Leveraging Green Innovation and Green Ambidexterity for Green Competitive Advantage: The Mediating Role of Green Resilient Supply Chain

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Leveraging Green Innovation and Green Ambidexterity for Green Competitive Advantage: The Mediating Role of Green Resilient Supply Chain

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A B S T R A C T

To mitigate global environmental impact, the textile industry must integrate environmental innovation and operational efficiency. This research delves into the influence of Green Innovation (GIV) and Green Ambidexterity (GAD) on the attainment of Green Competitive Advantage (GCG), with a specific focus on the crucial role played by Green Resilient Supply Chain (GRC) that prioritize sustainability. The study employs a cross-sectional explanatory survey method, drawing data from 150 textile companies in Indonesia. To comprehend the dynamic relationships between the variables at hand, the study adopts the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach. The findings demonstrate that Green Ambidexterity and Green Innovation directly enhance Green Competitive Advantage while also indirectly contributing through the establishment of Green Resilient Supply Chain. These results affirm that sustainable practices and Green Innovation are pivotal components of business strategies that align with regulatory and social expectations and bolster firms' competitive positioning. The implications of this study offer valuable insights for stakeholders, enabling them to formulate strategies that incorporate sustainability aspects into their business operations to achieve optimal outcomes in a fiercely competitive market context.

Keywords:
Green Innovation
Green Ambidexterity
Green Competitive Advantage
Green Resilient Supply Chain
Sustainability in Business

1. Introduction

The textile and textile products industry plays a critical role in the global economy, but it faces substantial sustainability challenges due to its heavy utilization of resources, such as water, energy, and raw materials (Loo et al., 2023; Švikruhová et al., 2023; Tummino et al., 2023). Indonesia, being a prominent player in the textile industry, not only consumes substantial resources through its production but also generates hazardous waste. If not appropriately managed, this waste can pose significant threats to the environment and exacerbate climate change. Effective management practices are necessary to prevent environmental damage and ensure the industry's sustainability (Chen et al., 2023; Tseng et al., 2023). To tackle these sustainability challenges, the concepts of sustainability and GIV are pivotal. These concepts encompass the development of environmentally friendly materials, utilizing renewable energy sources, and implementing efficient waste treatment technologies (Suki et al., 2023; Ullah et al., 2022). Such innovations are considered ethically responsible and provide a competitive advantage, aligning with the growing regulatory requirements and consumer demands for greener products (Ncube et al., 2023). Nevertheless, implementing these practices in Indonesia often faces obstacles such as high costs and a lack of awareness and commitment to sustainability (Sukayat et al., 2023; Fitriani & Ajayi, 2023).

The introduction of concepts such as green ambidexterity, green resilient supply chain, and GCG has become crucial for reducing environmental impact and strengthening market position (Ye & Lau, 2022; Sharma et al., 2023; Zhu & Wu, 2022; Pu et al., 2023). By adopting and implementing green strategies, textile companies are expected not only to comply with stringent environmental regulations but also to excel in industry competition, establish practical operational sustainability, and enhance competitiveness in an era of increasing sustainability (Švikruhová et al., 2023; Purnomo et al., 2024; Wiegand & Wynn, 2023). The creation and application of technologies, procedures, or goods that reduce

their negative effects on the environment is known as "green innovation." (Wu et al., 2023; Zhou et al., 2023). In the textile industry, this may involve the use of organic or recycled raw materials, more energy-efficient production processes, and environmentally friendly dyeing technologies (Harsanto et al., 2023; Moreira et al., 2023).

Meanwhile, green ambidexterity refers to a firm's capacity to simultaneously develop new green innovations and enhance the efficiency of existing operations. This entails adopting business models that can adapt to changes in the market and environmental regulations (Zomer & Savaget, 2023; Cancela et al., 2023). Green resilient supply chain refer to supply chains that can withstand and adapt to environmental changes, including shifts in climate, regulations, and consumer preferences. This involves implementing strategies such as supplier diversification, improved transportation efficiency, and the utilization of information technology to enhance supply chain visibility and cohesiveness (Torres-Rivera et al., 2023; Sezer et al., 2023; Holgado & Niess, 2023). The concept of GCG emphasizes the significance of sustainable competitive advantage through environmentally friendly business practices (Baah et al., 2023; Tan et al., 2022). In the context of the textile industry, companies that effectively harness GIV and ambidexterity can generate significant value-added benefits, such as enhancing their brand image among environmentally conscious consumers or accessing markets that prioritize eco-friendly products (Moreira et al., 2023; Cancela et al., 2023).

The integration of three key concepts - GIV, green ambidexterity, and green resilient supply chain - presents a comprehensive and sustainable strategy for addressing sustainability challenges in the textile industry (Mathiyazhagan et al., 2023; Sun et al., 2023). This study aims to explore the interconnectedness of these practices and their potential to create a sustainable competitive advantage for companies operating in this sector.

To address the growing pressure for environmental impact reduction, many companies, particularly those in resource-intensive industries like textiles, have embraced GIV and green ambidexterity as means to attain a GCG. However, while the importance of green resilient supply chain as a bridge between GIV and competitive advantage has been acknowledged, effective implementation of these practices into daily operations remains a challenge. Consequently, the focal issue revolves around how companies can overcome barriers and effectively integrate sustainable practices, thereby achieving optimal business sustainability and resilience.

This study investigates the impact of GIV and green ambidexterity on GCG in the textile industry, focusing on the crucial role of green resilient supply chain as a mediator in this relationship. Previous research has established a positive association between GIV and GCG. However, this study contributes to the literature by incorporating the role of green resilient supply chain as a critical mediating factor. By utilizing empirical data and conducting thorough analysis, this research aims to offer a more comprehensive understanding of how green innovative practices and business adaptability can contribute to the attainment of sustainable competitive advantage. Additionally, the study explores how green resilient supply chain promote the adoption of GIV, enhance the effectiveness of ambidexterity, and bolster market competitiveness.

Hence, this research introduces a novel perspective in the domains of sustainability and business strategy by presenting a new model that incorporates green resilient supply chain as mediators between GIV and GCG. This approach offers a fresh and significant viewpoint that has been rarely examined in previous literature, thereby paving the way for further theoretical and practical development. The proposed model addresses the existing knowledge gap and provides a broader comprehension of how green supply chain resilience can facilitate the adoption of GIV and enhance sustainable competitive advantage.

The findings of this study are anticipated to yield significant insights for business practitioners in devising and executing comprehensive sustainability strategies. By comprehending the pivotal function

of resilient and environmentally responsible supply chains as intermediaries, organizations can more efficiently incorporate GIV into their operational processes, consequently enhancing competitiveness within a demanding and dynamic market environment. This research contributes to the establishment of efficacious sustainability strategies and establishes a more robust framework for future sustainable development.

The subsequent section of this paper will be organized into distinct segments. The second part will delve into pertinent literature that substantiates the research hypothesis. The third part will elucidate the methodology employed to accomplish the research objectives. The fourth section will present the findings that aim to address the aforementioned hypothesis. The fifth section will engage in a discourse regarding interpreting the research findings within the framework of existing theory or research. Lastly, the conclusions will be expounded upon, encompassing implications and potential avenues for future research.

2. Literature Review

2.1 The Role of Green Ambidexterity in Achieving GCG

Green ambidexterity, which refers to an organization's ability to both explore new environmental technologies and exploit existing ones, has been found to have a positive and direct influence on GCG (Saleh et al., 2023; Yu et al., 2023; Cancela et al., 2023). This finding underscores the significance of striking a balance between innovation and efficient implementation in order to achieve sustainable business practices that offer a competitive edge (Chen & Gao, 2022; Reyad et al., 2022). Ambidextrous companies effectively implement GIV strategies that not only support sustainable development and competitive advantage but also manage to balance exploration and exploitation in their pursuit of strategic and environmental objectives (Cancela et al., 2023; Zhang et al., 2022; Guo et al., 2022; Huang et al., 2020).

The literature examined in this review reveals that green ambidexterity plays a crucial role in enhancing firms' competitive advantage by facilitating the exploration of new innovations and the exploitation of existing capabilities. However, further research is needed to evaluate the impact of green ambidexterity in different industry contexts. Hence, it can be conjectured that:

H_1: *Green Ambidexterity has a positive and direct effect on GCG*

2.2 The Role of Green Ambidexterity in Achieving Green resilient supply chain

Green ambidexterity is a crucial factor in promoting the development of green resilient supply chain that prioritize sustainability by incorporating sustainability principles into strategic decision-making processes. This approach facilitates adaptability and resilience within supply chains, mainly in the face of disruptive events for instance the ongoing pandemic (Sharma et al., 2023; Sun et al., 2023). By effectively balancing exploration and exploitation innovation capabilities, companies can effectively harness supply chain learning to enhance their sustainability performance (Mathiyazhagan et al., 2023; Silva et al., 2023). Moreover, placing emphasis on efficient information integration encourages the adoption of both explorative and exploitative practices, which is critical for the establishment of resilient supply chain that prioritize sustainability (Lyu et al., 2022).

The integration of learning mechanisms within supply chains has proven to enhance sustainability outcomes through the cultivation of ambidextrous capabilities. Therefore, these findings collectively

highlight the significance of learning mechanisms and ambidextrous capabilities in driving sustainability and resilience within supply chains (Sun et al., 2023; Li et al., 2023). Existing literature underscores the positive impact of green ambidexterity in bolstering supply chain resilience. However, this review identifies gaps in our understanding of which specific green ambidexterity practices are most effective in enhancing the green resilient supply chain that prioritize sustainability. This suggests the need for further research in this area. Based on these observations, we conclude that:

H_2: *Green Ambidexterity has a positive and direct effect on Green Resilient Supply Chain*

2.3 The Role of GIV in Achieving GCG

GIV practices play a crucial role in achieving exceptional market performance by integrating environmentally friendly solutions that align with GCG (Novitasari & Agustia, 2023). The concept that eco-friendly activities immediately boost a company's competitive advantage supports the relationship between GIV and market performance (Lestari & Sunyoto, 2023). This integration not only drives economic gains but also contributes to sustainable environmental impacts, making it a dual-purpose strategy that aligns with corporate goals and the global sustainability agenda (Bintara et al., 2023). Companies that engage in GIV, such as implementing environmentally friendly production patterns and corporate social responsibility, gain a competitive advantage, access new markets, and enjoy sustainable growth (Truong & Berrone, 2022; Lubacha & Wendler, 2021).

GIV plays a vital role in shaping the economy by influencing various aspects such as environmental impact, energy efficiency, and carbon emissions (Galván-Vela et al., 2023; Nan et al., 2022). Research shows that GIV can lead to sustainable economic development (Miao et al., 2023). It has been demonstrated to have a favorable effect on lowering environmental impact, lessening the effects of climate change, and increasing energy efficiency in both small and large businesses (Wang et al., 2023). Additionally, GIV is linked to improved environmental innovation performance, which can contribute to economic growth and GCG at the macroeconomic level (Gąsior et al., 2022). Therefore, encouraging GIV benefits the environment, can drive GDP growth, and provides broader GCGs to the economy on a larger scale (Asghar & Muhammad Zahir Faridi, 2022). The literature reviewed consistently supports the hypothesis that GIV directly contributes to GCG and emphasizes the importance of integrating sustainable practices in key business strategies to improve market performance. The review also identified the need for a framework to measure the quantitative impact of GIV on GCG and proposed a research agenda for the future development of this methodology. Thus, we surmise:

H_3: *GIV has a positive and direct effect on GCG*

2.4 The Role of GIV in Achieving Green Resilient Supply Chain

Improving the performance of an organization as a whole and its green resilient supply chain depend heavily on GIV. Research demonstrates that the adoption of GIV technology has a positive influence on firms' willingness to adopt innovative technologies, thereby improving the resilience and performance of supply chains (Li & Liu, 2023). Additionally, by mediating the relationship between Blockchain Technology (BCT) adoption and environmental supply chain performance, the creative application of BCT can improve the sustainability and resilience of green supply chains, especially in uncertain circumstances (Yuan et al., 2023; Mohamed et al., 2023).

Both internal and external GIV are essential for achieving environmental sustainability and strengthening green supply chains by improving resource management and mitigating environmental impacts (Amann et al., 2014). Studies indicate that internal and external environmental orientation significantly influences sustainable supply chain management practices, leading to enhanced

environmental, social, and economic performance (Wang & Ozturk, 2023). Additionally, GIV, intellectual capital, and supply chain management practices contribute positively to business sustainability, underscoring the importance of GIV in driving sustainability and competitiveness initiatives (Naila et al., 2023). Furthermore, collaboration with suppliers and customers within the supply chain has a substantial impact on GIV, highlighting the significance of extensive supply chain collaboration in promoting environmental responsibility and performance (Afghah et al., 2023; Suki et al., 2022). The literature consistently supports the hypothesis that GIV has a positive impact on the green resilient supply chain. This review underscores the transformative potential of GIV in reshaping supply chain management and underscores the need for further empirical research to quantify these impacts and refine implementation strategies. Therefore, we conclude:

H_4: *GIV has a positive and direct effect on Green Resilient Supply Chain*

2.5 The Role of Green Resilient Supply Chain in Achieving GCG

Green resilient supply chains are crucial for enabling companies to adapt and thrive in a dynamic environment, ultimately leading to long-term GCG (Safari et al., 2024). Green resilient supply chains can effectively respond to disruptions through investments in flexibility, innovation, and knowledge-based strategies (Mathiyazhagan et al., 2023; Vahid et al., 2023). By integrating dynamic capabilities and relational perspectives, green resilient supply chains improve sustainable operational performance, including market performance and quality (Sharma et al., 2023). Another study emphasizes the importance of combining resilience with sustainability to ensure business continuity and success in a rapidly changing landscape, where factors such as agility, a green perspective, and Industry 4.0 technologies are key to building a green resilient supply chain (Pu et al., 2023). The integration of this green resilient supply chain not only helps reduce disruptions but also promotes GCG so that companies can adapt and innovate (Setiawan et al., 2023; Wang et al., 2023).

A major factor in strengthening the green resilient supply chain and, thus, raising the GCG is the incorporation of digital technology into the green supply chain (Yang et al., 2023). The findings of various studies emphasize that digital transformation enhances the ability of green resilient supply chains, positively affecting GCG (Li et al., 2023; Song & Hu, 2023; Ning & Yao, 2023). In addition, the adoption of new technologies, such as Blockchain Technology, can enhance sustainability and green resilient supply chains in uncertain environments, leading to improved environmental supply chain performance (Wang et al., 2023; Yavari & Ajalli, 2021). Furthermore, the adoption of Green Supply Chain Digital Transformation practices, supported by innovative digital technologies, contributes to improved performance in Green Supply Chain Management, as well as highlighting the importance of digital transformation in achieving environmental sustainability and GCG (Mustafa et al., 2023; Zameer et al., 2022).

The reviewed literature strongly supports the hypothesis that a green resilient supply chain significantly contributes to a firm's GCG All of these studies highlight how crucial it is to incorporate resilient and environmentally friendly methods into supply chain management in order to promote sustainability and competitive advantage. Thus, we conjecture:

H_5: *Green Resilient Supply Chain has a positive and direct effect on* GCG

2.6 The Role of Green Ambidexterity in Achieving GCG through the Green Resilient Supply Chain

Green supply chain management practices have been found to enhance GCG, which is reflected in operational efficiency and continuous innovation. These factors are crucial for sustainable firm growth (Uddin et al., 2023; Sun et al., 2022). The ability of businesses to investigate innovations while using

current efficiencies is known as "green ambidexterity." This capability enables firms to better adapt to changing markets and environmental regulations (Saleh et al., 2023; Cancela et al., 2023). Enterprises may strategically enhance their knowledge-driven, environmentally resilient supply chain by employing Industry 4.0 technology and giving priority to socially sustainable supply chains. Ultimately, this leads to a more significant GCG (Sharma et al., 2023; Singh et al., 2023).

Other research suggests that green resilient supply chains play a crucial role in mediating between green ambidexterity and achieving a more significant GCG. It is widely acknowledged that resilience and sustainability are essential for success in a fast-paced corporate environment (Mathiyazhagan et al., 2023; Sezer et al., 2023). Green resilient supply chain, enhanced by these practices, are vital for addressing environmental disruptions and risks, and they often serve as a mediator between sustainability and GCG. Therefore, the green resilient supply chain is a crucial element that mediates between green ambidexterity and better outcomes in terms of GCG (Mathiyazhagan et al., 2023; Mohamed et al., 2023; Sharma et al., 2023).

The existing literature supports the hypothesis that green ambidexterity indirectly increases GCG through the implementation of green resilient supply chain. This review contributes to our understanding of how the dynamic capabilities facilitated by green ambidexterity can be utilized to drive green resilient supply chain. By doing so, it fills an important gap in the current literature on sustainable supply chain management and competitive strategy. Therefore, we hypothesize:

H_6: *Green Ambidexterity has an indirect positive effect on GCG through the Green Resilient Supply Chain*

2.7 The Role of GIV in Achieving GCG through the Green Resilient Supply Chain

Green supply chain management practices collaborate closely with GIV to create synergies that improve operational performance and environmental sustainability, helping companies gain an edge in an increasingly environmentally conscious market (Lai et al., 2023; Assumpção et al., 2023). GIV not only improves processes and products but also strengthens a firm's reputation as a leader in sustainability, which is crucial in today's competitive market (Taneja et l., 2023; Olaleye, 2023). Another study emphasizes that GIV and reputation are critical for companies striving for business excellence and environmental compliance (Galván-Vela et al., 2023). Moreover, GIV leads to economic success and contributes significantly to GCG (Becker, 2023; Chen et al., 2023).

Supply chain resilience, supported by green practices, acts as a mediator between GIV and gaining GCG, facilitating firms to survive and excel in a dynamic market environment. Research highlights how GIV solutions improve supply chain performance and resilience (Li & Liu, 2023). Moreover, adopting green supply chain management measures reduces environmental costs, further improving supply chain performance through agility and resilience (Ghaderi et al., 2023). Digital transformation is also highlighted as a significant driver of green resilient supply chains, with supply chain process integration mediating this relationship, especially under environmental uncertainty (Yuan et al., 2023). As such, the continuous integration of innovation forms a solid foundation for GCG, with green resilient supply chain playing a pivotal role in mediating this positive impact on the overall firm success (Mohamed et al., 2023).

The reviewed literature consistently supports the hypothesis that GIV indirectly influences GCG through the green resilient supply chain. These studies illustrate that integrating sustainable innovation into supply chain practices mitigates environmental impacts and enhances the green resilient supply chain, which is critical for achieving GCG in the marketplace. Thus, we surmise:

H_7: *GIV has an indirect positive effect on GCG through the Green Resilient Supply Chain*

We hereby present a robust conceptual research model (refer to Figure 1) that has been developed based on an extensive literature review and rigorous testing of hypotheses in numerous studies.

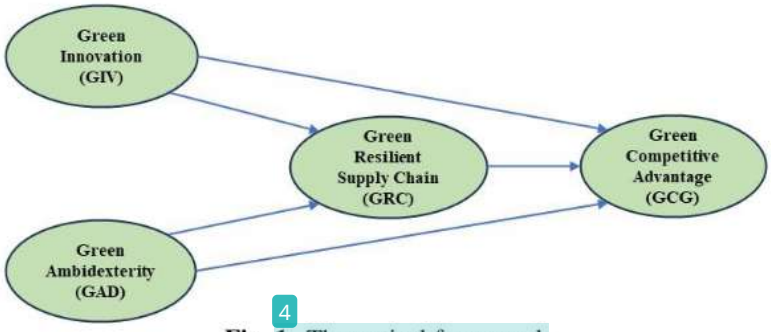

Fig. 1. Theoretical framework

3. Methodology

3.1 Research Design

The explanatory survey method is considered to be an optimal tool for examining causal relationships between variables and determining how an event may be impacted or altered by the influence of other variables (Strydom, 2014). As such, it is the most appropriate approach for fulfilling the objectives of this study. However, this research employs a cross-sectional method in terms of time frame. This implies that data is gathered from a subset of the population (in the form of sample responses) in order to gauge the opinions of this subset pertaining to the subject being investigated. Multiple data collections are not conducted (Sekaran & Bougie, 2013).

3.2 Data Source and Sampling Techniques

Before commencing the survey, a total of 23 questions were formulated in a comprehensive questionnaire. The questionnaire was constructed utilizing a seven-point Likert scale and was grounded on the four variables delineated in the conceptual research model. In order to ascertain that respondents possessed a profound comprehension of the questions, the questionnaire was translated into Indonesian. Subsequently, a pilot test encompassing 30 participants was conducted to guarantee a satisfactory level of understanding regarding the survey instrument prior to its dissemination amongst the research sample.

The research questionnaire was distributed online to 200 upstream and medium-sized textile companies in Indonesia, specifically in the provinces of Banten, West Java, and Central Java. The choice of these research locations was based on the concentration of upstream and middle-sector textile companies exclusively in these three provinces in Indonesia. The respondents consisted of human resources managers, production managers, or marketing managers, selected by the CEO due to their extensive

knowledge of the variables under investigation. Out of the 200 questionnaires distributed, only 150 responses were completed and deemed eligible for further analysis.

This research analysis utilizes Variance-based Partial Least Squares Structural Equation Modeling (PLS-SEM). The PLS-SEM model investigates the interconnectedness among variables, including moderator variables. The measurement model was assessed using SmartPLS 3.0 to ensure the construct variables' validity and reliability, following the guidelines proposed by Sarstedt et al. (2016). Despite the non-normal distribution of the data, the study validates the conceptual model through the implementation of PLS-SEM (Hair et al., 2022; Ringle et al., 2022).

4. Results

PLS-SEM is employed for assessing the research model. The assessment comprises two components: the inner and outer models. The outer model evaluation confirms its validity and reliability. To establish convergent validity, a factor loading value of at least 0.7 and an average variance extracted (AVE) value of at least 0.5 are required. Meanwhile, discriminant validity is assessed by ensuring that the correlation between latent constructs exceeds the square root of AVE (Fornell-Lacker criterion). The reliability of the model was evaluated using composite reliability (≥ 0.70) and Cronbach's alpha (≥ 0.70). Subsequently, an Inner Model Evaluation was conducted to predict the relationship between latent variables. The evaluation criteria for the Inner Model include the Statistical T Value, P-value, and R-squared value (coefficient of determination). If the R-squared values are 0.75, 0.5, and 0.25, it can be concluded that exogenous factors have a strong, moderate, or weak influence on endogenous variables, respectively. To determine the significance of the relationship between variables at a 5% level of significance, Hair et al. (2022) recommend utilizing a t-value greater than 1.65 and a P-value less than 0.05.

4.1 Outer Structural Model Results

Based on the findings presented in Table 1, it can be observed that each indicator meets the criteria for Convergent Validity, as evidenced by a Factor Loading of ≥ 0.7 and an AVE value of ≥ 0.5. With regard to the assessment of the outer model, these results are taken into consideration. Moreover, Table 2 provides evidence that the condition of discriminant validity has been met, as indicated by the square root of the AVE (Fornell-Lacker criterion) surpassing the correlation between latent components. Furthermore, the model exhibits a Composite Reliability of ≥ 0.70 and a Cronbach's Alpha of ≥ 0.70, which signifies that it meets the standards of reliability.

Table 1.
Validity and Reliability of the variables

Vbl	Idt	FaLo	Crb_α	Cps_Re	AV_E
Green Innovation (GIV)			.967	.973	.860
V1	implemented additional environmental protection programs beyond regulatory requirements	.924			
V2	uses the latest green technology	.944			
V3	use green energy	.940			
V4	minimizing the utilization of environmentally hazardous raw materials	.904			

Vbl	Idt	FaLo	Crb_α	Cps_Re	AV_E
V5	treatment of production waste in compliance with environmentally sustainable regulations.	.924			
V6	use of recycled raw materials	.927			
Green Ambidexterity (GAD)			.972	.977	.876
D1	improve manufacturing processes to reduce waste	.929			
D2	train employees in green programs	.949			
D3	continuous improvement to increase operational efficiency	.941			
D4	exploring new ways to protect the environment	.932			
D5	explore new ways to collaborate with supply chain partners to protect the environment	.931			
D6	exploration of innovative technologies for environmental protection	.934			
Green Resilient Supply Chain (GRC)			.977	.981	.896
C1	consider the environment and have a program in place to manage material supply disruptions	.944			
C2	sharing information with suppliers and distributors to manage supply chain disruptions and protect the environment	.947			
C3	have flexible alternative sources of supply	.954			
C4	optimize inventory levels across the supply chain	.954			
C5	streamline integration throughout the supply chain to protect the environment	.946			
C6	have an action plan for dealing with supply chain disruptions and protect the environment	.934			
Green Competitive Advantage (GCG)			.957	.967	.856
G1	outperformed competitors in environmental protection costs	.932			
G2	outperforms competitors in environmentally friendly product quality	.966			
G3	outperforms competitors in investment in green programs	.954			
G4	outperforms competitors in managing green programs	.820			
G5	outperforms competitors in reducing environmental costs over the long term	.946			

Vbl = Variables, Idt = Indicators; FaLo = Factor Loading; Crb_α = Cronbach's alpha; Cps_Re = Composite Reliability; AV_E = AVE

Table 2.
Fornell–Larcker criteria (discriminant validity)

	GAD	GCG	GIV	GRC
GAD	.936			
GCG	.998	.925		
GIV	.998	.998	.927	
GRC	.999	.998	.998	.947

4.2 Inner Structural Model Results

The evaluation criteria of the Inner Model utilize the R-squared value (coefficient of determination), Statistical T Value, and P-value. According to Table 3, an average R-Squared value exceeding 0.75 signifies a substantial impact of GIV and GAD as exogenous variables on the endogenous variables, namely GCG and GRC.

Table 3.
R-Squares (determinant coefficient)

	R_Sq	R_Sq_A
GCG	.998	.998
GRC	.998	.998

R_Sq = R Square; R_Sq_A = R Square Adjusted

To determine the significance of the influence between variables at a significance level of 5%, a t-value greater than 1.65 and a P-value less than 0.05 must be used. Upon comparing Table 4 and Fig. 2, it is clear that all hypotheses are accepted, indicating a direct or mediated positive relationship. Based on the findings presented in Table 5, the analysis of the research model reveals that the overall indirect impact, mediated by GRC, of GAD on GCD amounts to 0.180. Similarly, the indirect impact, mediated by GRC, of GIV on GCD is reported to be 0.127.

Table 4.
Hypothesis Testing Conclusion for all research hypotheses

Hypo	β	O	SDD	T_Sta	P_Va	Hy_TC
Hyp1: GAD -> GCG	.283	.283	.116	2.449	.007	Acp
Hyp2: GAD -> GRC	.586	.586	.091	6.433	.000	Acp
Hyp3: GIV -> GCG	.409	.409	.059	6.939	.000	Acp
Hyp4: GIV -> GRC	.414	.414	.091	4.543	.000	Acp
Hyp5: GRC -> GCG	.307	.307	.122	2.516	.006	Acp
Hyp6: GAD -> GRC -> GCG	.180	.180	.076	2.357	.00941	Acp
Hyp7: GIV -> GRC -> GCG	.127	.127	.060	2.112	.0176	Acp

Hypo = Hypothesis; β = Path Coefficients O = Original Sample; SDD = Standard Deviation; T_Sta = T Statistics; P_Va = P Value; Hy_TC = Hypothesis Testing Conclusion; Acp = Accepted

Table 5.

Total Indirect Effects

	GAD	GCG
GAD		.180
GCG		
GIV		.127

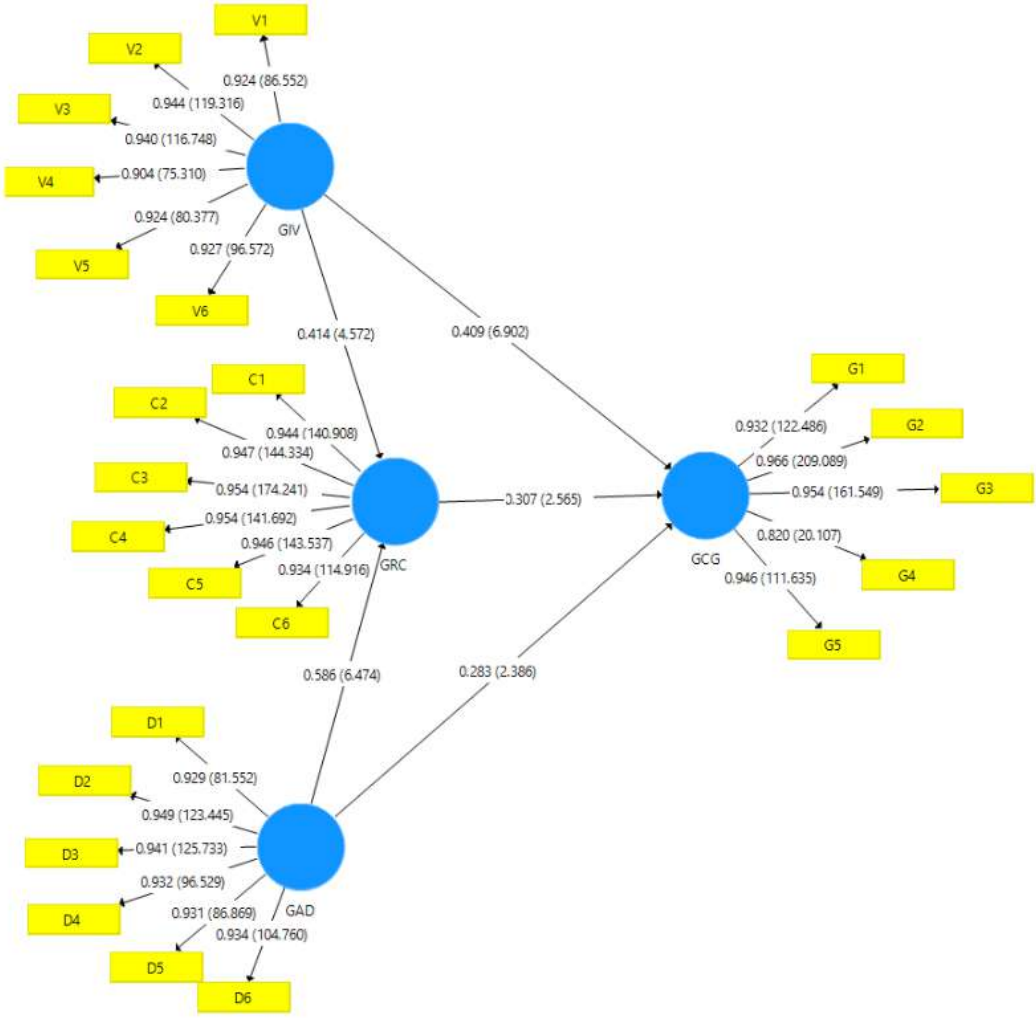

Fig. 2. The summary of the model from Bootstrapping results: Path coefficient, Factor Loading, and T-Values

5. Discussion

This research examines the utilization of green resilient supply chains within the Indonesian upstream and medium-sector textile industry as a means to acquire a competitive advantage in terms of

environmental sustainability. Furthermore, it investigates the influence of green ambidexterity and GIV on this particular phenomenon.

The results of H1 indicate that green ambidexterity has a positive and direct impact on GCG. Green ambidexterity refers to an organization's capacity to effectively and efficiently balance both environmental innovation and operational efficiency. This in turn enables the company to gain a substantial GCG (Zomer & Savaget, 2023; Hart, 2017). In practical terms, companies that adopt green ambidexterity tend to achieve sustainable innovation that meets and often exceeds relevant environmental standards. This enhances their efficiency, strengthens their brand image, and meets customer expectations, thereby creating meaningful differentiation in a competitive market (Saleh et al., 2023; Porter & Van der Linde, 2017). From a theoretical perspective, green ambidexterity is highly relevant to dynamic capabilities and resource-based theories (Teece et al., 1997; Barney, 1991). Dynamic capabilities theory explains how companies adapt, integrate, and reconfigure their internal capabilities to cope with a rapidly changing business environment, including the pressure to become more sustainable. On the other hand, resource-based theory views green ambidexterity as a rare and valuable strategic resource that enables companies to develop and sustain competitive advantages (Barney, 1991). The contribution of green ambidexterity in this context lies in its ability to generate innovative products and services that are environmentally friendly while maintaining a balance between the company's environmental and financial performance. Therefore, the contribution of green ambidexterity to GCG is both practically relevant and grounded in a strong theoretical foundation within the strategic management literature.

The results of H2 support the notion that green ambidexterity has a positive and direct impact on green resilient supply chains. Organizations that embrace green ambidexterity practices demonstrate a heightened ability to address environmental risks and disruptions, as they take proactive measures to adopt eco-friendly technologies and efficient operational processes (Zomer & Savaget 2023; Seuring & Müller, 2008). This proactive approach not only aids in the reduction of operational costs but also guarantees compliance with rigorous environmental regulations, thereby augmenting the overall green resilient supply chain (Katou et al., 2023; Kleindorfer et al., 2005). From a strategic standpoint, the adoption of green ambidexterity enables companies to position themselves as leaders in sustainability, which can serve as a crucial differentiating factor in the eyes of environmentally conscious consumers and investors (Hejazi et al., 2023; Porter & Kramer, 2006). Furthermore, organizations that successfully implement this strategy often experience improved stakeholder relationships, including those with suppliers and customers who recognize the significance of sustainable business practices. Consequently, green ambidexterity fosters an enhanced reputation, increased market access, and strengthened customer loyalty (Hart & Dowell, 2011). Therefore, by incorporating sustainable practices into product development and production processes, green ambidexterity encourages companies to build supply chains that are more resilient and capable of adapting to ever-growing environmental and social pressures.

The results of H3 confirm that GIV has a positive and direct effect on GCG. GIV, involving the creation and application of novel products, methods, and operational strategies to reduce adverse environmental effects, is essential for gaining a competitive edge in sustainability (Chen et al., 2023; Chen, 2008). GIV enables companies to create sustainable differentiation in the market by improving resource use efficiency, reducing operational costs, and enhancing their reputation as sustainability leaders. This, in turn, contributes to increased customer loyalty and new market potential, which are essential for strengthening competitive advantage (Zhou et al., 2023; Ambec & Lanoie, 2008). Furthermore, a great deal of scholarly literature has been written about the connection between GIV and GCG, demonstrating that adopting GIV responds to environmental regulatory requirements and stimulates successful commercial innovation (Becker, 2023; Dangelico & Pontrandolfo, 2010). Prior studies have demonstrated that companies that proactively engage in GIV often outperform their competitors in terms

of financial and market performance because these green practices establish a solid foundation for long-term growth and sustainability (Endo, 2008). Thus, not only does GIV theoretically contribute to GCG, but it is also supported by empirical evidence that demonstrates a positive correlation between GIV and the achievement of competitive advantage in day-to-day business operations. This provides a robust basis for companies to continue developing and integrating GIV into their business strategies to fortify their market position and ensure long-term business sustainability.

The results of H4 confirm that GIV has a positive and direct effect on green resilient supply chain. GIV is crucial for the establishment and maintenance of resilient and sustainable supply chains. By implementing innovative and environmentally friendly technologies and processes, companies can reduce their carbon footprint, minimize waste, and optimize the utilization of natural resources (Osório et al., 2023; Asif, 2023). Moreover, GIV provides assistance to companies in fulfilling and potentially exceeding environmental regulatory obligations. This, in turn, improves the overall efficiency and green resilient supply chain, particularly when faced with market fluctuations and external pressures (Seuring & Müller, 2008; Theyel, 2000). Aligned with contemporary business models, GIV supports the notion of a circular economy, wherein emphasis is placed on reuse, recycling, and waste reduction (Liu & Wang, 2022). This not only reinforces the resilience of the supply chain but also positions the company as a sustainability leader, capturing the attention of environmentally conscious investors and consumers (Siedschlag et al., 2022). Furthermore, the incorporation of GIV in the supply chain has a positive impact on enhancing a company's financial performance, as evidenced by organizations that have integrated sustainability principles into their core business strategies (Linton et al., 2007). Therefore, GIV entails enhancing supply chain efficiency and fostering a paradigm shift in the way businesses perceive the relationship between the environment, society, and the economy to achieve a green resilient supply chain.

The findings of H5 offer support for the notion that green resilient supply chains have a positive and direct impact on GCG. Resilient and sustainable supply chains enable companies to effectively respond to environmental and market disruptions, while also ensuring compliance with stringent environmental standards (Mathiyazhagan et al., 2023). These practices enhance operational efficiency, mitigate environmental risks, and bolster a company's reputation in the eyes of customers and stakeholders, thereby directly enhancing competitive advantage (Holgado & Niess, 2023; Pagell & Shevchenko, 2014; Awaysheh & Klassen, 2010). In the context of existing theory, the presence of green resilient supply chains aligns with the principles of the Resource-Based View (RBV) theory. This theory recognizes that sustainable resources and risk management capabilities are unique and valuable assets that can generate sustainable competitive advantages (Barney, 1991; Hart, 1995). Viewing supply chains through the lens of the RBV theory suggests that environmental resilience indicates the scarcity of resources and the difficulty for competitors to imitate them, thus establishing a barrier to entry and aiding companies in maintaining a superior market position over the long term (Torres-Rivera et al., 2023). Therefore, the significance of a green resilient supply chain in the domain of GCG is manifested through tangible advantages for companies, as it serves as a nexus between environmental sustainability and green business performance.

The findings of H6 support the notion that green ambidexterity has an indirect positive impact on GCG through the implementation of a green resilient supply chain. Green ambidexterity, defined as the ability of a company to effectively manage and implement environmental innovations while maintaining operational efficiency, plays a crucial role in strengthening the resilience of green supply chains (Sun et al., 2023). By adopting an ambidextrous approach, companies are able to not only innovate greener products and processes, but also enhance their resource and risk management capabilities, indirectly leading to improved operational resilience (Saleh et al., 2023). This provides a strong basis for the creation of long-term competitive advantages since green resilient supply chain make it easier for businesses to react swiftly to shifting market dynamics and environmental laws (Vachon & Klassen,

2006; Jabbour et al., 2013).The dynamic capacities hypothesis states that green ambidexterity helps businesses to efficiently and quickly respond to environmental changes by allowing them to continuously integrate, reconfigure, and adapt both internal and external resources (Saeed et al., 2023; Teece et al., 1997). Through this perspective, the resilience of the supply chain, bolstered by green ambidexterity, ensures operational sustainability and fosters competitive advantage by enhancing the capacity for adaptation and innovation (Munir et al., 2023). This relationship highlights how green ambidexterity contributes directly and indirectly to the enhancement of green supply chain resilience (Beske et al., 2014). Thus, as a mediator between green ambidexterity and GCG, the green resilient supply chain reinforces the concept of environmental sustainability, not only by creating direct added value but also by serving as a key factor in achieving long-term competitive advantage.

The findings of H7 provide confirmation of the indirect positive influence of GIV on GCG through the establishment of a green resilient supply chain. GIV, which encompasses the development and implementation of environmentally friendly solutions across an organization's operations, contributes significantly to the construction of a resilient supply chain that prioritizes sustainability (Liu, 2023). This type of innovation entails developing sustainable goods and operating procedures that reduce their negative effects on the environment and improve resource efficiency (Alkhatib, 2023). By enhancing the sustainability and resilience of supply chains, GIV enables companies to effectively navigate market fluctuations and regulatory pressures, ultimately bolstering their competitive advantage within a green and sustainable marketplace (Chen et al., 2023; Gold et al., 2010; de Sousa Jabbour et al., 2018). Theoretically, this link is consistent with the ideas of dynamic capacities theory, which clarifies an organization's ability to incorporate, build, and reorganize internal and external resources in reaction to a business environment that is changing quickly (Huang & Xiao, 2023; Chen et al., 2023; Teece et al., 1997). As a component of dynamic capabilities, GIV facilitates continuous adaptation and innovation, thereby not only meeting but often surpassing current environmental requirements. This approach fortifies the resilience of the supply chain, establishes a sustainable competitive advantage, and supports the evolving demands for sustainability in the business landscape (Yi & Demirel, 2023; Hart & Dowell, 2011). Thus, this research demonstrates that GIV also exerts a significant indirect impact through the establishment of a green resilient supply chain, serving as a pivotal element in the attainment of GCG and the realization of an overarching sustainable strategy.

The recommendations from this research are as follows: Firstly, companies are advised to implement environmentally friendly practices not only as a response to environmental regulations but also as a strategic tool to achieve competitive differentiation and market leadership. Secondly, companies are encouraged to increase their implementation of green ambidexterity practices, which have been empirically shown to directly enhance GCG and supply chain resilience. By striking a balance between environmental innovation and operational efficiency, companies can fortify their market position while supporting long-term sustainability. This approach also facilitates swift adaptation to market and regulatory changes, leading to considerable differentiation and heightened customer loyalty. Thirdly, it is highly recommended that GIV be integrated into all operational aspects and product strategies, as this not only enhances supply chain resilience but also fosters competitive advantage. GIV enables companies to surpass environmental compliance standards and capture the attention of environmentally conscious investors and consumers. This strategy indirectly promotes competitive advantage by enhancing financial performance and operational sustainability. Fourthly, to further bolster green resilient supply chain, it is advised to invest in environmentally friendly innovations that align with dynamic market conditions and regulatory requirements. Finally, fostering a culture that prioritizes environmentally sustainable practices at all organizational levels can significantly contribute to achieving sustainable competitive advantage and cultivating improved relationships with stakeholders.

6. Conclusion and Implications

This study uncovers the direct contribution of green ambidexterity and green innovation to green competitive advantage and their positive impact on the development of green resilient supply chains. Green ambidexterity, defined as a company's ability to effectively manage both environmental innovation and operational efficiency, not only enhances competitive advantage directly but also through the establishment of green resilient supply chains. Moreover, green innovation, encompassing the creation of environmentally friendly products and processes, also plays a significant role in bolstering the resilience and sustainability of supply chains, thus increasing competitive advantage. The integration of sustainable practices into business strategies is imperative for achieving long-term sustainability and gaining a competitive advantage in markets. This is why the green resilient supply chain plays a pivotal role as a mediator between green ambidexterity and green innovation and green competitive advantage. In essence, these findings lend support to the notion that adhering to sustainable practices and implementing environmentally friendly innovations not only meet regulatory and social expectations but also serve as integral competitive strategies. This research combines dynamic capabilities theory and resource-based theory to demonstrate how these distinctive capabilities can act as a source of sustainable competitive advantage.

The implications of the research findings for practical applications in the field of sustainable business management are as follows: Firstly, companies can enhance their responsiveness to environmental and social sustainability demands by focusing on aspects such as green ambidexterity, green innovation, and green resilient supply chains. Secondly, by comprehending the significance of a green resilient supply chain in attaining a competitive advantage in the green sector, companies can incorporate sustainable practices at every stage of their supply chain. This includes activities ranging from raw material procurement to product distribution. By integrating green innovation, businesses can improve resource efficiency, mitigate environmental risks, and strengthen relationships with their business partners. Consequently, the practical implications of this research extend to internal company performance, relationships with external stakeholders, and the company's competitive positioning within the increasingly complex global market.

However, it is worth noting that this research has certain limitations. For instance, it does not consider other variables such as the influence of green leadership or factors related to organizational culture that may impact the implementation of green practices. Additionally, future studies should take into account external factors that could affect the implementation of sustainable strategies. These factors may include changes in government regulations, technological advancements, and global market dynamics. A more thorough grasp of the elements affecting the performance of sustainable solutions in a larger context can be attained by adding more variables and dimensions to the analysis.

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