Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 2, 984-999
2025
Publisher: Learning Gate
DOI: 10.55214/25768484.v9i2.4638

Green intellectual capital driving green competitive advantage: The mediation of green innovation and transformational leadership

Ngoc Duong Pham[1*], Quoc Tri Pham[2], Tuan Nguyen[2], Vinh Hoa Ho[2], Duc Hieu Tham[2]
[1]Faculty of Commerce University of Finance – Marketing, 778 Nguyen Kiem, Phu Nhuan District, Ho Chi Minh City, Vietnam; ngocduongx@ufm.edu.vn (N.D.P.).
[2]University of Economics and Finance – UEF, Vietnam; phamquoctri@thanhdosg.com (Q.T.P.) nguyentuanbaoviet@gmail.com (T.N.) hoahv22mba@uef.edu.com (V.H.H.) hieutd22mba@uef.edu.vn (D.H.T.).

Abstract: This article explores the complex relationships between Green Intellectual Capital (GIC), Green Innovation (GIN), Transformational Leadership (TFL), and Green Competitive Advantage (GCA), with a focus on the mediating roles of GIN and TFL in the connection between GIC and GCA. Using quantitative data collected from 315 directors and departmental managers in the manufacturing industry in Vietnam, the study applied a second-order PLS-SEM approach to analyze the relationships. The findings show that GIC positively influences GIN, TFL, and GCA, with GIN and TFL also exerting positive effects on GCA. Additionally, GIN and TFL serve as partial mediators in the relationship between GIC and GCA. This research contributes to sustainability management literature by offering new insights into the factors driving green competitive advantage. By integrating GIC, GIN, and TFL into a unified model, the study provides valuable strategic implications for firms seeking to develop sustainable competitive advantages through green innovation and leadership.

Keywords: *Green Competitive Advantage, Green Innovation, Green Intellectual Capital, Transformational Leadership.*

1. Introduction

In today's context, where environmental concerns have become a central priority, an increasing number of enterprises are adopting eco-friendly strategies to align their operational goals with the imperatives of sustainable development [1]. This transition is particularly critical in the food industry, a major contributor to anthropogenic greenhouse gas emissions, accounting for approximately 26% of global emissions [2]. Given the sector's pivotal role in the economic structure of the Southeast region of Vietnam, mitigating its environmental impact is imperative. As the region grapples with rising levels of environmental degradation and pollution [3], reducing emissions from this industry has become an urgent necessity.

Driven by regulatory mandates and increasing consumer demand for environmentally sustainable products, GCA has emerged as a critical strategic approach. GCA not only ensures organizational compliance with environmental regulations but also fosters long-term economic value and sustainable growth. Within the food industry, GCA extends beyond traditional benefits such as cost reduction and product quality enhancement; it encapsulates the ability to implement innovative green strategies that are difficult for competitors to replicate, thereby securing a significant competitive advantage [4].

A critical strategy for achieving GCA resides in the effective deployment of GIC, which encompasses intangible assets such as knowledge, competencies, and relational networks related to environmental stewardship and green innovation at both individual and organizational levels [5]. Intellectual capital plays a vital role in enhancing organizational performance, and the concept of GIC has become essential for comprehending environmental management through the development of green

History: Received: 9 December 2024; Revised: 27 January 2025; Accepted: 29 January 2025; Published: 7 February 2025
* Correspondence: ngocduongx@ufm.edu.vn

initiatives [6]. However, the effective utilization of GIC does not always guarantee the anticipated realization of GCA [7], necessitating further exploration of the mediating factors that could optimize the relationship between GIC and GCA.

Among the potential mediators, TFL and GIN emerge as particularly influential. TFL, characterized by visionary and inspirational leadership, facilitates the transmission of the impact of GIC in enhancing GCA [7]. Concurrently, GIN bolsters an organization's capacity for environmental innovation, promotes the development of eco-friendly products and sustainable production processes, and plays a pivotal role in connecting GIC to GCA [8]. However, empirical research examining the mediating roles of TFL and GIN in the GIC-GCA relationship remains significantly underexplored. Notably, no existing study has comprehensively integrated GIC, GCA, TFL, and GIN into a unified framework, highlighting the necessity of this research to offer a more holistic and nuanced understanding of the interplay among these critical factors.

Furthermore, while GIC and GCA have garnered significant scholarly attention globally, the extent of in-depth investigations into the relationship between these two constructions remains limited. Most existing research has focused on the role of GIC in fostering general competitive advantage [9, 10] while the specific connection between GIC and GCA has yet to be thoroughly explored. Moreover, the scope of these studies has predominantly been restricted to sectors such as manufacturing [8] public services [7] hospitality [11] and creative enterprises [6]. In contrast, the food industry, a critical sector with substantial environmental impact—has not received adequate scholarly attention [4]. This gap underscores the necessity for further research to investigate the nuanced dynamics of GIC and GCA within this overlooked yet vital sector.

These arguments highlight the existence of a critical research gap that necessitates rigorous investigation. To address this gap, the current study is structured around key research questions aimed at exploring the intricate interrelationships within this context. Specifically, the study first examines the interactions among GIC, GIN, and TFL in relation to GCA within the specific local context. Subsequently, it investigates the influence of TFL and GIN on the attainment of GCA. Finally, the study explores the mechanisms through which GIC contributes to GCA, with particular emphasis on the mediating roles of TFL and GIN.

Theoretically, this research extends the Resource-Based View (RBV) by integrating GIC, GIN, and TFL into a comprehensive framework, illuminating the pivotal role of green knowledge in driving sustainable competitive advantage and addressing a critical gap in existing literature. Concurrently, the study offers a fresh perspective on the dynamic interplay between GIC and GCA within the food industry of Southeast Vietnam, thereby enriching the academic discourse relevant to this specific geographical context. Furthermore, the findings provide practical managerial implications for fostering GIC, stimulating GIN, and optimizing TFL practices, empowering enterprises to enhance operational efficiency and strengthen their competitive positioning. This dual contribution not only advances organizational performance but also aligns with broader societal imperatives of sustainable development.

2. Theoretical Underpinning and Hypotheses Development

2.1. Theoretical Underpinning

This article adopts the Resource-Based View (RBV) framework, popularized by Suparna, et al. [9] and Barney [12] which posits that an organization's competitive advantage derives from the effective utilization of its resources and capabilities. According to this theory, intangible resources are pivotal in generating a superior competitive advantage. Moreover, organizational capabilities can be continuously adapted and enhanced to respond to environmental changes, thereby fostering and sustaining a long-term competitive advantage [9]. From the RBV perspective, a firm is said to have a competitive advantage due to its unique combination of resources and capabilities Barney [12].

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 2: 984-999, 2025
DOI: 10.55214/25768484.v9i2.4638

RBV serves as a critical analytical framework for elucidating how a firm's distinctive resources and capabilities, particularly intangible assets, become decisive elements in developing and sustaining a competitive advantage [11]. Additionally, RBV provides a robust theoretical lens for understanding the intricate relationships among sustainability factors, such as intellectual capital, innovation, and transformational leadership, in the pursuit of green competitive advantage [7].

2.2. Hypotheses Development

2.2.1. Green Intellectual Capital

Intellectual capital is defined as "an intangible asset that includes the value of knowledge, skills, ideas and training that is not listed on the balance sheet" [13]. Building upon this concept, GIC emerges as a strategic approach to business development, integrating environmental sustainability with knowledge-based resources to promote sustainable growth through intellectual assets [14]. GIC refers to the aggregation of intangible assets, knowledge, competencies, and relationships connected to environmental protection and green innovation at both individual and organizational levels [10]. These intangible assets include expertise in environmental management embedded in employees, databases, processes, organizational systems, and relationships with key stakeholders [15].

In this article, GIC is conceptualized through three primary components: green human capital, green structural capital, and green relational capital [10]. Green Human Capital encompasses employees' proactive involvement in environmental initiatives while maintaining high levels of work performance [16]. It reflects employees' accumulated knowledge, skills, and sense of responsibility toward executing environmental protection efforts [17]. Furthermore, it highlights the importance of effective coordination among individuals, with leadership playing an active role in supporting the organization's environmental objectives [16].

Green Structural Capital pertains to the firm's internal systems and resources that facilitate environmental protection activities. These include effective environmental management systems, specialized teams, formal regulations, investments in sustainable infrastructure and equipment, personnel allocation, knowledge management platforms, and incentive policies to reward environmental contributions [17]. Lastly, Green Relational Capital refers to the organization's external relationships with customers, suppliers, partners, and network members engaged in environmental management and green innovation [10].

Through these components, GIC provides the necessary foundation of knowledge, capabilities, and collaborative networks essential for driving environmental protection initiatives and green innovation. Green Human Capital plays a pivotal role in fostering green innovation by enabling the creation of high-quality, sustainable products and services [16]. Green Relational Capital strengthens the company's ability to forge long-term, sustainable partnerships with key stakeholders, promoting collaboration in green innovation efforts [17]. Existing literature demonstrates that GIC not only enhances green innovation [5] but also serves as a key driver for the advancement of green innovation initiatives [8].

Green structural capital, as a component of GIC, provides the management systems, technologies, and organizational cultures necessary to support environmental protection initiatives [10]. These elements enable leaders to strategically guide the organization toward sustainable futures, identify emerging environmental needs, and implement appropriate organizational changes [18]. This suggests that GIC constitutes a resource well-aligned with the principles of transformational leadership, fostering positive organizational change. Moreover, empirical evidence highlights the pivotal role of GIC in enhancing transformational leadership, empowering leaders to drive sustainability-focused initiatives effectively [7].

Thus, the following hypotheses are proposed:

H_1: GIC positively affects GIN.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 2: 984-999, 2025
DOI: 10.55214/25768484.v9i2.4638

H_2. GIC positively affects TFL.

2.2.2. Green Competitive Advantage

A firm's competitive advantage is determined by its ability to perform activities in ways that competitors cannot or are not able to do [19]. GCA refers to the company's capacity to secure a leading position in environmental management and green innovation. Against this backdrop, the uniqueness and complexity of environmental strategies make them difficult for competitors to imitate, enabling the organization to achieve sustainability objectives and long-term benefits [20].

Prioritizing environmental protection not only enhances business performance but also outcomes but also advances broader societal and environmental issues, fostering a sustainable ecosystem of mutual benefits for all stakeholders [21]. To garner stakeholder support, companies must effectively communicate their GIC and make it visible and accessible. GIC plays a pivotal role in this process, as stakeholder engagement significantly enhances the company's competitive advantage [22].

Furthermore, GIC aids businesses in minimizing their environmental footprint while simultaneously reducing operational costs, thereby enabling the gaining of sustainable competitive advantage [21]. In the food and beverage sector, GIC plays a significant role in enhancing the effectiveness of GCA [4]. Additionally, as intangible and distinctive resources consistent with the principles of RBV theory, GIC facilitates the progression of GCA [11].

Given this, the article puts forth the following hypothesis:

H_3. GIC positively affects GCA.

2.2.3. Green Innovation and Transformational Leadership

GIN encompasses both hardware and software innovations pertaining to environmentally sustainable products or processes. This includes technological advancements aimed at energy conservation, pollution reduction, waste recycling, green product design, and corporate environmental management [23]. In the developmental trajectory, enterprises must integrate green principles into their strategic frameworks and actively pursue diverse forms of green innovation [24].

Green innovation can be categorized into two primary dimensions: product innovation and process innovation. Green product innovation enhances the efficient utilization of raw materials, minimizes raw material costs, and generates additional revenue streams by transforming waste into marketable products. On the other hand, green process innovation yields environmental benefits by optimizing the use of raw materials and energy throughout the production cycle [22]. This approach empowers organizations to develop advanced production technologies and methodologies aimed at reducing waste, conserving energy, and fostering sustainable production practices.

From the perspective of RBV theory, green innovation not only augments environmental performance but also bestows a substantial competitive advantage over industry rivals [25]. By prioritizing green innovation, organizations can diversify their product offerings and penetrate new markets at competitive price points [6]. Research indicates that green innovation fosters organizational learning, which is a critical component of sustainable organizations, thereby enhancing the green competitive advantage [26]. This perspective aligns with the findings of Setyaningrum, et al. [6].

Transformational leadership is defined as a process wherein a leader elevates group or organizational performance beyond expectations through the establishment of strong emotional connections with followers and a shared commitment to a higher moral purpose [27]. This intricate and dynamic process involves leaders shaping the values, beliefs, and aspirations of their followers, thereby steering the organization toward future objectives, recognizing environmental needs, and facilitating necessary changes [18].

This article further explores transformational leadership through the lens of Carless, et al. [28], highlighting several key dimensions: (1) communicating a vision, (2) developing employees, (3)

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 2: 984-999, 2025
DOI: 10.55214/25768484.v9i2.4638

providing support, (4) empowering employees, (5) leading by example, (6) exhibiting creativity, (7) demonstrating charisma. Within the RBV framework, transformational leadership not only enhances organizational adaptability but also represents a vital internal resource for sustaining green competitive advantage [29]. This assertion is corroborated by research conducted by Rahayu, et al. [7].
Based on this discussion, these hypotheses are proposed:

H_4. GIN positively affects GCA.

H_5. TFL positively affects GCA.

2.2.4. Mediating role of GIN and TFL in the GIC-GCA relationship

Green Structural Capital, facilitated by an effective reward mechanism, supports the organizational environment in sustaining a commitment to environmental protection [10]. This approach incentivizes employees to develop green products that possess competitive value while simultaneously reducing costs in the production process [8]. Consequently, this enhances the organization's GCA [5].

Moreover, the intangible assets associated with GIC, such as reputation, play a crucial role in enhancing the organization's competitive performance. Efforts to bolster the organization's reputation contribute to a strengthened green image, thereby positively influencing competitive outcomes [1].

Additionally, GIC is instrumental in fostering transformational leadership. By stimulating employees' intellectual engagement and creativity, GIC enables them to identify innovative opportunities [10] thereby reinforcing their commitment to the organization's long-term objectives [7, 10]. Furthermore, GIC manifests through active managerial support, ensuring that employees are equipped with the optimal conditions necessary to fulfill their environmental protection responsibilities [16]. This process ultimately strengthens the organization [29].

Under the RBV framework, GIC, GIN, and TFL are recognized as valuable resources that enhance an organization's green competitive advantage. GIC can function to cultivate an environmentally oriented organizational culture [10]. Such an environmentally directed orientation, serving as a form of strategic capability, profoundly influences the behavior associated with the execution of green business activities. This orientation has the potential to stimulate the necessary resources and capabilities for developing sustainable practices, thereby yielding both economic and environmental benefits, ultimately leading to an enduring competitive advantage [30].

These arguments suggest that the green innovation fostered by GIC not only significantly enhances GCA but also improves the overall efficiency of the organization [4, 5]. Furthermore, the strengthening of GIC not only facilitates TFL but, through TFL, further enhances the effectiveness of GCA [7].
Hence, the article proposes these hypotheses:

H_6. GIN mediates GIC's effect on GCA.

H_7. TFL mediates GIC's effect on GCA.

Based on the synthesized hypotheses, this article presents the following research model:

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 2: 984-999, 2025
DOI: 10.55214/25768484.v9i2.4638

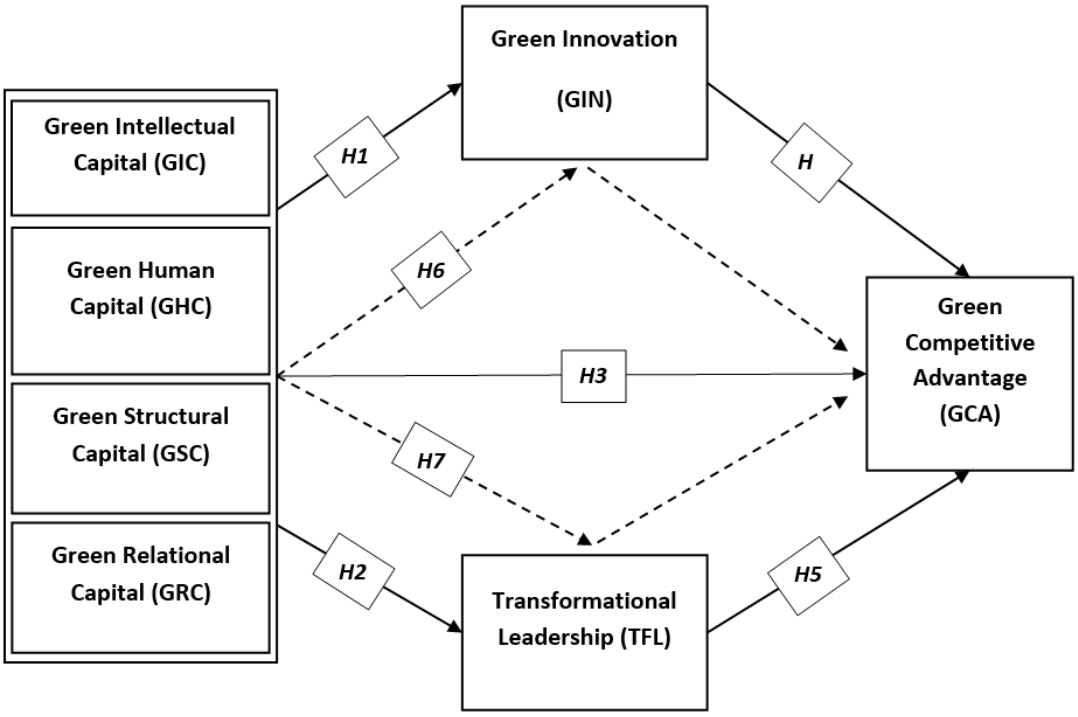

Figure 1.
Conceptual model.

3. Research Design and Methodology

3.1. Sample and Data Sources

For the sampling process, a convenient sampling method was utilized to recruit respondents capable of providing relevant insights based on a reliable list of contacts within the research field. A total of 376 emails were sent to selected participants, primarily consisting of directors and managers from various departments in the food industry. The questionnaire included 38 items designed to assess the key constructions of Green Intellectual Capital (GIC), Green Competitive Advantage (GCA), Transformational Leadership (TFL), and Green Innovation (GIN). Throughout the data collection period from July to October 2024, reminder emails were sent to encourage participation from those who had not yet responded. Additionally, follow-up phone calls and personal messages were employed to emphasize the importance of the research and encourage timely responses.

The sample was stratified based on key factors such as gender, firm size, function/department, experience, and managerial level. This stratification ensured diverse representation and enhanced the overall validity of the findings. After processing, a total of 336 responses were collected. Following the exclusion of invalid samples, 315 valid responses were retained for final analysis, meeting the requirements for Partial Least Squares Structural Equation Modeling (PLS-SEM) and ensuring sufficient statistical power for meaningful insights.

3.2. Data Processing Method

This article employed SmartPLS 3 for PLS-SEM analysis on 315 samples. The measurement model was assessed for reliability and validity using Cronbach's alpha, CR (>0.7), AVE (>0.5), HTMT (<0.85), and VIF. Structural model analysis calculated path coefficients, with significance tested via bootstrapping (5,000 subsamples), and mediation effects evaluated using the VAF value.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 2: 984-999, 2025
DOI: 10.55214/25768484.v9i2.4638

The variable measurement in this research was conducted through a structured questionnaire designed to capture the constructions of GIC, GCA, TFL, and GIN, with a focus on ensuring reliability and validity. GIC was operationalized through seventeen items based on three components, which were adapted from Astuti and Datrini [16]; Huang and Kung [17]. GCA was assessed using seven items referenced from Chen, et al. [24]; Astuti and Datrini [16]. For GIN, seven items from Wang and Juo [31]; Le [32] were utilized to measure the organization's capacity for implementing environmentally friendly innovations. Lastly, TFL was evaluated with six items sourced from Kim, et al. [33]; Ting, et al. [34] focusing on leadership behaviors that promote sustainability within the organization.

To refine the questionnaire, discussions were held with five representatives from relevant companies to gather insights and feedback. Additionally, a pilot survey was conducted with 30 samples to test the clarity and effectiveness of the measurement items. Based on the feedback and results from this preliminary survey, the final questionnaire was developed and used for the official data collection phase. Responses were measured on a 5-point Likert scale (1 = "Strongly Disagree," 5 = "Strongly Agree") to examine the relationships between GIC, GCA, and the mediating roles of TFL and GIN in Vietnam's Southeast food industry.

4. Results

4.1. Sample Characteristics

The article sample included 315 participants from the Southeast Vietnam food industry in Table 1, with 54.29% male (171 participants) and 45.71% female (144 participants), indicating a relatively balanced representation with a slight predominance of male participants. Regarding firm size, most respondents came from smaller organizations, with 179 participants (56.83%) representing firms with fewer than 10 employees, 89 (28.25%) from companies with 10 to 99 employees, 34 (10.79%) from those with 100 to 199 employees, and 13 (4.13%) from firms with 200 or more employees.

Table 1.
Demographical profile.

		n	%
Genders	Male	171	54.29
	Female	144	45.71
Firm size	Less than 10 employees	179	56.83
	10 to 99 employees	89	28.25
	100 to 199 employees	34	10.79
	200 employees and above	13	4.13
Function/ Department	Production	129	40.95
	Research and Development	50	15.87
	Human Resources	44	13.97
	Marketing and Sales	54	17.14
	Other departments	38	12.06
Experience	Less than 5 years	66	20.95
	5 – 10 years	113	35.87
	11 - 15 years	79	25.08
	More than 15 years	57	18.10
Managerial level	Directors	88	27.94
	Managers	227	72.06
		315	100%

This diversity in the sample enhances the validity and reliability of the findings, providing a robust foundation for analyzing the relationships between Green Intellectual Capital, Green Competitive Advantage, Green Innovation, and Transformational Leadership within the local food industry.

4.2. Measurement Model Analysis

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 2: 984-999, 2025
DOI: 10.55214/25768484.v9i2.4638

GIC is reflected by three second-order variables: GHC, GST, and GRC (Figure 2). According to the results presented in Table 2, the analysis of this measurement model indicates that all outer loadings are above 0.7. Furthermore, both Cronbach's Alpha and Composite Reliability (CR) values exceed 0.8, and the AVE values are higher than the 0.5 threshold [35].

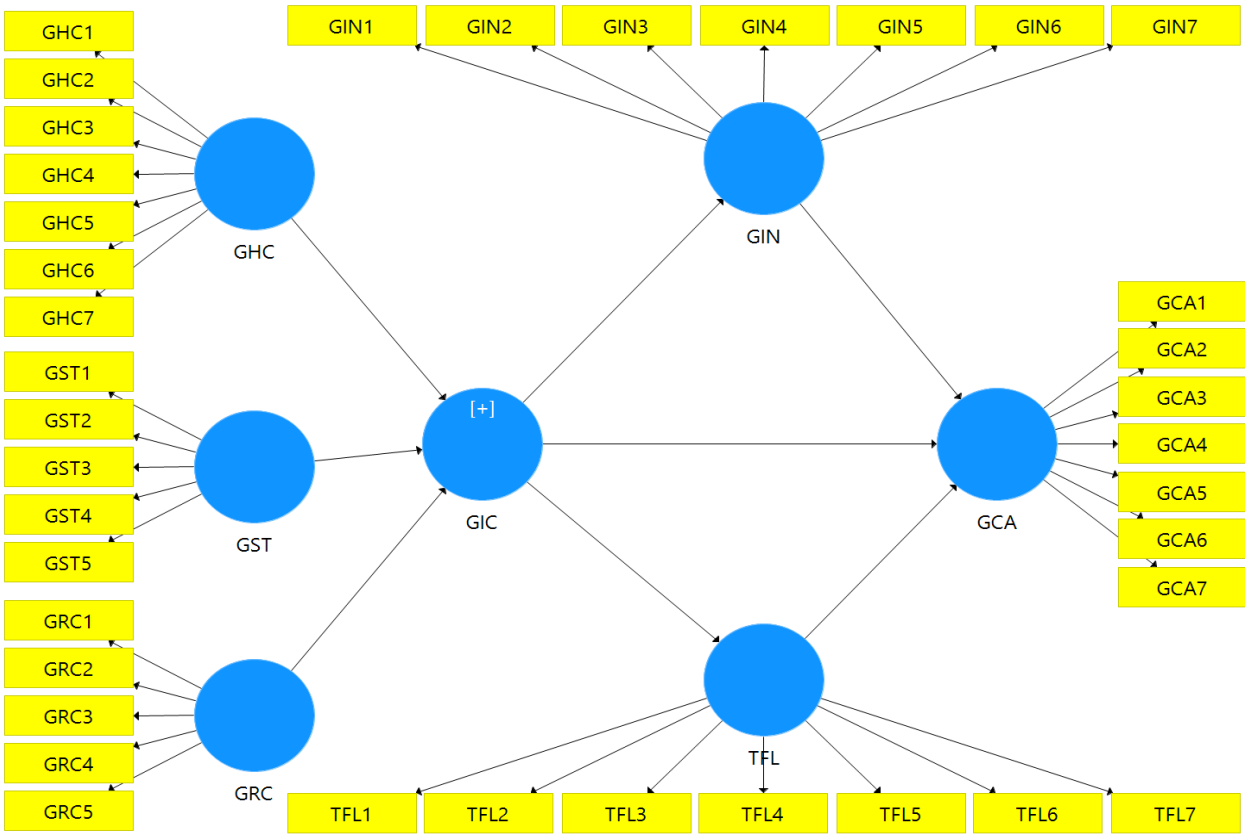

Figure 1.
Second-order variable analysis model.

Table 2.
Construct reliability and validity.

Variables	Factor loading	Cronbach's Alpha	CR	AVE	VIF
GHC	0.782 - 0.838	0.914	0.931	0.659	2.179 - 2.711
GST	0.799 - 0.863	0.895	0.922	0.704	1.917 - 2.985
GRC	0.816 - 0.846	0.886	0.916	0.686	2.260 - 2.854
GIN	0.730 - 0.803	0.884	0.910	0.590	1.811 - 2.143
TFL	0.707 - 0.834	0.887	0.912	0.597	1.731 - 2.376
GCA	0.739 - 0.800	0.886	0.911	0.594	2.136 - 2.554

Based on these results, GHC, GST, and CRC meet the criteria to form the measurement structure for GIC. Consequently, the model is simplified to include four components: GIC, CGA, GIN, and TFL (Figure 3).

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 2: 984-999, 2025
DOI: 10.55214/25768484.v9i2.4638

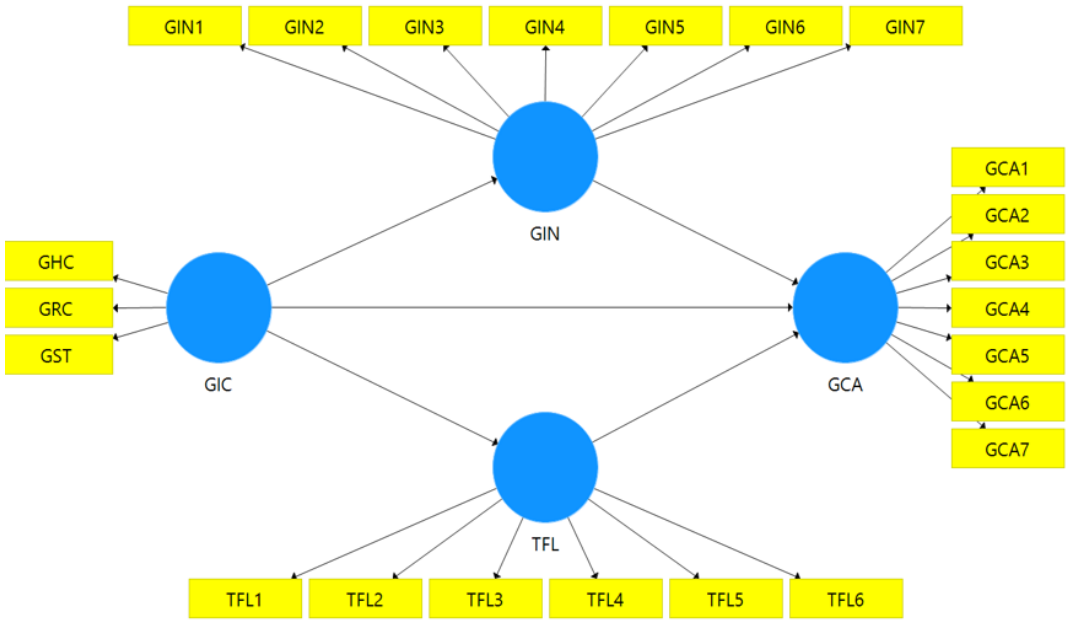

Figure 2.
First-order variable model.

The analysis of the first-order model variables in Table 2 reveals that GIN, TFL, and GCA exhibit outer loadings above 0.7, with Cronbach's Alpha and CR both exceeding 0.8 and AVE values greater than 0.5. Furthermore, discriminant validity is confirmed with HTMT values below 0.85 [35].

Based on the results obtained from the measurement model analysis, we can proceed with the structural model analysis in the subsequent steps.

4.3. Structural Model Analysis

The maximum VIF value is 2.985 (< 3), indicating that there is no collinearity [35]. The research hypotheses and structural model were then evaluated using bootstrapping techniques. Direct effects are shown in Table 3, whereas Table 4 outlines the mediated effects.

The p-values shown in Table 3 are < 0.05, with β values ranging from 0.229 to 0.378 and t-values between 3.166 and 7.470. These findings suggest that hypotheses H1, H2, H3, H4, and H5 are fully supported.

Table 3.
Direct effects.

Hypotheses	β	t-values	p-values	Decision
H1: GIC -> GIN	0.342	6.581	0.000	Supported
H2: GIC -> TFL	0.378	7.470	0.000	Supported
H3: GIC -> GCA	0.218	4.448	0.000	Supported
H4: GIN -> GCA	0.229	3.166	0.002	Supported
H5: TFL -> GCA	0.282	4.203	0.000	Supported

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 2: 984-999, 2025
DOI: 10.55214/25768484.v9i2.4638

Table 4.
Indirect effects.

Hypotheses	β	t-values	p-values	VAF-values	Decision
H6: GIC -> GIN -> GCA	0.078	2.760	0.006	26.43%	Partial Mediation
H7: GIC -> TFL -> GCA	0.107	3.501	0.000	32.84%	Partial Mediation

In Table 4, the maximum p-value is 0.006 (< 0.05), with t-values ranging from 2.760 to 3.501. Additionally, the VAF values [36] for the relationships GIC -> GIN -> GCA and GIC -> TFL -> GCA are 26.43% and 32.84%, respectively. Since these VAF values are between 20% and 80%, it indicates that GIN and TFL serve as partial mediators in the connection between GIC and GCA. Consequently, hypotheses H6 and H7 are supported.

5. Discussions

Our discussion aims to provide a comprehensive and in-depth look at the complex relationship between GIC and GCA, with GIN and TFL playing key mediating roles. This integrated approach extends previous studies, emphasizing that GIC's ability to leverage GIN and TFL is central to an organization's ability to achieve sustainable competitive advantage.

5.1. Green Intellectual Capital and Green Innovation

The results of the article show that GICs play an important role in promoting GIN (β = 0.342). This context implies that investing in GICs can provide many opportunities for green innovation implementation not only in the food industry but also in the agricultural industry [5] and the manufacturing industry [8]. It can be inferred that when employees are skilled and proactive in participating in environmental activities, businesses will easily adopt environmental pollution reduction processes in production. Investing in infrastructure and equipment for environmental protection will help businesses apply energy-saving technology. At the same time, cooperating with customers in developing environmentally friendly products will promote the creation of green products. These factors create the foundation for businesses to continuously innovate in green products and processes, thereby bringing sustainable solutions to businesses and markets.

5.2. Green Intellectual Capital and Transformational Leadership

In addition, this article also underscores the role of GIC in supporting the development of TFL (β = 0.378). This result is also consistent with the findings of Rahayu, et al. [7]. It can be seen that building a green knowledge system in an enterprise properly helps leaders convey a clear vision and create organizational cohesion towards sustainability. When work groups work together effectively to achieve environmental protection goals, this can promote leadership initiatives in the field of environmental protection. This connection not only improves leadership capacity but also promotes a culture of innovation and sustainable development in enterprise.

5.3. Green Intellectual Capital and Green Competitive Advantage

Furthermore, the results from this article indicate that the effective implementation of GIC can enable organizations to establish sustainable competitive advantages (β = 0.218). This assertion is supported by the findings of Xin and Wang [11] and Panjaitan, et al. [4]. The results demonstrate that when employees actively engage in developing products that generate positive environmental impacts, organizations can produce higher-quality products compared to their competitors. Additionally, an effective environmental management system enhances the optimization of production processes, thereby enabling organizations to operate green initiatives more efficiently. Moreover, the establishment of stable and sustainable relationships with customers contributes to fostering a positive image of social

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 2: 984-999, 2025
DOI: 10.55214/25768484.v9i2.4638

and environmental responsibility. This not only serves to attract customers but also strengthens the organization's market position.

5.4. Green Innovation and Green Competitive Advantage

Another salient finding from this article is that GIN significantly contributes to the establishment of GCA (β = 0.229). This perspective is corroborated by previous research [24, 37, 38]. The results suggest that the promotion of green innovation within enterprises, such as the implementation of energy-saving technologies in production processes, can facilitate the creation of lower-cost products, thereby enhancing the organization's sustainable competitive advantages. Furthermore, the adoption of recycling and waste management technologies that adhere to international standards can establish formidable barriers for competitors, enabling organizations to maintain a unique differentiation that is challenging to replicate in the market.

5.5. Transformational Leadership and Green Competitive Advantage

It is noteworthy that the analysis conducted in this article reveals a positive relationship between TFL and GCA (β = 0.282). This perspective is also supported by the findings of Probojakti, et al. [29]. This finding underscores that when leaders inspire, instill a sense of pride, and promote creativity and innovation among employees, organizations can more rapidly develop green products and gain a competitive advantage in terms of speed. Additionally, a leader's emphasis on investing in employee training and development enhances the organization's innovative capabilities, enabling it to deliver green solutions more effectively than its competitors. These initiatives collectively establish a robust foundation for sustainable competition, ensuring long-term organizational growth and maintaining a competitive edge within the market.

5.6. The Mediating Role of Green Innovation and Transformational Leadership

Moreover, the findings of this article indicate that GIN and TFL serve as mediating factors between GIC and GCA. This aligns with the conclusions drawn by Hendarjanti and Nawangsari [5]; Xin and Wang [11] and Rahayu, et al. [7]. This relationship can be elucidated by the premise that when employees are thoroughly equipped with the requisite knowledge, skills, and a strong sense of responsibility regarding environmental stewardship, organizations are better positioned to enhance products in accordance with ecological standards while simultaneously optimizing and conserving input resources during the production process. Consequently, organizations not only expedite the development of green products but also manage production costs more efficiently than their competitors. Furthermore, organizational leaders engage in coherent practices, such as leading, by example, demonstrating respect, instilling pride among employees, and fostering autonomy and creativity. These initiatives enhance internal coordination and galvanize teams to swiftly generate innovative green initiatives and solutions. As a result, organizations not only accelerate the pace of green product development but also cultivate a distinctive competitive advantage over their market rivals.

5.7. Theoretical Implications

This research provides meaningful insights significantly into the theory of sustainability management, particularly within the framework of the RBV. The research not only affirms the applicability of the RBV but also enhances the comprehension of this theoretical framework by highlighting the roles of GIC, GIN, and TFL in cultivating GCA.

The results demonstrate that GIC serves as a foundational element in advancing GIN and GCA. This insight underscores that possessing knowledge, skills, and intellectual property related to

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 2: 984-999, 2025
DOI: 10.55214/25768484.v9i2.4638

environmental sustainability constitutes a vital strategic resource for organizations seeking to develop green initiatives and attain sustainable competitive advantages.

Furthermore, the mediating roles of GIN and TFL in facilitating the impact of GIC on GCA have been substantiated. By emphasizing the significance of GIN and TFL, this article contributes to the existing body of literature, which has been limited in its exploration of the mediating mechanisms through which GIC enhances GCA.

This research is particularly noteworthy as it represents the first comprehensive article to integrate GIC, GIN, and TFL within a unified framework aimed at augmenting GCA. The amalgamation of these three components within a singular model offers new insights into leveraging these distinctive resources to forge long-term competitive advantages for organizations and promote collective prosperity within communities. Additionally, this article pioneers the investigation of the relationship between GIC and GCA within the Vietnamese context, thereby making a significant contribution to addressing the theoretical gaps present in this locale.

Collectively, these theoretical implications emphasize the necessity of evaluating practices associated with intellectual capital, alongside the behaviors of employees and leadership concerning environmental orientation, to cultivate sustainable competitive advantages for organizations. By expanding the theoretical framework and establishing a foundation for future inquiries, this article meaningfully advances ongoing dialogues in the realm of corporate governance.

5.8. Managerial Implications

The findings of this article substantiate that GIC significantly influences both GIN and TFL, while GIN and TFL directly affect GCA. This indicates that, in alignment with corporate strategy, the pursuit of GCA necessitates a concerted focus on cultivating GIC, enhancing GIN, and elevating TFL.

Organizations must regard GIC as a pivotal component for adhering to environmental regulations and optimizing resource utilization to attain a sustainable competitive advantage [16]. To foster GIC, businesses should concentrate on three principal dimensions: cultivating environmentally conscious human capital, developing systems and infrastructures that bolster green initiatives, and forging sustainable partnerships with stakeholders, including customers and suppliers. These facets are essential for augmenting GIC within organizations. In terms of Green Human Capital, enterprises must equip employees with environmental competencies, which can be accomplished through targeted training programs. Moreover, enhancing collaboration among workgroups to achieve shared environmental objectives is paramount. With respect to green structural capital, firms need to establish robust environmental management systems and invest in sustainable infrastructure and equipment. Furthermore, the implementation of transparent policies and reward mechanisms is crucial for incentivizing significant contributions toward green objectives. Finally, Green Relational Capital underscores the necessity of reinforcing sustainable collaboration with customers, suppliers, and strategic partners in green initiatives. The development of environmentally benign products and services not only satisfies consumer demands but also cultivates loyalty and satisfaction.

To catalyze green innovation, managerial leadership must proactively steer the organization toward sustainable development [38]. Enterprises ought to invest in new or enhanced processes, products, and technologies to supplant wasteful and inefficient energy practices, thereby advancing GIN [30]. Concurrently, to optimize GIN and actualize GCA as anticipated, organizations can engage in practices such as utilizing eco-friendly materials, designing and labelling sustainable packaging, and perpetually innovating to comply with ecological standards. A strategic emphasis on renewable energy sources and the adoption of waste treatment technologies that adhere to international standards is also imperative. Achieving these objectives requires not only organizational commitment but also the integration of sustainability values into the corporate culture [38].

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 2: 984-999, 2025
DOI: 10.55214/25768484.v9i2.4638

To enhance TFL and align GCA with overarching organizational objectives, businesses must cultivate a leadership cadre capable of inspiring, connecting, and motivating employees toward sustainable goals. Leaders should foster an environment that encourages independent thinking, recognizing and supporting employees within a framework of trust. Effective leaders must exemplify consistency in their actions and serve as role models within the organization while dedicating time to the training and development of individual competencies. Leadership efficacy is further enhanced when leaders are adept at promoting innovation and agilely responding to market uncertainties [29].

Moreover, the investigation of the mediating roles of GIN and TFL elucidates that GIC's emphasis on fostering GCA significantly bolsters the organization's green competitive positioning. Specifically, this results in tangible benefits, including reductions in the costs associated with producing green products, enhancements in research and development capabilities, and the cultivation of a favorable environmental image among consumers. Consequently, businesses must prioritize GIN and TFL if they aspire to secure a competitive green advantage in an increasingly competitive market environment. In essence, investment in GIC, GIN, and the cultivation of transformational leadership is not merely a short-term strategy; it is a decisive determinant for sustaining market position and competitive viability in the long run. Furthermore, the synergistic interplay of GIC, GIN, and TFL will engender a positive organizational climate that fosters creativity and innovation while amplifying employees' sense of accountability regarding environmental issues. This holistic approach not only yields economic benefits but also contributes to the broader sustainable development of both businesses and society.

6. Conclusion, Limitations, and Future Research Scope

This research effort has substantiated the validity of the evaluation process through the corroboration of the proposed hypotheses, thereby reinforcing the theoretical foundation of the model. Nonetheless, certain limitations warrant acknowledgment.

Firstly, while the article emphasizes the significance of the RBV theory, it should be noted that alternative frameworks, such as the Natural-Resources-Based View (NRBV), could also elucidate the application of intangible resources like GIC in fostering long-term GCA for enterprises, as suggested by Astuti and Datrini [16]. Secondly, the article does not meticulously investigate the interrelationships among the internal factors within the model. Thirdly, while this research occupies a pioneering position in examining the role of GIC in enhancing GCA in the Vietnamese context, the constructs of GIC, GCA, GIN, and TFL are inherently complex and subject to temporal variations, so the research results may not fully represent the reality in different periods. Fourthly, beyond elucidating the mediating mechanisms through which GIC influences GCA via GIN and TFL, the article may not adequately account for other potential variables that could fulfill a similar mediating function. Ultimately, the results of this investigation pertain to a particular industry and the geographic context of a country within an emerging economy, which may circumscribe their generalizability to disparate industries and other nations.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Copyright:

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 2: 984-999, 2025
DOI: 10.55214/25768484.v9i2.4638

References

[1] W. Yadiati, N. Nissa, S. Paulus, H. Suharman, and M. Meiryani, "The role of green intellectual capital and organizational reputation in influencing environmental performance," *International Journal of Energy Economics and Policy*, vol. 9, no. 3, pp. 261-268, 2019. https://doi.org/10.32479/ijeep.7752

[2] J. Poore and T. Nemecek, "Reducing food's environmental impacts through producers and consumers," *Science*, vol. 360, no. 6392, pp. 987-992, 2018. https://doi.org/10.1126/science.aaq0216.

[3] Monre-Vietnam Ministry of Natural Resources and Environment, *National environmental status report 2017: Waste management*. Ha Noi: Viet Nam Publishing House of Natural Resources Environment and Cartography, 2017.

[4] H. Panjaitan, S. Rahman, and M. Hutahuruk, "Model of green competitive advantage through green leadership, green intellectual capital, and environmental ethics in industrial enterprises in Indonesia," *International Journal of Trends in Accounting Research*, vol. 5, no. 1, pp. 22-32, 2024. https://doi.org/10.54951/ijtar.v5i1

[5] H. Hendarjanti and L. C. Nawangsari, "How does the green competitive advantage of building a sustainable palm oil industry? The role of green innovations as a mediation," *Corporate Governance and Organizational Behavior Review*, vol. 7, no. 3, pp. 57-69, 2023. https://doi.org/10.22495/cgobrv7i3p5

[6] R. P. Setyaningrum, H. M. M. Putra, M. Muafi, I. Salsabil, and F. S. Goestjahjanti, "Exploring the drivers of creative MSMEs' green competitive advantage in Indonesia: A natural resource-based view perspective," *Journal of Logistics, Informatics and Service Science*, vol. 11, no. 7, pp. 497–517, 2024. https://doi.org/10.33168/JLISS.2024.0726

[7] H. G. Rahayu, H. Warsono, R. Kurniati, and H. Purnaweni, "The effect of green intellectual capital on green competitive advantage in sustainable city management," *International Journal of Energy Economics and Policy*, vol. 13, no. 3, pp. 532-537, 2023. https://doi.org/10.32479/ijeep.14434

[8] A. Riaz, G. Santoro, K. Ashfaq, F. H. Ali, and S. U. Rehman, "Green competitive advantage and SMEs: Is big data the missing link?," *Journal of Competitiveness*, vol. 15, no. 1, p. 73, 2023. https://doi.org/10.7441/joc.2023.01.05

[9] G. Suparna, N. N. K. Yasa, I. G. A. K. Giantari, I. P. G. Sukaatmadja, and M. Setini, "Green transformational leadership to build value, innovation and competitive advantage in era digital," *Management*, vol. 18, pp. 102–115, 2021. https://doi.org/10.14704/WEB/V18SI04/WEB18117

[10] Y.-S. Chen, "The positive effect of green intellectual capital on competitive advantages of firms," *Journal of Business Ethics*, vol. 77, no. 3, pp. 271-286, 2008. https://doi.org/10.1007/s10551-006-9349-1

[11] C. Xin and Y. Wang, "Green intellectual capital and green competitive advantage in hotels: The role of environmental product innovation and green transformational leadership," *Journal of Hospitality and Tourism Management*, vol. 57, pp. 148-157, 2023. https://doi.org/10.1016/j.jhtm.2023.10.001

[12] J. Barney, "Firm resources and sustained competitive advantage," *Journal of Management*, vol. 17, no. 1, pp. 99-120, 1991. https://doi.org/10.1177/014920639101700108

[13] J. Nahapiet and S. Ghoshal, "Social capital, intellectual capital, and the organizational advantage," *Academy of Management Review*, vol. 23, no. 2, pp. 242-266, 1998. https://doi.org/10.5465/amr.1998.533225

[14] A. A. P. G. B. Arie, P. D. Kumalasari, and I. A. R. Manuari, "The role of green intellectual capital on competitive advantage: Evidence from Balinese financial institution," *Sriwijaya International Journal of Dynamic Economics and Business*, vol. 3, no. 3, pp. 227-242, 2019. https://doi.org/10.29259/sijdeb.v3i3.227-242.

[15] E. Bombiak, "Green intellectual capital as a support for corporate environmental development—polish company experience," *Energies*, vol. 15, no. 9, p. 3004, 2022. https://doi.org/10.3390/en15093004

[16] P. Astuti and L. Datrini, "Green competitive advantage: Examining the role of environmental consciousness and green intellectual capital," *Management Science Letters*, vol. 11, no. 4, pp. 1141-1152, 2021. https://doi.org/10.5267/j.msl.2020.11.025

[17] C. L. Huang and F. H. Kung, "Environmental consciousness and intellectual capital management: Evidence from Taiwan's manufacturing industry," *Management Decision*, vol. 49, no. 9, pp. 1405-1425, 2011. https://doi.org/10.1108/00251741111173916

[18] M. M. Korejan and H. Shahbazi, "An analysis of the transformational leadership theory," *Journal of Fundamental and Applied Sciences*, vol. 8, no. 3, pp. 452-461, 2016. https://doi.org/10.4314/jfas.v8i3s.192

[19] P. Kotler and K. L. Keller, *Marketing management 15th global edition (Global)*. Harlow: Pearson Education Limited, 2016.

[20] Y. S. Chen, "Green organizational identity: Sources and consequence," *Management Decision*, vol. 49, no. 3, pp. 384-404, 2011. https://doi.org/10.1108/00251741111120761

[21] A. Bhatti, S. Ur Rehman, F. Mirza, N. Nguyen, S. Samad, and I. Kamal, "Green intellectual capital, green transformational leadership, and sustainable performance: A moderated mediation model," *World Journal of Science, Technology and Sustainable Development*, vol. 19, no. 2, pp. 1-18, 2023.

[22] N. Ahmar and T. Astuti, "Competitive advantage based on green intellectual capital and green innovation," *Asian Journal of Engineering, Social and Health*, vol. 2, no. 11, pp. 1406-1414, 2023. https://doi.org/10.46799/ajesh.v2i11.169

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 2: 984-999, 2025
DOI: 10.55214/25768484.v9i2.4638

[23] Y.-S. Chen, S.-B. Lai, and C.-T. Wen, "The influence of green innovation performance on corporate advantage in Taiwan," *Journal of Business Ethics*, vol. 67, no. 4, pp. 331-339, 2006. https://doi.org/10.1007/s10551-006-9025-5

[24] Y. Chen, L. Gao, and Y. Zhang, "The impact of green organizational identity on green competitive advantage: The role of green ambidexterity innovation and organizational flexibility," *Mathematical Problems in Engineering*, vol. 2022, no. 1, p. 4305900, 2022. https://doi.org/10.1155/2022/4305900

[25] A. U. Din, Y. Yang, R. Yan, A. Wei, and M. Ali, "Growing success with sustainability: The influence of green HRM, innovation, and competitive advantage on environmental performance in the manufacturing industry," *Heliyon*, vol. 10, no. 10, p. e30855, 2024. https://doi.org/10.1016/j.heliyon.2024.e30855

[26] Y. Tu and W. Wu, "How does green innovation improve enterprises' competitive advantage? The role of organizational learning," *Sustainable Production and Consumption*, vol. 26, pp. 504-516, 2021. https://doi.org/10.1016/j.spc.2020.12.031

[27] H. R. Díaz-Sáenz, *Transformational leadership*. United States: The SAGE Handbook of Leadership, 2011.

[28] S. A. Carless, A. J. Wearing, and L. Mann, "A short measure of transformational leadership," *Journal of Business and Psychology*, vol. 14, pp. 389-405, 2000. https://doi.org/10.1023/A:1022991115523

[29] W. Probojakti, H. N. Utami, A. Prasetya, and M. F. Riza, "Building sustainable competitive advantage in banking through organizational agility," *Sustainability*, vol. 16, no. 19, p. 8327, 2024. https://doi.org/10.3390/su16198327

[30] H. Zameer, Y. Wang, H. Yasmeen, and S. Mubarak, "Green innovation as a mediator in the impact of business analytics and environmental orientation on green competitive advantage," *Management Decision*, vol. 60, no. 2, pp. 488-507, 2022. https://doi.org/10.1108/MD-01-2020-0065

[31] C. H. Wang and W. J. Juo, "An environmental policy of green intellectual capital: Green innovation strategy for performance sustainability," *Business Strategy and the Environment*, vol. 30, no. 7, pp. 3241-3254, 2021. https://doi.org/10.1002/bse.2800

[32] T. T. Le, "How do corporate social responsibility and green innovation transform corporate green strategy into sustainable firm performance?," *Journal of Cleaner Production*, vol. 362, p. 132228, 2022. https://doi.org/10.1016/j.jclepro.2022.132228

[33] H. Kim, J. Im, and Y. H. Shin, "The impact of transformational leadership and commitment to change on restaurant employees' quality of work life during a crisis," *Journal of Hospitality and Tourism Management*, vol. 48, pp. 322-330, 2021. https://doi.org/10.1016/j.jhtm.2021.07.010

[34] I. W. K. Ting, H. J. Sui, Q. L. Kweh, and G. Nawanir, "Knowledge management and firm innovative performance with the moderating role of transformational leadership," *Journal of Knowledge Management*, vol. 25, no. 8, pp. 2115-2140, 2021. https://doi.org/10.1108/JKM-08-2020-0629

[35] J. F. Hair, J. J. Risher, M. Sarstedt, and C. M. Ringle, "When to use and how to report the results of PLS-SEM," *European Business Review*, vol. 31, no. 1, pp. 2-24, 2019. https://doi.org/10.1108/EBR-11-2018-0203

[36] J. F. Hair, G. T. M. Hult, C. M. Ringle, and M. Sarstedt, *A primer on partial least squares structural equation modeling* Thousand Oaks: Sage, 2014.

[37] S. Zhang, M. Chen, and G. Tang, "How green human resource management can promote green competitive advantage: The role of green innovation," *Business Strategy and the Environment*, vol. 33, no. 5, pp. 4613–4625, 2024. https://doi.org/10.1002/bse.3715

[38] C.-H. Wang, "How organizational green culture influences green performance and competitive advantage: The mediating role of green innovation," *Journal of Manufacturing Technology Management*, vol. 30, no. 4, pp. 666-683, 2019. https://doi.org/10.1108/JMTM-09-2018-0314

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 2: 984-999, 2025
DOI: 10.55214/25768484.v9i2.4638