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Linking Green Human Capital, Green Transformational Leadership, Green Dynamic Capabilities, and Green Innovation: A Moderation Model

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Abstract. Although the notion of green human capital (GHC), as a critical component of green intellectual capital (GIC), has acquired significant attention among researchers and practitioners, its relationship with green innovation (GI) performance continues to remain unclear. The present research aims to address this knowledge gap by distinguishing GI adoption and integration in the context of developing countries, i.e., Morocco. Based on natural resource-based view (NRBV), this study evaluates the direct effect of GHC on GI. Most importantly, this research examines the moderating role of green dynamic capabilities (GDCs) and green transformation leadership (GTL) on the link between GHC and GI. Using a quantitative exploratory approach, data were obtained from 201 knowledge-intensive SMEs in Morocco. PLS Path Modeling (PLS-SEM) is applied to test the hypotheses. The results demonstrated that GTL is a critical underlying mechanism that moderates GHC and GI's relationship. However, results confirmed the negative moderation of GDCs for the relationship between GHC and GI. This research opens up a new way for environmental management practices that can help knowledge-intensive SMEs to achieve green products and process innovation. Thus, this study incites top management teams (TMT) to give more importance to GHC as a critical source of green business innovation and sustainable competitive advantage.

Keywords: green human capital; green dynamic capabilities; green innovation; green transformational leadership; knowledge-intensive industry

1. Introduction

Recently, August 2022 was significant for U.S. climate mitigation and sustainable energy (Cartwright, 2022). According to the Biden Administration, the Inflation Reduction Act (IRA) would result in a $370 billion investment in energy security and climate change projects to lower carbon emissions by 40% by 2030 (Vasilakos et al., 2022). This major governmental program shows the importance of the environmental field in public policies and stakeholders' pressure for green initiatives (Nassani et al., 2022).

In spite of the debate between proponents for adopting and integrating sustainable initiatives and those formally rejecting them (Lin et al., 2022), it is commonly accepted that the emergence of a "green and socially responsible company" (Alyahya et al., 2022) is a response to the environmental deficit caused by the traditional industrial economy (Liu et al., 2022) and institutional pressure (Ning et al., 2021) to develop sustainable practices. The nature and scale of current environmental challenges call for GI as a solution. Indeed, GI is an excellent solution for integrating the philosophy of sustainability into the corporate value chain (Fahad et al., 2022).

GI, a topic rising from innovation and sustainable literature (Ha & Nguyen, 2022, Guinot et al., 2022), is commonly considered an innovation paradigm centered on preserving the environment and promoting sustainable development (Feng et al., 2022; Wang et al., 2022). GI manifests in new goods, processes, and technologies with fewer polluting energy sources and raw materials that produce less waste (Li et al., 2022).

However, although GI is a possible pathway to boost sustainability, the development and alignment of these innovation activities along the corporate value chain are complex (Abadzhiev et al., 2022). To manage complexity, scholars suggest a set of internal and external capabilities that help GI alignment at the value chain level, such as social networks potential (Song et al., 2021), open innovation practices (Meidute-Kavaliauskiene et al., 2021), proactive environmental strategies (Mulaessa & Lin, 2021), and sustainable digital transformation (Feng et al., 2022).

Based on the NRBV (Hart, 1995), the relevance and value of GIC are described, and how GHC, as a critical and fundamental component, helps firms to achieve sustainability and competitive advantage is reported (Chen, 2008; Jirakraisiri et al., 2021; Ullah et al., 2022; Rustiarini et al., 2022).

Many scholars call upon firms to rely on green intellectual resources, enhance employees' environmental knowledge (Wang & Juo, 2021), and develop green individual and organizational identity and creativity (Song & Yu, 2018). With increasing environmental issues, companies are asked to reconfigure their human resource management (HRM) strategies and introduce green actions and practices into training, promotion, and remuneration strategies to accelerate the sustainability transition of the workforce and retain green skills (Ullah et al., 2022; Cai et al., 2020; Singh et al., 2020).

GHC is becoming a strategic resource for implementing green competitiveness and achieving improved financial and social performance (Agyabeng-Mensah & Tang, 2021). Recent studies have focused on green human resource management (GHRM), GIC management, and GI strategies (Ullah et al., 2022; Shah et al., 2021; Bombiak, 2022; Liu et al., 2022; Malik et al., 2020). Other studies have punched the close relationship between GHRM, green leadership styles, and GI (Leroy et al., 2018; Ahmad et al., 2021; Song et al., 2020; Ahmad et al., 2022).

Indeed, green transformational leadership (GTL) is one of the most critical leadership styles in fostering green performance (Chen et al., 2014). The purpose of GTL, also known as "environmental transformational leadership" (Althnayan et al., 2022), is to encourage and inspire employees to support environmental sustainability (Mittal & Dhar, 2016). Chen & Chang (2013) described GTL as leaders inspiring employees to meet ecological goals and overcome environmental obstacles. GTL can, directly and indirectly, improve employee green creativity through employees' green self-efficacy and green mindfulness (Chen et al., 2014), personal initiatives (Du & Yan, 2022), and employees' green behaviors (Fontes et al., 2021; Sobaih et al., 2022).

In addition to these ambitions, companies currently face environmental pressures, inflationary pressures, and rising energy prices caused by the successive health and geopolitical crises of the COVID-19 pandemic and the Russia-Ukraine conflict (Hermundsdottir et al., 2022; Korosteleva, 2022). GI depends on enterprises' capacity to embrace environmental management changes rapidly (Sun et al., 2020) and to use this crisis as a catalyst for accelerating the firm's green transition, e.g., green dynamics capabilities (GDCs) (Korosteleva, 2022).

Green dynamic capability (GDC) is a firm's ability to integrate resources for sustainability and green operations (Yousaf, 2021). According to Teece (2018), GDCs refer to firms' capacity to identify and respond effectively to environmental safety issues and opportunities. There is a need for improvements in GDCs in response to the growing concern for environmental sustainability and GI (Li, 2022). According to the NRBV (Hart, 1995), several studies have revealed a significant link between GHC as a critical component of GIC and GI (Ullah et al., 2022; Liu et al., 2022; Mehmood & Hanaysha, 2022); GHC and GTL (Zhao & Huang, 2022); GTL and GI (Chen et al., 2014; Al-Ghazali et al., 2022; Zhang et al., 2020); GDCs and GI (Yousaf, 2021; Li, 2022).

However, more studies need to expand on the interrelatedness of the four mentioned factors mentioned (Chen & Chang, 2013; Luan et al., 2022). Additionally, existing Moroccan research on GI topic focuses more on technical aspects, economic and financial indicators than human and organizational capabilities (Smouh et al., 2022; Houssini & Geng, 2022; Alitane et al., 2022; Gargab, 2021; Youssef et al., 2022).

This study aims to bridge a knowledge gap on the relevance of GHC in encouraging GI in the Moroccan knowledge-intensive industry. The current paper intends to evaluate the influence of GHC on GI performance and the combined moderating effect of GDCs and GTL.

Thus, the current study has two objectives: First, to evaluate the influence of GHC on GI. Second, to analyze the moderating role of GDCs and GTL in the relationship between GHC and GI of knowledge-intensive SMEs. The study used the conceptual framework of two variables, GTL and GDCs, to examine the link between GHC and GI. The research offers recommendations to academics and practitioners in the Moroccan knowledge-intensive industry for achieving green innovation performance through GHC, GDCs, and GTL. The current study aimed to achieve the following research questions (RQs):

1. How does GHC influence the GI of intensive knowledge SMEs?
2. How do GDCs and GTL influence GI performance in the intensive knowledge industry?
3. How do GDCs and GTL moderate the link between GHC and GI in the intensive knowledge industry?

The article was constructed as follows to achieve the study objectives and answer the RQs: Section 2 presents the theoretical foundation for the research by examining the connection between the research variables. Section 3 explains the study methodology, and Section 4 includes data collection and analysis information. The discussion of the research is contained in Section 5. This section also discusses both the theoretical and managerial implications of the study. The conclusion is explained with limitations and suggests avenues for future studies in Section 6.

2. Conceptual Framework and Research Hypotheses Formulation

2.1. The Green Issues in the Moroccan Context

The Kingdom of Morocco is an agricultural country; it employs 40% of the national workforce and 74% in rural territories (Abdelmajid et al., 2021). Based on rainfall, the percentage of value-added in the three sectors remained around 15% for agriculture. 27% of the industry, which employs 12% of the workforce, and 51% of the service sector, which provides 40% of employment (67% of total creation), are anticipated to expand; most jobs are in conventional low-skilled services (Harbouze et al., 2019).

Since 2008, the Moroccan Government has engaged in major sustainable development initiatives by implementing several strategic programs aimed at ensuring food security and protecting the environment against climate change through the development of sustainable agricultural production, a national energy strategy that makes efficiency a national priority, such as (non-exhaustive list): "Green Morocco Plan 2008–2018" (https://www.agriculture.gov.ma/fr/data-agri/plan-maroc-vert, accessed on 13 December 2022), a "Génération Green 2020–2030" (https://www.agriculture.gov.ma/, accessed on 13 December 2022), a "National Energy Efficiency Strategy" (2009–2019) & (2020–2030)" (https://www.mem.gov.ma/, access on 13 December 2022), "National Climate Plan 2020–2030" (https://www.environnement.gov.ma/, accessed on 13 December 2022), and a "National Strategy for Sustainable Development 2030" (https://www.environnement.gov.ma/, accessed on 13 December 2022).

These strategies and sectorial programs support Morocco's regional and worldwide environmental leadership. These initiatives have well-defined objectives and key performance indicators contributing to the national green goals (Table 1).

Additionally, these plans and strategies have targeted the leading sectors of the Moroccan economy, mainly the knowledge-intensive industry, such as the automotive industry (Benchekroun & Boumane, 2020), textile sector (Smouh et al., 2022), manufacturing industry (Alba & Todorov, 2018; El Maalmi et al., 2021); agro-food industry (Abdelmajid et al., 2021; Govind et al., 2021) and water and energy sector (Haddad et al., 2022).

Furthermore, local initiatives have been adopted by local governments and civil society to integrate the principles of sustainability and environmental protection into Moroccan society, such as the Eco-Hammam initiative (Sibley et al., 2021), Eco-district (Echlouchi et al., 2022), terroir products (Perry, 2020), gender-based initiatives (Montanari & Bergh, 2019).

However, despite the efforts and positive results welcomed by the international community (Ammari et al., 2022), Zaatari (2022) demonstrated that Morocco's green economy model is unlikely sufficient to assist the country in fulfilling its international obligations and resolving its development issues. This conclusion supports Barua & Khataniar's (2016) position that middle-income economies follow a path of weak sustainability to achieve green innovation and growth performance (Gargab, 2021).

To this end, the new development model report (CSMD,2021) recommends four fundamental transformations for inclusive and sustainable development by 2035: strengthened human capital, territorial sustainability, social inclusion, and diversified economy.

Hence, Moroccan organizations, including knowledge-intensive industries, focus more on GI performance. Considering these environmental requirements, GI demands now more than ever before strengthened GHC via the development of green employee behavior (Sobaih et al., 2022), green thinking (Al-Ghazali et al., 2022), and environmental organization learning (Su et al., 2022). This research adds to the limited published literature regarding the influences of GHC on GI through GTL and GDCs in the Moroccan knowledge-intensive industry.

Table 1. National strategies & plans; objectives and actions (non-exhaustive list)

Strategies & Plans	Axes	Target & Objectives	Sources
Green Morocco Plan (2008–2018)	Pillar I strives to establish a modern, high agricultural potential, Private investment, State support (Agricultural Development Fund), and conversion, intensification, and diversification projects. Pillar II develops technically, commercially, and socially sustainable solidarity agricultural initiatives in unstable places (oases, mountains, and plateaus of the semi-arid)	Make agriculture the main lever for growth over the next 10–15 years; Aggregation as a model for the organization of agriculture; Private investment promotion; Adopting a contractual approach; The development of Moroccan agriculture as a whole without exclusion; Sustainable development of Moroccan agriculture; the recast of the sectoral framework (Land, Water, Tax, National market, Support and monitoring/evaluation	(Abdelmajid et al., 2021 ; Elder, 2022 ; Faysse, 2015 ; Berdai, 2016)
“Generation green” agriculture strategy (2020–2030)	Axe 1: Human element promotion; Axe 2: Agricultural development.	New agricultural middle class, young entrepreneurs, and professional organizations; Develop agricultural value chains; Improve agricultural product distribution and establish sustainable, resilient agriculture through the 2020–2027 national drinking water supply and irrigation program.	(Faysse, 2015 ; Youssfi et al., 2020 ; Amiri et al., 2021)
National Energy Efficiency Strategy (2009–2019) & (2020–2030)	Respect for the energy efficiency fundamentals in all new investments; Integration of energy efficiency requirements in all public expenditure and state-supported projects; Structuration and professionalism of the energy efficiency sector; Placing energy efficiency at the heart of the issues and concerns of professionals and citizens; Financial and institutional capacity building and evaluation of energy efficiency programs.	Four energy-consuming sectors: Transport (38% of final energy consumption), buildings (33%), industry (21%), and agriculture and street lighting (8%); Eighty measures; saving energy consumption of around 20% in 2030: (Transport: −24% Industry: −22% Buildings: −14%; Public lighting: −13%).	www.cese.ma (accessed on 13 December 2022) (Gargab, 2021)
National Climate Plan (2020–2030)	Improve climate governance; Climate-risk resilience; Accelerate the transition to a low-carbon economy;	Climate governance, institutional and sectoral cooperation; Legal framework for combating climate change;	(Smouh et al., 2022 ; Kahime et al.,

	Climate-proof territories; Build human, financial, and technological capabilities.	International and regional cooperation mechanisms; Sustainable and resilient agricultural sector; Decarbonizing energy production and achieving Morocco's energy transition; Sustainable and resilient development of territories	2017 ; Ismail et al., 2022)
National Strategy for Sustainable Development 2030	Economic pillar: efficient economy for sustainable development; Social pillar: Health policies, Education, Solidarity; Environmental pillar: green economy and green jobs; Cultural pillar: Cultural strategy for sensitive areas, Oases, the Zones of Mountains, and the Littoral.	Improving development governance; Gradual green economy transition; Improving natural resource management and biodiversity; Fighting climate change; Territorial development; Building social cohesion; National and local culture promotion	(Kahime et al., 2017 ; Dahl et al., 2021)

2.2. Green Human Capital and Green Innovation

NRBV theory emphasizes that if firms are to achieve GI, they must develop new resources and capabilities and strategically allocate resources to green strategies to develop green products, processes, technological innovation, and market performance (Wang et al., 2022). Many authors (Walker et al., 2008; Runhaar et al., 2008; Abdullah et al., 2016) identified the lack of environmental knowledge and resource availability as significant barriers to SMEs' green innovation adoption and integration.

Human resources are crucial to the firm's ecological goals and environmental management activities (Munawar et al., 2022). Firms actively improve their environmental standards and practices, although the question remains whether investing in these activities is beneficial or only a matter of public perception (Lannelongue et al., 2017). The importance of GHRM lies in its ability to increase staff awareness of environmental concerns and influence their attitudes, behaviors, knowledge, and skills related to environmental protection (Esmaeilpour & Bahmiary, 2017; Dumont et al., 2017). Therefore, many scholars have examined how GHC influences environmental performance, giving a company a competitive advantage (Chen, 2008). It is desirable to refer to the green knowledge, values, skills, and attitudes required to transition to a green economy, collectively constituting GHC. Its scarcity can significantly impede environmental progress, delaying and stymieing technological and economic transformations associated with environmental improvement (Goncharov, 2022). Indeed, GHC can align an organization's strategic decisions, operational activities, green organizational culture, and green values to generate GI (Pham et al., 2018, Song et al., 2020).

Similarly, under external pressure, employees' and managers' environmental knowledge and skills are vital for GI and ecological management (Wang et al., 2020). Muisyo & Qin (2021) postulated that a close association of GHRM and GI culture is needed to achieve green manufacturing products and processes. Ra et al. (2019) revealed that investment in green education and soft green skills helps Asia's knowledge-intensive agriculture develop high-tech agropreneurs.

Ullah et al. (2022) argued that human resources play a significant part in producing eco-friendly products, highlighting the necessity of environmentally focused human capital to enhance and support environmental and green efforts in enterprises. Numerous studies show that GHC is more responsive to ecological learning and training, which increases GI performance by enhancing employees' ability to manage environmental risks (Li et al., 2022; Muisyo & Qin, 2021).

Song et al. (2020) and Lannelongue et al. (2017) postulated that the innovative association of GHC, GHRM practices, and environmental knowledge is demanded to achieve effective GI performance and environmental sustainability. Thus, we hypothesize:

H1: GHC positively affects green innovation in the knowledge-intensive industry.

2.3. The Moderating Role of Green Dynamic Capabilities and Green Transformational Leadership

According to Teece (2007) and Helfat & Peteraf (2009), firms' competitive advantage is primarily influenced by their dynamic capability. Chen and Chang (2013) propose the original concept of "green dynamic capabilities," defined as "the ability of a company to exploit its existing resources and knowledge to renew and develop its green organizational capabilities to react to the dynamic market" (Teece et al., 1997), to achieve green growth in a changing environment.

The modern business environment is a dynamic one, and companies must contend with frequent shifts in the priorities of their customers, as well as changes in technology, supply networks, market demand, the political and regulatory focus, and innovations in both the materials and manufacturing technologies used (Alnaim et al., 2022). Likewise, to reduce waste, pollution, and ecological degradation, businesses must develop new knowledge and organizational capabilities and reorganize resources and internal expertise (Singh et al., 2022).

To this end, Yu et al. (2022) argued that GI adoption and performance-related outcomes require GDCs to calibrate resources and agility to environmental changes to attain sustainable development. Indeed, GDCs stimulate resource reconfiguration capability by combining existing and new business knowledge (Qiu et al., 2020). GDCs foster sustainable development and green initiatives through HRM (e.g., recruiting and training) (Yu et al., 2022). GDCs facilitate the embeddedness and propagation of green knowledge and skills needed to strengthen sustainable entrepreneurship, develop green products, and reduce environmental risk and uncertainty (Muisyo & Qin, 2021).

Several recent studies (Singh et al., 2020; Zhao & Huang, 2022; Al-Ghazali et al., 2022) have examined the link between GHC, GTL, and GI performance. According to Sobaih et al. (2022), GTL motivates employees to comprehend an organization's environmental goals by offering a clear vision, enthusiasm, motivation, and backing to fulfill ecological performance. Furthermore, GTL is considered a driver of GPD (Chen & Chang, 2013; Zhang et al., 2020), green employee behavior (Sobaih et al., 2022), and green performance (Chen et al., 2014). Recent research looked into various factors that might act as mediators or moderators in the relationship between GTL and green creativity (Zhang et al., 2020; Mittal & Dhar, 2016), green performance (Chen et al., 2014), and the performance of SMEs (Majali et al., 2022). Another study on the manufacturing SME industry found that GDCs moderate the relationship between GTL and green product and process innovation (Ahmad et al., 2022). Chen & Chang (2013) indicate that the positive correlation between GPD and their antecedents—GDCs and GTL—is partially mediated by green creativity.

Little research has been conducted on the moderating role of GTL and GDCs in the link between GHC and GI performance. Pan et al. (2021) conceptualized that the higher GTL, GDCs, and green organizational identity are, the higher the mediation effect of GI between GIC (including GHC) and agricultural corporate sustainable competitive advantage. This study is regarded as one of the most recent to evaluate the relationship between GHC and GI in a knowledge-intensive industry. GTL and GDCs are expected to moderate the relationship between GHC and GI performance positively. Hence, we could hypothesize that:

H2: Green transformational leadership moderates the relationship between green human capital and green innovation performance.

H3: Green dynamic capabilities moderate the relationship between green human capital and green innovation performance.

Figure 1 demonstrates the conceptual framework of this study:

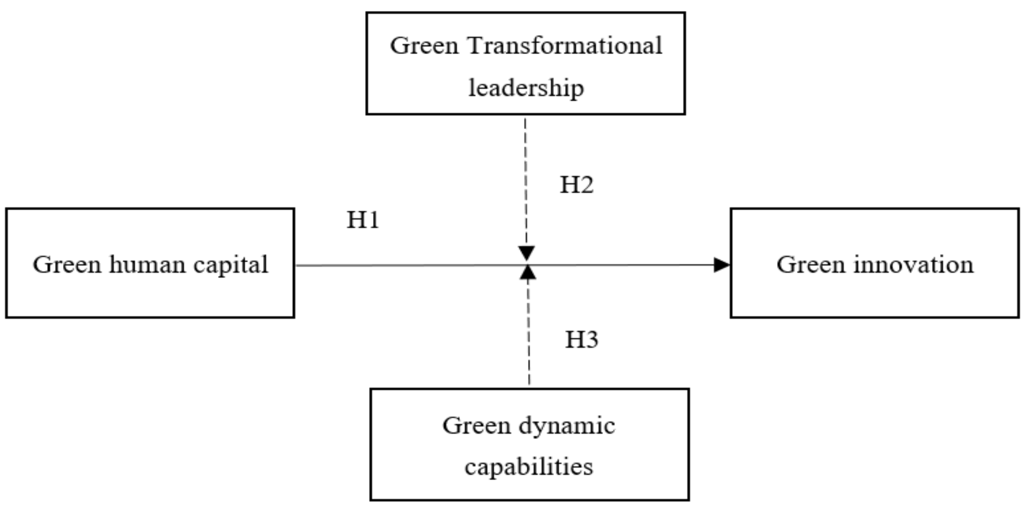

Fig. 1 Conceptual framework

3. Research Methodology

3.1. Methodological Choices and Statistical Tool

The study adopts a quantitative approach to measure, quantify and generalize the results based on a representative sample of the study population. The hypothetico-deductive approach—which statistically tests the relationship between constructs to offer empirical evidence (Sekaran & Bougie, 2016)—was used to examine hypotheses and causality (Wilson, 2010).

As the variables are unidimensional/reflective latent constructs, covariance-based structural equation modeling (SEM) is applicable. SEM is a powerful statistical method for testing models (Hair et al., 2016). SEM enables researchers to test several hypothesized correlations simultaneously, assesses alternative models, and indicates model-to-data fit (F. Hair Jr et al., 2014). SEM combines factor analysis with multiple regression. Regression analyzes the connection between criteria and predictor variables and explains the observed variables' shared variance. In contrast, factor analysis finds hidden variables (i.e., factors) and determines the factor structure underlying questionnaire scores (Hair et al., 2016). SEM uses variance-based partial least squares and covariance-based algorithms (Hair et al., 2011).

3.2. Study Population, Sampling, and Data collection

This study focused on GHC and GI among knowledge-intensive industries in Morocco. It also tested the moderating role of GDCs and GTL. According to Leydesdorff (2008) and Eurostat (https://ec.europa.eu/eurostat, accessed on 22 February 2022), knowledge-intensive industries include High-Tech, Medium-High-Tech, Medium-Low-Tech, and Low-Tech manufacturing firms (Table 2).

There were several reasons for selecting knowledge-intensive manufacturing firms for this research. First, based on Amachraa & Quelin's (2022) findings, the industries that added the most value between 1995 and 2018 were, in significant order, tourism, transport, telecommunications, and industries (particularly, textiles, agri-food, and automotive). Second is the problem of declining green performance in recent years (Smouh et al., 2022). Third, more research is needed on the sustainable performance declining issues of knowledge-intensive manufacturing SMEs in Morocco (Alba & Todorov, 2018; Zaatari, 2022). The study sample for the present study was obtained from (https://ma.kompass.com/, accessed on 20 April 2022). The top management team (TMT), i.e., owners and managing directors/CEOs, represents the unit of analysis for the current research

Table 2. Classification of knowledge-intensive industries

Technology Intensity	Industries
High-tech	Aerospace industries; Computers; Office machinery; Pharmaceuticals; Electronics-communications
Medium-high-tech	Scientific instruments; Motors vehicles-trailers and semi-trailers; Electrical machinery; Chemicals and chemical products; Non-electrical machinery; Other transport equipment; Machinery and equipment;
Medium-low-tech	Metal products; Ferrous metals; Coke and petroleum refining; Rubber and plastic products;
Low-tech	Textiles and clothing; Paper; Food; Wood products; Beverages and tobacco; Printing.

This research applies a random sampling method based on the 12500 knowledge-intensive manufacturing SMEs list. Following Krejcie & Morgan's (1970) table, a sample of 373 manufacturing SMEs was required. Wolf et al. (2013) suggested adding 40% to the sample size (373 + 373 × 40% = 523). The author sent 550 questionnaires (a French version was emailed with a cover letter detailing the study's scientific/ethical aims). A recognized expert translator established the French questionnaire (English Senior Professor).

This study uses three academic specialists in HRM studies and three automotive industry middle managers to guarantee the quality and validity of all items. Following the expert's remark, the final survey draft was modified to fit our national context. The constructs were rated from "strongly disagree" to "strongly agree" on a 5-point Likert scale. The data were collected from

SMEs in Morocco from June 2022 to October 2022. Only 201 were returned with complete data or 36.54 %. Table 3 shows respondent characteristics and SMEs.

Table 3. Respondent's profile and SME's characteristics.

Parameter	Frequency	Percentage (%)
Industry type		
High-tech	56	27.86
Medium-high-tech	78	38.81
Medium-low-tech	32	15.92
Low-Tech	35	17.41
Firm's age (Years of operations)		
1 to 5 years	48	23.88
6 to 10 years	112	55.72
More than 10 years	41	20.4
Education		
Diploma	16	7.96
Bachelor degree	102	50.75
Master's degree	69	34.33
Doctorate's degree	14	6.96
Experience		
1–5 years	134	66.67
More than 5 years	67	33.33
Position		
CEO	16	7.96
Director	82	40.8
Manager	103	51.24

3.3. Variables and Measures

The current study employed five (5) items for GHC dimensions identified from previous research (Chen, 2008; Chen & Chang, 2013). The dimensions of GDCs were measured using five (5) items (Nassani et al., 2022; Chen & Chang, 2013), while the dimensions of GTL were measured using six (6) items (Singh et al., 2020; Chen & Chang, 2013). A seven-item (7) scale adapted from Chen et al. (2006) and Zhang et al. (2018) was utilized to measure the independent variable of GI.

4. Quantitative Data Analysis

As mentioned above, SEM is the appropriate statistical method. The study adopted the two-step model estimation approach: the measurement model for construct validation and the structural model (SM) for testing hypotheses.

4.1. Measurement Model Evaluation

According to Hair et al. (2021), reflective measurement model evaluation confirms construct measure reliability and validity, justifying their inclusion in the path model. Reflective measurement model evaluation criteria include indicator reliability, internal consistency reliability [Cronbach's alpha, reliability coefficient (rhoA), composite reliability (rhoc)], convergent validity (CV), and discriminant validity (DV). Indeed, the validity tests involve two-test, namely CV and DV. As suggested by (F. Hair Jr et al., 2014; Fornell & Larcker, 1981; Hair et al., 2019), the CV was tested by figuring out the average variance extracted (AVE) values that were greater than or equal to 0.50 and the factor loadings that were greater than or equal to 0.70. Internal consistency validity was also validated and statistically accepted by the Cronbach alpha (CA) coefficients and composite reliability values, which were all more than 0.70. Besides, items with factor loadings below 0.70 were eliminated to enhance convergent validity since they would reduce AVE values and violate convergent validity criteria. Therefore, GTL5, GTL6, GPSI2, GPSI3, and GPSI4 were excluded.

Table 4. Constructs, scale items, and measurements model loadings

1st Order	2nd Order	Item	Loading	CA	rhoc	AVE
Green Human Capital (GHC)		GHC1	.747	.863	.900	.643
		GHC2	.790			
		GHC3	.805			
		GHC4	.863			
		GHC5	.8			
Green Dynamic Capabilities (GDCs)		GDC1	.802	.904	.929	.723
		GDC2	.861			
		GDC3	.891			
		GDC4	.865			
		GDC5	.829			
Green Transformational Leadership (GTL)		GTL1	.841	.914	.939	.794
		GTL2	.912			
		GTL3	.935			
		GTL4	.874			
		GTL5 *	-			
		GTL6 *	-			

Green Innovation (GI)	Green Product Innovation (GPI)	GPI1	.853	.908	.931	.730
		GPI2	.829			
		GPI3	.885			
	Green Process Innovation (GPSI)	GPI4	.888			
		GPSI1	.814			
		GPSI2 *	-			
		GPSI3 *	-			
		GPSI4 *	-			

* Removed item.

Based on Fornell and Larcker Criterion technique (Fornell & Larcker, 1981), the study tested the DV to assess the comparison of correlation between constructs with the square root of the AVE of constructs variables itself. As indicated in Table 5, bold values are above the respective row and column, suggesting the research measures were discriminant. Additionally, the Heterotrait-Monotrait ratio (HTMT) of correlations was developed by Henseler et al. (2015) to ensure the model is well-examined. The values in parentheses in Table 5 are less than .85 and satisfy the HTMT.85 criterion (Kline et al., 2012), demonstrating DV. The confidence interval does not indicate a value of 1 on any of the variables (Henseler et al., 2015), confirming DV.

Table 5. Fornell-Larcker Criterion & HTMT ratio

	GHC	GDCs	GTL	GI
GHC	.802			
GDCs	.181 (.201)	.850		
GTL	.104 (.126)	.296 (.321)	.891	
GI	.247 (.264)	.386 (.420)	.307 (.321)	.854

4.2. Assessment of PLS-SEM Results

This research includes three hypotheses–one direct-influencing hypothesis and two hypotheses that evaluate the moderating effect of GDCs and GTL. Smart-PLS software tested the relationships between endogenous and exogenous constructs (Hair et al., 2017). Using Smart-PLS® (v. 3.2.9), boot-strapping of 5000 sample size was run with a significance of 5% and a two-tailed test.

Figure 2 summarizes the inner model test results. It shows estimated causal paths between GHC and GI performance using GDCs and GTL as moderators. Path coefficients (β), *t* values, and *p* values were employed to examine exogenous and endogenous relationships. The null hypothesis is accepted if the t-value is larger than 1,96 and the p-value is less than .05.

Table 6 presents the hypotheses testing results. The structural path coefficient showed a significant positive relationship between GHC and GI. The direct influencing hypothesis (H1) is supported (β = .154, t = 2.516, p = .012). The hypothesis that GDCs and GTL have a moderating effect on the link between GHC and GI performance was examined and evaluated over the investigation. The results showed that the H2 test, which explains the moderating role of GHC and GTL interaction, was supported (β = .152, t = 2.055, p = .040). Furthermore, the result of the H3 test, which explains the moderating effect of GHC and GDCs interaction, was not validated since it did not have statistical significance; the *p*-value was greater than .05 (β = −.032, t = .451, p = .652). The value of the model's coefficient of determination (R^2-value or r-squared) is 23.9%, which is a medium effect, explaining 24% of the variance in the endogenous construct, namely GI.

Additionally, Figure 3 shows that GTL improves the relationship between GHC and GI. Furthermore, GDCs dampen this relationship.

Table 6. Direct and moderating hypotheses results

Hypotheses	β	Std Error	T-Statistics	p-Value	Result
GHC → GI	.154	.061	2.516	.012	Supported
GHC*GTL → GI	.152	.075	2.055	.040	Supported
GHC*GDCs → GI	−.032	.072	.451	.652	Not supported

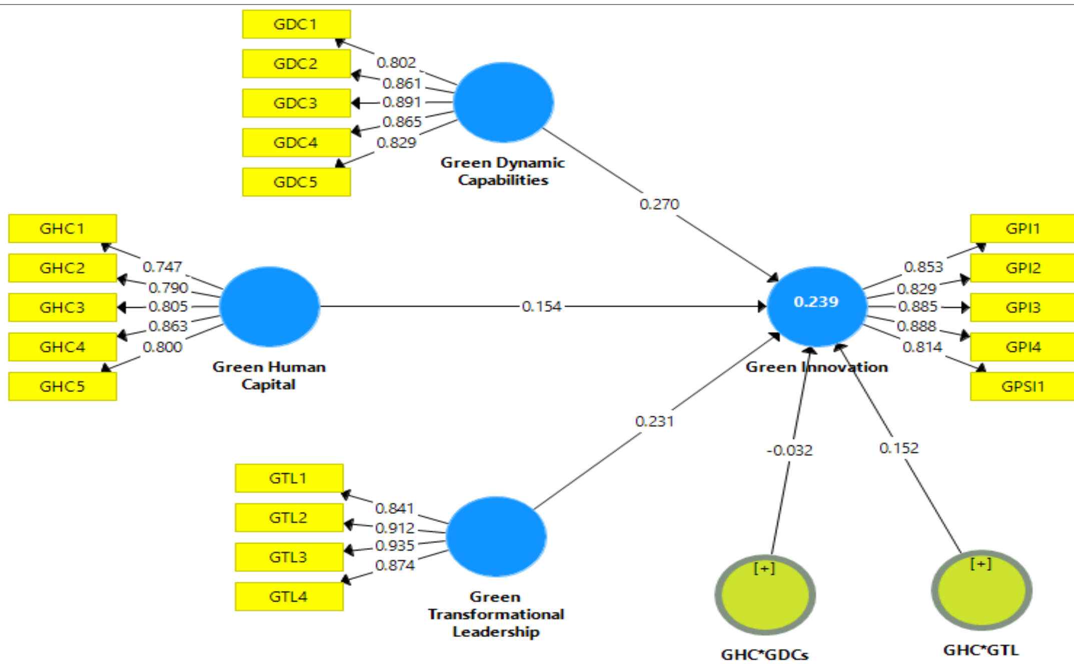

Fig. 2: SEM for study model

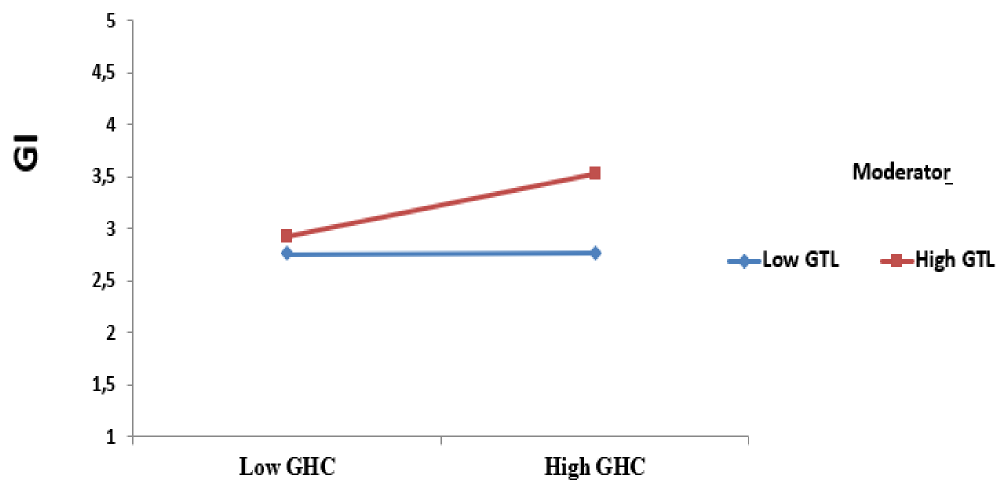

Fig. 3: The interaction effects

5. Discussion

Following the NRBV, this study analyzed and expanded the body of the theory by emphasizing the significance of GHC and GTL in green innovation capabilities. This paper examined the direct relationship between GHC and GI (H1). In the second (H2) and third (H3) hypotheses, the moderation role of GTL and GDCs in the relationship between GHC and GI was tested. The study found several empirical outcomes using data gathered from SMEs' top management teams. The direct hypothesis (H1) testing the relationship between GHC and GI performance was accepted ($\beta = 0.154$, $t = 2.516$, $p = 0.012$). Acceptance of H1 confirms that the GHC is acknowledged as one of the critical resources for SMEs in achieving GI performance. According to the study's findings, there is a significant and positive relationship between GHC and GI. Current results are similar to previous studies on this topic (Song & Yu, 2018; Liu et al., 2022; Song et al., 2020; Muisyo & Qin, 2021).

Recently, KII in Morocco witnessed considerable development in terms of GHC, like providing enough green experience, green competencies, green education and training, green IT skills, and green organizational knowledge to address new environmental- economic-health challenges (Kahime et al., 2017; Danh, 2017) which in turn leads to increase SMEs' GI capabilities and their outcomes on Moroccan green growth performance (Houssini & Geng, 2022). Using insights from KII in a developing economy, i.e., Morocco, the findings suggest that SMEs can benefit from green knowledge assets for developing high-green innovation value-added products and green structural systems and processes.

Moreover, grounded in strategic leadership theory (SLT) and seeking to extend the body of NRBV, the study introduced and tested the moderating influence of GTL on the relationship between GHC and GI (H2). The findings revealed that the interaction path was positive and significant ($\beta = .152$, $t = 2.055$, $p = .040$). According to SLT, leadership has grown to be acknowledged as an essential resource for SMEs' GI capabilities and a required method of attaining effectiveness, survival, and sustained competitive advantage (AlNuaimi et al., 2021). Prior research indicates that the association of GTL behaviors and GHRM practices may be essential in developing GI (Singh et al., 2020; Zhao & Huang, 2022). Indeed, Song et al. (2020) argued that GHRM practices could provide valuable tools for developing GHC to help firms realize their GI performance. Chen et al. (2014) reinforced this point of view that green transformational leaders with higher employees' green mindfulness and higher employees' green self-efficacy positively affect GI performance.

Maitlo et al. (119) also claimed that GTL improves green creativity through a GI climate and employees' green autonomy. Recently, Cahyadi et al. (2023) postulated that SMEs could solve their workers' green behavior concerns by supporting GTL and HR practices.

Moroccan knowledge-intensive industries carefully enhance green leadership behaviors and promote employees' pro-environmental behaviors to improve GI capabilities. Indeed, green transformational leaders may enhance green innovation by inspiring individuals with their green environmental strategies, creating a clear vision, and making staff passionate about ecological goals. Hence, it argues that when firms have leaders who inspire green objectives, goals, vision, and facilities for employees, individuals can better capitalize on the green motivation and green abilities obtained at the workplace to boost GI.

For the third hypothesis, the study found that GDCs negatively moderated the GHC – GI relationship ($\beta = -.032$, $t = .451$, $p = .652$), meaning GDCs failed to moderate the GHC-GI relationship. Thus, H3 was rejected. As such, the high GDCs decrease the direct effect of GHC-GI. This result contradicts Strauss et al. (2017), who concluded that employees' behaviors as micro-foundations of dynamic sustainability capacities in highly dynamic situations enable firms to adapt and reconfigure their resources, contributing to sustainability. However, to the best of the authors' knowledge, there is no study on the moderating influence of GDCs on the relationship between GHC and GI in the existing literature (Inayat et al., 2022). Besides, most previous studies have utilized GDCs as an independent or a mediator construct (Nassani et al., 2022; Chen & Chang, 2013; Yousaf, 2021; Qiu et al., 2020; Lin & Chen, 2017; Xing et al., 2020; Yuan & Cao, 2022) in SMEs' green and environmental research topics.

The current result is intriguing. The contradictions found can be explained by climate and environmental context, e.g., climate change and the COVID-19 pandemic (Kahime et al., 2017; Guaadaoui et al., 2021; Houria & Fatima, 2021), missing educational system agility, and lack of knowledge transfer Universities-SMEs (Ismail et al., 2022; Taleb & Pheniqi, 2022), Multi-stakeholder complexity (Chatibi & Lotfi, 2022), economic barriers (Youssef et al., 2022), social structure, poor governance in a changing technological context, and declining natural resources (Govind et al., 2021).

6. Conclusion and Research Implications

The study includes various factors that may improve SMEs' GI and environmental performance. The study underlined the importance of GHC and GTL as critical SME solutions to improve GI capabilities (Rustiarini et al., 2022; Cahyadi et al., 2023). Strategic and intellectual capital scholars have agreed that GTL is one of the primary sources for developing GHC and transferring green workplace behaviors from the individual to the organizational level (Singh et al., 2020; Zhang et al., 2020).

Additionally, this study revealed an urgent need to focus on GDCs in the knowledge-intensive sector, as GDCs is needed to strengthened the relationship between GHC and GI. Local research and studies stated that institutional context, business environments, socioeconomic-health challenges, and resource issues could be significant constraints.

Nowadays, knowledge-intensive industries are more than ever confronted with educational, geopolitical, economic, technological, and environmental challenges. Many knowledge-intensive SMEs seek new sustainable resources, such as GHC, to foster long-term sustainable competitive advantage. Developing green human capabilities associated with green leadership behaviors and organizational adaptability and agility can contribute to green business innovation in the green knowledge economy.

This study focused on SMEs' green human practices and strategies to sustain eco-friendly innovation-based competitive advantages. Furthermore, green human practices are regarded as one of the most important pillars upon which companies must stand to promote GI activities and enhance environmental sustainability. This study might enhance employees' green attitudes, managers' green leadership, and sustainable practices and assist firms in propagating environmental innovation culture. Moreover, the study presents pioneer evidence regarding combining three critical drivers of sustainable human management, green leadership strategies, and GDCs to maintain GI. Future research should examine how these connections may be explained from alternative perspectives and concepts.

The study findings contribute to theory and practice and expand on NRBV knowledge of how an organization can achieve GI performance through human resources (Song et al., 2020).

The research addressed significant gaps in the green knowledge assets domain concerning GI performance and the intervening and interacting impacts of GTL and GDCs. To the best of the authors’ knowledge, the research is among the first to examine GHC and GI performance in a knowledge-intensive industry context. However, most previous studies in the context of GHRM and green knowledge assets have addressed GI issues in several sectors worldwide. Therefore, relatively few studies use the same framework to investigate the issue of the green performance of knowledge-intensive SMEs in Morocco. Accordingly, this article appears to be the first to evaluate GTL and GDCs in the GHC and GI performance relationship in the national context.

The RBV and NRBV validated prior findings that managerial efforts to develop strong GHC increase GI performance. Furthermore, the results imply that leaders and managers in SMEs should view GI as a strategic resource and exploit it to achieve environmental management goals. Such a model may work wonders for GI and environmental performance, provided GHC obtains unequivocal support and commitment from top management.

Moreover, the encouraging data results educate leaders on managing their GHC for GI by fostering pro-environmental, transformational leadership behaviors, institutionalizing environmental management duties into the employee performance evaluation, and promoting visionary leader competency (Rani & Widyowati, 2021). Individuals, markets, and governments rely more on businesses that attempt to preserve competitive advantages, particularly those that address environmental factors. The study’s conclusions indicate that a firm’s human capital must be responsive to the natural environment and accountable for environmental operations.

6.1. Limitations and Futures Research

The study has various restrictions and limitations. First, the research focused on a specific industry in Morocco. Other sectors and industries operate under particular legislation, political relationships, and facilities. Future studies should increase its sampling beyond this setting to obtain more universal conclusions. This article focuses on a specific industry as a significant contributor to environmental concerns. Other industries have a large ecological effect, which has motivated investigations. Second, the study data were cross-sectional; however, longitudinal or panel data might help clarify the study’s components. Third, quantitative data from the questionnaire assessed hypotheses and objectives, but qualitative approaches like interviews were neglected. Future qualitative investigations may provide additional insight. Finally, we advise that further investigation be conducted related to other mediating/moderating constructs, such as green absorptive capability or GHRM practices, and analyzing causal links of these constructs.

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