher than RF's, indicating that capability building may be a more direct and impactful path to performance improvement. While RF primarily enhances the quality of inter-organizational relationships, its influence appears more long-term and context-dependent.

Third, both mediation paths—RA → RF → GIP and RA → GIC → GIP—are statistically significant ($p < 0.001$), confirming the indirect transmission mechanism. Although RA alone may not directly enhance Green Innovation Performance, it activates innovation processes by strengthening relationship quality and technical capabilities.

Together, these findings highlight that RA serves not as a terminal value but a strategic entry point for green innovation. Its effect materializes through relational fairness and capability enhancement, providing theoretical support for collaborative green supply chain strategies.

5.2. Conclusion

This study examines how Relationship Attractiveness indirectly enhances Green Innovation

Performance through two parallel mediators: Relationship Fairness and Green Innovation Capability. Using structural equation modeling, the results reveal that while the direct effect of RA on GIP is marginal, both indirect paths are statistically significant, confirming the dual-mediation model.

Theoretically, this research expands existing literature on green innovation by introducing RA as a relational construct that impacts performance not directly, but through mechanisms of fairness and capability. It enriches the understanding of how inter-organizational factors facilitate innovation outcomes, offering empirical support for green supply chain governance and relational capital frameworks.

Practically, the findings suggest that firms seeking Green Innovation Performance improvements should invest in cultivating relationship attractiveness with key partners. Transparent cooperation mechanisms and capability-building efforts in green technologies can amplify long-term performance gains. Especially in collaborative networks or platform-based ecosystems, RA can function as a strategic lever for sustainable innovation.

5.3. Future Research Directions

Although this study validates the dual-mediation model, it has several limitations that offer avenues for future research.

1) The data is cross-sectional and drawn from manufacturing enterprises within a specific region in China. Future studies could extend the analysis across diverse industries (e.g., service, digital platforms) and international contexts to enhance generalizability.

2) The study relies on self-reported data, which may introduce common method bias. Subsequent research could adopt multi-source data (e.g., performance records, third-party assessments) or longitudinal designs to improve causal inferences and validity.

3) RA is treated as a holistic construct. Future studies could explore its subdimensions—such as economic attractiveness, reputational value, and cooperative stability—to understand differentiated pathways of influence.

4) As green innovation is an ongoing and dynamic process, future research could incorporate dynamic capability theory or process-tracing methods to explore how relational and capability factors co-evolve over time, deepening insights into sustainable performance development.

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