INFLUENCE OF GREEN ENVIRONMENTAL ORIENTATION ON CORPORATE SUSTAINABLE PERFORMANCE IN THE MANUFACTURING SECTOR

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENT FOR THE DEGREE OF DOCTOR OF PHILOSOPHY
IN INDUSTRIAL BUSINESS ADMINISTRATION
KING MONGKUT'S INSTITUTE OF TECHNOLOGY LADKRABANG
BUSINESS SCHOOL
KING MONGKUT'S INSTITUTE OF TECHNOLOGY LADKRABANG
2025

KMITL-2025-KBS-D-128-003

Dissertation Title	Influence of Green Environmental Orientation on Corporate Sustainable Performance in the Manufacturing Sector
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Student ID	63611120
Degree	Doctor of Philosophy
Program	Industrial Business Administration (International Program)
Year	2025
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ABSTRACT

Against the backdrop of rising global environmental awareness and the advancing agenda of sustainable development, how manufacturing firms can enhance their sustainable performance through green-oriented strategies has become a critical topic in both strategic management and sustainability research. This study develops a comprehensive structural equation model to investigate how Internal Green Environment Orientation (IGEO) and External Green Environment Orientation (EGEO) influence Sustainable Performance (SP) through two key mediating variables: Green Competitive Advantage (GCA) and Green Innovation (GI).

Using primary data from 468 valid responses collected from manufacturing enterprises in China, this study employs SPSS and AMOS for reliability testing, descriptive statistics, confirmatory factor analysis, and structural equation modeling. The mediating effects are rigorously tested using the Bootstrap method.

The results reveal several novel insights. First, external green orientation (EGEO) is a more significant driver of green competitive advantage (GCA) than internal orientation, emphasizing the critical role of regulatory pressure, customer demands, and market dynamics in shaping firm competitiveness. Second, internal green orientation (IGEO) plays a more pivotal role in enhancing green innovation (GI), suggesting that internal commitment, leadership, and culture are foundational for sustainable innovation. Third, this study confirms the dual-pathway mechanism: both GCA and GI significantly mediate the relationship between green orientation and sustainable performance, offering a new integrated explanation for how green strategies translate into performance gains.

These findings contribute new theoretical knowledge to the orientation–capability–performance framework by simultaneously modeling both competitive advantage and innovation

as mediators. Practically, the study provides a strategic roadmap for manufacturing firms seeking green transformation, and recommends coordinated development of internal green capabilities and external stakeholder engagement. Policymakers are advised to craft enabling environments that support enterprise innovation and competitiveness for long-term sustainable growth.

ACKNOWLEDGEMENT

The completion of this dissertation is the result of the collective wisdom and support of many individuals. I would like to express my deepest gratitude to all those who have provided guidance, encouragement, and assistance throughout my journey toward the Doctor of Philosophy degree.

First and foremost, I would like to extend my sincere appreciation to my supervisor, **Assoc. Prof. Dr. Nuttawut Rojniruttikul**. Throughout my doctoral studies and the research process, Dr. Nuttawut has offered invaluable support with his rigorous academic standards, profound professional knowledge, and patient, thoughtful mentorship. From topic selection and research design to data analysis and manuscript writing, his guidance has not only expanded my academic horizons but also deepened my understanding of the responsibilities and value of scholarly research. He has been a mentor in academia and a role model in life.

I am also deeply grateful to the Business School of King Mongkut's Institute of Technology Ladkrabang for providing an excellent academic environment and rich resources, allowing me to engage in research and exchange ideas in an international and diverse atmosphere. My thanks also go to all the faculty members, administrative staff, and fellow students who offered their support and encouragement during my time at the university.

Special thanks are due to the representatives and respondents from manufacturing enterprises in China who participated in the questionnaire survey. Your active cooperation and support enabled me to collect valuable primary data and complete this research successfully.

Moreover, I am immensely thankful to my family for their unwavering love and support. To my parents, who have always stood quietly behind me with constant encouragement—your love has been my greatest source of strength. To my partner, thank you for being by my side through moments of pressure and difficulty, offering warmth and strength when I needed it the most.

With heartfelt gratitude, I dedicate this work to all those who have supported me in my academic and personal journey.

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CHAPTER 1

INTRODUCTION

1.1 Research Background

The global industrialization process has brought about numerous adverse impacts on the environment, including increasingly severe environmental pollution, abnormal climate changes, a reduction in biodiversity, declining environmental quality, and scarcity of resources, among other issues ((Menguc & Ozanne, 2005, Feng et al., 2018). Since the beginning of China's reform and opening-up policy, rapid economic development has been achieved, with historic highs in both economic scale and growth rate (Cao et al., 2022). China has continuously improved its economic structure, elevated social security levels, witnessed significant increases in urban and rural incomes, enhanced its social security system, and made remarkable progress in social stability and advancement. However, China's economic development still faces several prominent challenges.

Firstly, the substantial consumption of resources, such as fossil fuels, energy, and water resources, during China's economic development has resulted in limited effective resource utilization, exacerbating the issue of a "resource burden" (Zhang et al., 2022). Secondly, China's economic development still lags behind in terms of advanced technology adoption and innovation capabilities, leading to bottlenecks in certain sectors (Liu et al., 2022). Lastly, environmental protection in China still has ample room for improvement, with high levels of pollutant emissions, which have adverse consequences for economic development (Zhang et al., 2022). Furthermore, China's economic development exhibits problems related to an unreasonable economic structure, unsustainable growth patterns, regional economic imbalances, and susceptibility to unstable international economic conditions and a tendency towards international trade protectionism (Xie et al., 2019).

To address the conflicts between economic development and environmental protection, member states of the United Nations signed the United Nations Framework Convention on Climate Change (UNFCCC), which mandates measures to reduce

greenhouse gas emissions and mitigate the impacts of industrialization on global climate change. Since 2005, China has been implementing the UNFCCC, prompting various sectors of society to take a series of measures to strengthen ecological protection, reduce greenhouse gas emissions, and promote sustainable development. In 2015, the United Nations unveiled the 2030 Agenda for Sustainable Development, aimed at advancing global sustainability, eradicating poverty, fostering social inclusion, protecting the environment, and facilitating international cooperation to achieve sustainable development goals. In the context of these international commitments, China, in its 19th National Congress report, clearly outlined plans to implement nearly zero carbon emission pilot projects and establish a clean, low-carbon, safe, and efficient energy system (Adhami et al., 2018). Chinese President Xi Jinping has repeatedly emphasized China's "dual carbon" goals on the international stage, specifically, peaking carbon emissions by 2030 and achieving carbon neutrality by 2060, demonstrating China's commitment to addressing climate change.

The integration of international commitments and domestic policymaking, as exemplified by China's efforts to address climate change, underscores the importance of corporate sustainability in today's world. Especially in the context of China, is essential, this study summary the evidence from six aspects.

(1) Rapid Economic Growth and Environmental Costs: China's rapid economic growth has led to it becoming the world's largest carbon dioxide emitter. According to the Global Carbon Project, in 2019, China was responsible for 28% of global carbon dioxide emissions1. As the world's factory, industries play a significant role in this output, making corporate sustainability pivotal in efforts to reduce these emissions.

(2) Renewable Energy Efforts: China's investment in renewable energy is indicative of the scale of transformation required for a low-carbon future. In 2019, according to the International Renewable Energy Agency (IRENA), China accounted for 30% of the world's total renewable energy capacity. This showcases the potential role corporations play in advancing renewable technologies and sustainable practices.

(3) Urbanization and its Impact: By 2019, approximately 60% of China's population lived in urban areas, as reported by the World Bank. With urbanization comes increased energy consumption and waste generation. Therefore, sustainable urban planning, green infrastructure, and efficient resource management by corporations become critical.

(4) Corporate Green Financing: According to data from the Climate Bonds Initiative, by the end of 2019, China was the second-largest green bond market in the world. Green financing by corporations can accelerate the transition to a sustainable economy, reflecting the financial sector's recognition of the importance of sustainability.

(5) Consumer Awareness: A 2019 survey by the China Chain Store & Franchise Association indicated that over 70% of Chinese consumers were willing to pay more for eco-friendly products. This trend is forcing corporations to integrate sustainability into their products, supply chains, and operations.

(6) Regulations and Policies: China has implemented numerous environmental laws and regulations that directly impact businesses. Compliance and proactive engagement in sustainable practices will determine the success and competitiveness of corporations in such a regulatory landscape.

In conclusion, From the convergence of environmental challenges, policy imperatives, consumer preferences, and financial tools, corporate sustainability emerges as a crucial area of study. For China, with its unique scale of industrialization and commitment to a sustainable future, understanding corporate sustainability's intricacies becomes even more paramount. The issue of balancing China's economic development with environmental protection has become a global concern and forms the central theme of this study. Achieving sustainable economic growth while safeguarding the environment is a major challenge faced by China and the global community. This issue is the core focus of this research, which seeks to provide empirical data and key insights into how China's manufacturing companies' green environmental orientation affects their sustainable performance.

1.2 Research Problems

Firstly, while prior research has explored the link between environmental management practices, such as green supply chain management, and various forms of performance (economic, environmental, or social), there is a notable gap in the literature concerning the causal relationship between environmental orientation and a company's sustainable performance. Furthermore, scholars have not yet empirically validated the mediating role of the three dimensions of green innovation—green products, processes, and management—as intermediaries in the aforementioned relationship. In this study, we address these gaps by investigating the impact of environmentally oriented manufacturing companies on green competitive advantage and the mediating role of green competitive advantage. Therefore, from a theoretical perspective, this research bridges the existing research deficiencies.

Secondly, this research focuses on Chinese manufacturing companies, a significant yet relatively underexplored area in the existing literature. Prior studies have predominantly centered on Western countries, leaving a gap in people understanding of emerging markets like China.

from a practical standpoint, this study acknowledges that many manufacturing companies in China exhibit limited capabilities in green innovation and often rely on end-of-pipe emission reduction methods to address environmental pollution issues. This study will propose that green innovation, as a crucial environmental management practice, and green competitive advantage act as a bridge between environmental orientation and a company's sustainable performance. Through the adoption of new or improved processes, technologies, systems, products, and environmental strategic deployments, companies can avoid or minimize environmental harm, address pollution issues at their source, and effectively attain and maintain a competitive edge.

Additionally, this research is grounded in the resource-based view, providing a robust theoretical foundation for discussing the contributions of environmental orientation, green innovation, and green competitive advantage to a company's sustainable performance. The resource-based view identifies the value of possessing strategic resources and capabilities, enabling environmentally oriented companies to actively reconfigure their business practices, continually adapt and position themselves with regard to green-related strategic capabilities, and address the evolving internal and external conditions to reduce the environmental impact of their operations and products. In essence, this study delves into the foundational elements of green innovation by unveiling the relationships between internal resources, capabilities, and competitive advantages.

In summary, this study's innovative contributions lie in its exploration of the causal relationship between environmental orientation and sustainable performance, its validation of green innovation as a mediator, and its grounding in the resource-based view, thereby providing a comprehensive and novel perspective on how environmentally oriented manufacturing companies can enhance their sustainable performance.

1.3 Research Question

The following research questions will be posed:

RQ1: To what extent does green environmental orientation influence the sustainable performance of Chinese manufacturing companies?

RQ2: What are the causal relationships among green environmental orientation, green innovation, and green competitive advantage within the sustainable performance model of Chinese manufacturing companies?

RQ3: How well does the sustainable performance model fit the context of Chinese manufacturing companies, and what factors contribute to or hinder its goodness of fit?

1.4 Research Objectives

The primary objectives of this study are to investigate the impact of green environmental orientation on the sustainable performance of Chinese manufacturing companies and to analyze the mediating roles of green innovation and green competitive advantage in this process. Specifically, this research aims to achieve the following objectives:

(1) To assess the level of sustainable performance of Chinese manufacturing companies.

(2) To establish causal relationships among variables in the sustainable performance model of Chinese manufacturing companies.

(3) To test the goodness of fit for the sustainable performance model of Chinese manufacturing companies.

1.5 Significance of the Study

1.5.1 Theoretical Significance

Firstly, it contributes to filling a critical gap in the existing literature. While prior studies have explored the relationships between environmental management practices, performance, and advantage, there has been a notable lack of research investigating the causal relationship between environmental orientation and a company's sustainable performance. Moreover, the empirical validation of green innovation's three dimensions—green products, processes, and management—as mediating factors in these relationships is a novel contribution to the field.

Secondly, this study extends the understanding of environmental orientation's role in shaping green competitive advantage. By examining how environmentally oriented manufacturing companies in China can enhance their green competitive advantage, this research provides insights into how businesses can leverage their environmental initiatives for strategic advantage.

Lastly, by adopting the resource-based view as a theoretical foundation, this study deepens our comprehension of the contributions of environmental orientation, green innovation, and green competitive advantage to a company's sustainable performance. This perspective illuminates how firms can actively reconfigure their business practices, adjust their strategic capabilities, and reduce their environmental impact through internal resource and capability management.

1.5.2 Practical Significance

First and foremost, this study addresses the practical needs of manufacturing companies in China. Given the challenges of limited green innovation capabilities and the reliance on end-of-pipe emission reduction measures to combat environmental pollution, this research offers a practical solution. By emphasizing the role of green innovation and green competitive advantage as bridges between environmental orientation and sustainable performance, this study provides actionable insights for companies seeking to reduce their environmental footprint while maintaining advantage.

Furthermore, the findings of this study can guide policy makers and environmental authorities in China. By understanding the key factors that influence sustainable performance in the manufacturing sector, regulators can design more effective environmental policies and incentives that encourage companies to adopt environmentally friendly practices.

In conclusion, this research not only contributes to the academic understanding of the relationships between environmental orientation, green innovation, green competitive advantage, and sustainable performance, but also offers practical tools and recommendations for manufacturing companies and policymakers in China. Based on the research findings, this study proposes the development of a practical guidebook or best-practice manual that manufacturing enterprises can use to implement green strategies effectively. Additionally, the insights from this research can inform policy formulation, corporate training programs, and strategic planning workshops aimed at enhancing environmental sustainability and competitive advantage in the manufacturing sector.

1.6 Research Scope

1.6.1 Scope of contents

This study focuses on exploring the mechanisms through which green environmental orientation influences the sustainable performance of Chinese manufacturing companies. The research is grounded in the Resource-Based View (RBV) theory, which emphasizes that a firm's internal resources and capabilities can lead to sustained competitive advantages. Based on this theoretical foundation, the study incorporates four main constructs: Internal Green Environmental Orientation (IGEO), External Green Environmental Orientation (EGEO), Green Innovation (GI), and Green Competitive Advantage (GCA), with Sustainable Performance (SP) as the final outcome variable. The content scope covers the examination of direct and mediating relationships among

these variables through a structural equation modeling approach, thereby offering both theoretical insights and empirical evidence on how green orientation contributes to sustainable development in the manufacturing sector.

1.6.2 Scope of Population

Population: The population of this study encompasses manufacturing companies operating within China. These companies span a vast array of industries, each contributing differently to the nation's manufacturing output and facing distinct environmental challenges. Industries of interest include automotive, electronics, textiles, machinery, among others.

1.6.3 Area of study

The geographic scope of this research covers manufacturing enterprises across multiple major regions of China, including North China, South China, East China, Central China, Northwest, Southwest, Southeast, and Northeast China. This broad regional coverage ensures that the findings are representative of the country's diverse industrial landscape, allowing for a comprehensive understanding of how green environmental orientation impacts sustainable performance across different regional contexts.

Each region in China presents unique economic characteristics, environmental challenges, and policy implementations, offering a rich and varied setting for the study. For instance, East and South China are economically advanced and innovation-driven, while Central and Western regions are rapidly developing with growing environmental concerns and industrial restructuring efforts. By incorporating firms from these diverse regions, the study captures regional heterogeneity and enhances the generalizability and applicability of its results.

This study is based on the theoretical framework of environmental management and sustainability, and further extends it by integrating green environmental orientation, green innovation, green competitive advantage, and sustainable performance as key constructs. The insights derived from this geographically diverse sample aim to inform both regional and national strategies for green transformation in China's manufacturing sector.

1.7 Definition of Terms

1. Internal Green Environment Orientation: Internal green environmental orientation (IGEO) refers to a positive attitude towards environmental issues based on internal organizational culture, typically initiated by business leaders. It represents the investment of the enterprise in

environmental protection, as well as internal values and ethical standards, and is a collective internal awareness of environmental responsibility among all members (managers and employees) within the enterprise.

2. **External Green Environment Orientation:** External green environmental orientation (EGEO) refers to the perception of managers regarding the environmental demands that need to be addressed by external stakeholders. For example, the opinions of external stakeholders such as government, customers, and competitors regarding environmental demands can make enterprises aware of the importance of being green.

3. **Green Competitive Advantage:** Green competitive advantage (GCA) is mainly measured from two aspects: cost advantage and differentiation advantage, which are brought to the enterprise by green management practices. Among them, the competitive advantage of green differentiation mainly comes from enterprises providing green services or products that are different from their competitors, advocating green packaging or labeling, being able to provide products and services with lower sales prices in the industry, having few legal disputes with energy-saving and environmental protection government departments, having harmonious relationships between departments within the enterprise, maintaining stable and long-term partnerships with important suppliers, and having good customer satisfaction and reputation. In addition, the low-cost advantage of green is mainly measured by measuring the costs of transactions, financing, coordination, emissions reduction or pollution control, recycling of waste, energy, services or production, etc.

4. **Green Innovation:** Green innovation (GI) is an innovative or creative activity carried out in a green way in the products, processes, and other aspects of an enterprise, with the goal of achieving sustainable development and following the concept of green development. Based on the different objects of innovation, green innovation can be divided into green product innovation and green process innovation. Innovations related to product design, production, etc. are classified as green product innovation, while green process innovation involves introducing or creating new production processes to reduce resource waste and environmental pollution.

5. **Sustainable Performance:** Sustainable performance (SP) is a comprehensive performance that includes economic performance, environmental performance, and social performance. The environmental aspect involves the activities and responsibilities undertaken by the enterprise for green purposes; the economic aspect is the organization's efforts to maximize profits, using minimal raw materials, inventory management, and reducing production costs; and the social aspect usually includes employee-centered social performance and community-centered social performance.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Chapter 2, centered on literature review, meticulously explored the pivotal constructs of Green Environment Orientations, Green Competitive Advantage, Green Innovation, and their intertwined relationships with Sustainable Performance. Through a synthesis of various scholarly insights, the chapter not only provided a theoretical foundation for the study but also highlighted the significance of these constructs in shaping businesses' eco-conscious strategies and their impact on sustainable outcomes.

2.2 Related Theories

- 2.2.1 Resource-Based View Theory
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2.2 Related Theories

2.2.1 Resource-Based View Theory

The Resource-Based View (RBV) theory, rooted in strategic management and organizational theory, posits that companies can carve out and sustain competitive advantages by harnessing their distinct resources and capabilities (Zou & Tamer Cavusgil, 1996). Distinctively, it emphasizes that both tangible and intangible assets, paired with organizational capabilities and competencies, lay the groundwork for a firm's competitive edge.

Central to RBV is the emphasis on the uniqueness and strategic significance of resources. For a resource to offer a competitive edge, it must meet the VRIN criteria, being Valuable, Rare, Inimitable, and Non-substitutable. These are the resources that allow companies to exploit market opportunities or neutralize potential threats, and crucially, they should defy easy replication by competitors (Ferreira & Ferreira, 2025).

Beyond the mere possession of these resources, RBV highlights the pivotal role of organizational capabilities and competencies. These often emerge from a meld of a company's historical trajectory, accumulated learning, and domain-specific expertise (Cecchini et al., 2013). In dynamic markets, the concept of dynamic capabilities becomes central. This pertains to a firm's agility in adapting, evolving, and reconfiguring its resources to sync with shifting market demands, a concept further elaborated.

Resource heterogeneity is another integral facet of RBV, elucidating the inherent variations in resources across firms. This resource disparity can lead to performance differentials, with some firms naturally positioned to outperform their peers due to their unique resource constellation (Nayak et al., 2023). Meanwhile, the notion of resource transferability addresses the ease with which resources can be moved or shared across firms. While tangible assets, like machinery, might be transferred with relative ease, intangibles, such as brand equity or corporate culture, are less malleable.

A driving tenet of RBV is the attainment of a sustainable competitive advantage. This involves nurturing resources that are not just rare and valuable, but also resistant to imitation, ensuring that the competitive edge is long-lasting (Ganbold et al., 2021). Recent empirical work underscores the centrality of RBV in guiding strategic management decisions. For instance, companies are encouraged to optimize their unique resources and capabilities to sharpen their competitive position in the market. Decisions surrounding resource allocation, diversification, and innovation are often rooted in RBV's principles, aiming to augment and preserve the firm's competitive stance (Ferreira & Ferreira, 2025).

2.2.2 Sustainable Development Theory

Sustainable Development Theory, also termed "sustainability theory," presents an integrative framework aimed at synergizing the aspects of economic growth, ecological health, and social welfare. Deeply embedded in this perspective is a commitment to ensuring that economic development does not destabilize ecological systems or amplify social disparities. This understanding is anchored in the belief that the present generation should fulfill its needs without curtailing the potential of future generations to meet their own, thus offering a future-focused approach to development (Zhou et al., 2020).

This theory's genesis can be attributed to the increasing cognizance of the potential fallouts of unchecked economic development. The cautionary concept of the "tragedy of the commons" stands as a testament to the dangers of individualistic pursuits that disregard the well-being of shared resources and the collective (Mondal et al., 2024). Pushing back against such shortsightedness,

sustainability theory promotes a harmonious approach, urging practices that align economic aspirations with ecological stewardship and societal advancement.

Central to the Sustainable Development Theory is its acknowledgment of the interconnectedness of economic, environmental, and social domains. These realms are interwoven, such that an intervention in one can ripple through the others. This holistic mindset compels stakeholders to address challenges with a comprehensive lens, realizing that a disruption in ecological health, for instance, can have socioeconomic repercussions (Zhou et al., 2020, Borim-de-Souza et al., 2015).

Equally pivotal is the theory's temporal dimension, emphasizing the enduring implications of today's choices. This long-view perspective accentuates the responsibilities today's societies shoulder towards their successors, emphasizing that the decisions and actions of the present lay the foundation for the world of tomorrow (Steffen et al., 2015). The call for sustainable development is not the exclusive purview of a select few but rather a collective endeavor. This inclusive ethos underscores the theory, emphasizing that achieving a sustainable trajectory requires the concerted efforts of diverse stakeholders, from governments and businesses to communities and individuals (Pesqueux, 2009, Nasiri et al., 2022).

The theory's embrace of the precautionary principle further distinguishes it. In a world riddled with uncertainties, this principle champions a risk-averse approach, especially when actions have the potential to inflict harm on the environment or society. Such a stance urges stakeholders to adopt strategies that err on the side of caution, ensuring the well-being of both current and future generations (Runhaar et al., 2006).

In this context, Sustainable Development Theory underscores the need for adaptability and resilience in both societal structures and ecosystems. Given the ever-evolving challenges of a dynamic world, entities must be primed to adapt, ensuring their continued relevance and effectiveness in addressing emergent challenges.

2.2.3 Environmental Externality Theory

Environmental Externality Theory revolves around the understanding of costs or benefits that affect a party who did not choose to incur those costs or benefits. In the context of environmental management, externalities often relate to unintended side-effects of industrial processes, where consequences are not borne by those responsible but rather by society, the environment, or other entities. The theory underscores the idea that businesses, when operating without restrictions, may not internalize all costs associated with their actions, leading to suboptimal outcomes for society at large.

Historically, the traditional economic framework emphasized efficiency and optimization, often sidelining the consequences that extend beyond immediate production and consumption cycles. However, as environmental degradation and its repercussions became more evident, the need to factor in these external costs became undeniable (Dascalu et al., 2010).

The discourse around environmental externalities have significantly evolved over the past few decades. As global environmental challenges such as climate change, biodiversity loss, and resource depletion have taken center stage, the implications of externalities have broadened, pushing businesses to rethink their operational strategies. With the realization that unchecked externalities can lead to long-term economic disruptions, scholars and policymakers are advocating for a more integrative approach to business operations. Recent works, like those by Pang and Xie (2024), delve deep into the economic implications of environmental externalities, especially in the context of climate change, suggesting both adaptive and mitigation strategies.

2.2.4 Diffusion of Innovation Theory

The Diffusion of Innovation (DOI) Theory, conceptualized by sociologist Everett Rogers in 1962, offers a profound perspective on how new technologies, processes, or ideas permeate and gain acceptance within societies or organizations. Unlike the immediate assumption that innovations receive universal acclaim upon introduction, the DOI theory elucidates that acceptance is staggered, and individuals within a society or an organization embrace innovations at varying rates. This leads to the categorization of individuals into groups such as innovators, early adopters, early majority, late majority, and laggards, each exhibiting unique characteristics influencing their rate of adoption (Davidoff & Kleiner, 1991).

Rogers' theory outlines several vital factors influencing the pace of an innovation's acceptance. The perceived relative advantage of the innovation, its compatibility with existing values and practices, the complexity or ease of its understanding, the ability to experiment with it (trialability), and the visibility of its results (observability) all play crucial roles. Furthermore, communication channels, both mass media and interpersonal, critically shape the dissemination of information about innovations. While mass media might create initial awareness, personal networks often drive genuine acceptance and assimilation of innovative ideas or practices (Wang, 2025).

The evolution of green practices and sustainable innovations in modern industries makes the application of the DOI theory ever more salient. A business venturing into green manufacturing would benefit immensely from understanding this theory, anticipating the challenges and timescales involved in getting its stakeholders, both internal and external, to accept and integrate these new practices. Such insights can significantly shape strategic decisions, marketing efforts,

and stakeholder engagements (Lindgren & Widén, 2019).

Recent research has expanded the DOI theory's application, focusing on industries' shift towards sustainable practices. Wang et al. (2025) delves into the diffusion of renewable energy technologies across communities. Lindgren and Widén (2019) focus on the proliferation of green supply chain practices among manufacturers.

2.2.5 Corporate Competitiveness Theory

Corporate Competitiveness Theory delves into understanding the factors and mechanisms that drive a firm's ability to outperform its rivals in a market setting. Rooted in both strategic management and economic disciplines, this theory posits that a company's competitive edge is not just derived from possessing superior resources but also from the adeptness with which these resources are deployed and utilized. While various components contribute to corporate competitiveness, such as product innovation, strategic alignment, and organizational structure, it's the synergistic interplay of these elements that often dictates a firm's stature in the competitive landscape (Lenssen, 2006).

Historically, traditional measures of corporate competitiveness revolved around market share, profitability, and growth. However, as global markets evolved and became more dynamic, it was clear that an enduring competitive advantage required a more holistic approach. Scholars like Gao et al. (2025) argued for the importance of value chain analysis, highlighting that every activity in a firm's value chain contributes to its overall competitive position. Padilla-Lozano and Collazzo (2022) underscored the importance of core competencies and the strategic management of resources in shaping corporate competitiveness.

In the contemporary business setting, corporate competitiveness encompasses a broader spectrum of factors. The advent of global supply chains, rapid technological advancements, and increasing consumer awareness has brought sustainability and environmental responsibility to the forefront. Companies today are realizing that integrating sustainable practices isn't just a moral obligation but a strategic imperative to maintain and enhance their competitive position. In this context, the assimilation of green practices into core business strategies has become a significant determinant of competitiveness.

Recent studies reinforce this expanded understanding. Sukumar et al. (2020) introduced the concept of "blue ocean strategy", emphasizing the creation of new, uncontested market spaces, often driven by sustainable innovation. Furthermore, Isabirye et al. (2025) explored how sustainable supply chain practices influence corporate competitiveness in emerging markets, concluding that such practices lead to both financial and non-financial benefits.

2.2.6 Triple Bottom Line Theory

The Triple Bottom Line (TBL) theory, initially presented by John Elkington in 1997, offers an expanded view on corporate performance, urging organizations to weigh their contributions not merely by economic value but also through their environmental and social impacts. This philosophy, encapsulated in the Profit-People-Planet triad, has since reshaped the paradigm of sustainable business operations, emphasizing a broader vision of corporate responsibility.

Historically dominated by profit-driven metrics, the business world underwent a pivotal transformation as global awareness grew about the ramifications of unchecked industrial activities on societal well-being and environmental integrity. TBL surfaced in this changing landscape, promoting equilibrium between monetary pursuits, societal benefits, and environmental conservancy.

In its economic dimension, the TBL concept upholds the enduring significance of profit, underscoring its pivotal role in ensuring organizational sustainability. However, it expands the narrative to incorporate the 'people' and 'planet' components. The societal angle emphasizes business engagements that foster community welfare, endorse fair labor practices, and shun exploitative behaviors. Simultaneously, the environmental pillar advocates for reduced ecological footprints and heightened commitment to environmental conservation.

Recent academic explorations reveal an inherent synergy among these three facets. For instance, Corral Granados and Granados Gámez (2010)maintain that TBL not only addresses the externalities but also steers businesses towards innovative solutions, leading to long-term profitability. Furthermore, Shim et al. (2021) provides tools and techniques for businesses to measure and report on their TBL performance, highlighting its growing importance. Additionally, Abraham (2024) examine the challenges and complexities of the TBL approach, emphasizing the intricacies of balancing the three pillars in real-world scenarios.

2.2.7 Stakeholder Theory

Stakeholder Theory, as we understand it today, primarily originates from R. Edward Freeman's seminal work in 1984 titled "Strategic Management: A Stakeholder Approach." Before Freeman’s groundbreaking perspective, the dominant discourse in corporate strategy and business ethics was largely centered on shareholders. The focus was predominantly on maximizing shareholder value, and businesses were primarily evaluated by their profitability metrics. However, Freeman introduced a paradigm shift by postulating that businesses should account for a broader spectrum of entities – those that either affect, or are affected by, the company's actions and

decisions (Valentinov, 2023).

Central to the Stakeholder Theory is the very definition of stakeholders. Freeman characterized them as any group or individual who has the ability to influence or is influenced by the achievement of a company's objectives. This broadened the purview from just shareholders to include a host of other entities such as employees, customers, suppliers, communities, and even the broader environment in which the company operates. Another foundational aspect of this theory is the idea of value creation. Freeman asserted that businesses should strive to create value not just for shareholders, but for all stakeholders. This necessitates a delicate act of balancing, given that stakeholder interests can often diverge and even conflict. Furthermore, the theory accentuates the interconnected relationships between a business and its myriad stakeholders. It postulates that companies exist within a complex web of relationships and that their operational and strategic decisions should account for this intricate network .

Over the subsequent decades, the rudimentary concepts presented by Freeman have been dissected, expanded upon, and evolved by numerous scholars. For instance, Mitchell, Agle, and Wood in 1997 embarked on the intriguing task of stakeholder identification, seeking to delineate which stakeholders truly matter the most. Their influential work has since become foundational in guiding stakeholder management strategies across businesses. Simultaneously, scholars like Donaldson and Preston in 1995 delved deeper into the ethical dimensions embedded within the Stakeholder Theory. They advocated that stakeholders possess intrinsic value, and their interests warrant consideration, irrespective of what instrumental benefits they might offer to the firm. More recently, the strategic implications of Stakeholder Theory have also been explored. Harrison, Freeman, and Abreu in 2015 highlighted how proactive and thoughtful stakeholder management could endow firms with tangible competitive advantages. Additionally, in sync with the global shift towards sustainability, recent academic pursuits have also started integrating environmental considerations into Stakeholder Theory. Pioneers in this space, such as Driscoll and Starik in 2004, have postulated that even non-human entities, like the environment or ecosystems, should be regarded as vital stakeholders, thus advocating for more holistic and sustainable business practices.

Table 2.1 Summary of theory

Theory	Scholar	Definitions
Resource-Based View	Zou and Tamer Cavusgil, 1996; Ferreira and Ferreira, 2025; Cecchini et al., 2013; Nayak et al., 2023; Ganbold et al., 2021	firms can achieve and sustain a competitive advantage by leveraging unique, scarce, inimitable, and non-substitutable resources and capabilities.
Sustainable Development Theory	Zhou et al., 2020; Mondal et al., 2024; Borim-de-Souza et al., 2015; Steffen et al., 2015; Pesqueux, 2009; Nasiri et al., 2022; Runhaar et al., 2006	Theory emphasizes the integration of economic growth, ecological health, and social welfare, advocating for development practices that meet present needs without compromising future generations' ability to meet their own.
Environmental Externality Theory	Dascalu et al., 2010; Pang and Xie (2024)	Theory highlights how unintended environmental costs or benefits from economic activities impact third parties not involved in those activities, emphasizing the need for mechanisms such as taxation or regulation to internalize these externalities and correct market failures
Diffusion of Innovations Theory	Davidoff and Kleiner, 1991; Wang, 2025; Lindgren and Widén, 2019; Wang et al., 2025	Theory explains how new ideas, technologies, or practices spread through societies or organizations over time, emphasizing that adoption occurs in stages among different adopter groups and is influenced by factors such as perceived advantage, compatibility, complexity, trialability, and observability

Table 2.1 (Continue)

Theory	Scholar	Definitions
Corporate Competitiveness Theory	Lenssen, 2006; Gao et al., 2025; Padilla-Lozano and Collazzo, 2022; Sukumar et al., 2020; Isabirye et al., 2025	Theory explores how firms achieve and sustain a competitive advantage through the effective use of resources, strategic alignment, innovation, and core competencies, with increasing emphasis on sustainable and environmentally responsible practices as essential elements for long-term market success
Triple Bottom Line Theory	Slaper & Hall, 2011; Hubbard, 2009	Theory advocates for a holistic approach to evaluating corporate performance by emphasizing not only economic profitability but also social responsibility and environmental sustainability, encapsulated in the "Profit-People-Planet" framework. It urges businesses to balance financial success with positive social impact and ecological stewardship, promoting long-term value creation and accountability across all three dimensions

2.3 Current Situation of Chinese Manufacturing Enterprises

China, often dubbed as the "world's factory," has witnessed monumental growth in its manufacturing sector over the past few decades. Historically perceived as a hub for low-cost production, the nation has been steadily climbing the value chain, aiming for innovation-driven manufacturing and fostering high-tech industries.

2.3.1 Evolution and Growth

The landscape of China's manufacturing industry has undergone profound transformations since the dawn of the 21st century. Rooted in the ambitious economic reforms initiated in the late 20th century, China transitioned from a largely agrarian economy to a manufacturing powerhouse.

The beginning of the 2000s heralded an era of accelerated economic liberalization. As China opened its doors wider to foreign direct investment (FDI), it saw an influx of multinational

corporations setting up manufacturing bases to leverage the cost advantages offered by the country. This movement led to the rapid proliferation of private enterprises, transitioning the economic landscape from state-owned dominance to a more balanced mix, where private enterprises played a significant role in boosting manufacturing output (Liu & Kang, 2023).

2001 was a watershed moment for China's manufacturing evolution as it marked China's accession to the World Trade Organization (WTO). With this inclusion, Chinese manufacturing entities gained unprecedented access to global markets. Tariffs on Chinese exports were substantially reduced, leading to a surge in export-led growth. Conversely, the removal of many non-tariff barriers allowed China to import state-of-the-art technologies, thus infusing its manufacturing sector with technological prowess (Li et al., 2023b).

Underpinning these macroeconomic shifts was China's vast labor pool. The abundant, skilled, yet cost-effective labor attracted businesses worldwide, making the country a favored destination for manufacturing. Furthermore, the central and local governments strategically emphasized infrastructure development, ensuring seamless connectivity and efficient production ecosystems. From expansive highway networks to high-speed railways and world-class ports, China's infrastructure investment played a pivotal role in catapulting its manufacturing industry to global preeminence (Li et al., 2023a)

By the mid-2000s, China had firmly established itself as the "world's factory", becoming an indispensable node in global supply chains, producing a diverse array of goods ranging from textiles and toys to electronics and automobiles.

2.3.2 Shift to Value-Added Manufacturing

While China's initial growth in the manufacturing sector was primarily characterized by low-cost production driven by its abundant labor pool, the last decade has witnessed a conscious pivot. Recognizing the limitations of a growth model reliant on cost-competitiveness and low-value-added products, Chinese policymakers and industry leaders have emphasized climbing the value chain. This transition aimed at positioning China not just as a global manufacturing hub but also as a center of innovation and high-quality production.

A primary catalyst for this evolution has been the increasing domestic competition, wage inflation, and the realization that long-term sustainability necessitates a departure from the low-cost model (Padilla-Lozano & Collazzo, 2022). To that end, there's been a concerted push towards improving industrial capabilities, investing in research and development, and fostering a culture of innovation within the manufacturing sector.

The "Made in China 2025" initiative, unveiled in 2015, stands as a testament to this strategic

shift. Aimed at transforming China from a manufacturing giant into a global high-tech manufacturing power, this initiative identified ten priority sectors. These sectors encompass areas like advanced information technology, new materials, aerospace equipment, and biomedicine, signaling a clear intent to navigate towards sophisticated, technology-intensive manufacturing (Liao et al., 2022).

One of the significant tenets of the strategy is promoting green manufacturing. This is in line with China's commitments to environmental sustainability and reducing carbon emissions. The integration of digital technologies and the pursuit of intelligent manufacturing have also been emphasized, with smart factories and the internet of things (IoT) playing pivotal roles in modernizing China's manufacturing landscape (Tang et al., 2023).

Furthermore, the focus on quality over quantity has ushered in a paradigm shift. The initiative stresses brand-building, innovation, and creating globally competitive firms, reducing reliance on original equipment manufacturing (OEM) contracts and aiming for original design manufacturing (ODM) and original brand manufacturing (OBM) statuses, which offer higher value retention and profitability (Zhang et al., 2023).

In summary, China's manufacturing narrative is evolving. While the country's roots as the world's manufacturing epicenter remain firm, its branches are reaching towards innovation, technology, and sustainability, laying the foundation for its future growth.

2.3.3 Challenges and Environmental Concerns

China's dominance in the manufacturing domain has not come without its fair share of challenges and obstacles. As the country steadily transformed into the world's factory, it had to grapple with an array of intricate issues, both economic and environmental.

A significant concern in recent times has been the increasing labor costs. The demographic changes, combined with the burgeoning middle class's aspirations, have led to wage inflation. This is a departure from the past when the nation could bank on its vast pool of low-wage laborers to attract foreign companies seeking cost-effective manufacturing solutions (Liu & Kang, 2023). This upsurge in labor costs has made some segments of Chinese manufacturing less competitive, especially when juxtaposed against emerging economies like Vietnam, India, and Bangladesh, which offer lower wage structures.

This escalating cost structure isn't limited to just labor. The costs associated with land, utilities, and raw materials have also witnessed a significant uptick, putting additional pressure on manufacturers to maintain their price competitiveness on the global stage (Yasir et al., 2020).

Environmental concerns further compound these challenges. Decades of rapid industrialization have led to significant environmental degradation, manifesting in pollution of air, water, and soil. Cities like Beijing have grappled with alarming levels of air pollution, a direct consequence of unchecked emissions from factories and industrial units. The degradation isn't merely an ecological concern but also represents a substantial economic challenge due to its impacts on public health, agriculture, and overall quality of life (Muisyo et al., 2022).

Acknowledging the looming environmental crisis, the Chinese government has begun to pivot towards a more sustainable growth model. In recent years, there's been a heightened emphasis on green technologies and sustainable manufacturing processes. The government's push towards electric vehicles, renewable energy, and waste reduction is indicative of this shift. Manufacturers are now subjected to more stringent environmental regulations, necessitating investments in cleaner technologies and practices. While these regulations aim to curb pollution, they also represent an added operational challenge for businesses, especially those unprepared or unwilling to adapt (Wang, 2025)

In summary, while China's manufacturing prowess remains uncontested, the road ahead is paved with challenges. The dual pressures of maintaining economic competitiveness while addressing environmental concerns require a delicate balancing act, one that will shape the future trajectory of the nation's manufacturing landscape.

2.3.4 Embracing Sustainability

As the world gravitates towards sustainable practices, China, housing one of the largest manufacturing sectors globally, is at the forefront of this transition. The journey of Chinese manufacturing enterprises towards sustainability isn't merely a strategic pivot but a profound transformation driven by multifaceted factors.

The global narrative around climate change and environmental degradation has, to a significant extent, influenced this shift. International consumers, stakeholders, and partners increasingly demand sustainable and ethically-produced goods. This global push has translated into market pressures, with many international businesses expecting their supply chain partners, including Chinese manufacturers, to adhere to eco-friendly standards (Zhang et al., 2023).

Domestically too, the clarion call for sustainable practices is strong. Urbanization and industrial growth have resulted in discernible environmental impacts, from smog-covered cities to water pollution. The Chinese citizenry, increasingly informed and globally connected, has begun to demand better environmental governance and corporate responsibility. This domestic awakening,

coupled with stricter environmental regulations from the government, has propelled manufacturers to reconsider their operational methodologies.

To align with these global and domestic imperatives, many Chinese manufacturing enterprises are making concerted efforts to integrate sustainability into their core business strategies. Investments in green technologies are on the rise, with companies exploring renewable energy sources, sustainable materials, and cleaner production techniques. A Green Environment Orientation is no longer seen as an added cost but as an investment in future profitability and reputation (Dangelico & Pontrandolfo, 2015).

Moreover, efficient waste management has become a central concern. Rather than treating waste as a mere byproduct, companies are adopting a circular economy approach, looking at waste as a resource to be recycled and reused. Such initiatives not only reduce environmental harm but also lead to cost savings in the long run.

Efforts are also underway to diminish the carbon footprint. From adopting energy-efficient machinery to optimizing logistics for reduced fuel consumption, the emphasis is on minimizing the greenhouse gas emissions associated with manufacturing processes.

In essence, the sustainability narrative in China's manufacturing sector has evolved from being a mere response to external pressures to a proactive and strategic choice, laying the foundation for a greener and more sustainable future for Chinese manufacturing.

2.4 Concepts and Theories of Internal Green Environment Orientation

In the realm of Chinese manufacturing, the prominence of IGEO is increasingly evident. With global and domestic shifts toward sustainability, many manufacturing firms in China are introspecting, emphasizing R&D in green technologies, witnessing active leadership involvement in sustainable strategies, and fostering a culture that inherently values and promotes green practices (Wang et al., 2023). The notion of Internal Green Environment Orientation (IGEO) epitomizes the intrinsic commitment of an organization toward fostering environmental sustainability from within. This dedication is not driven by external pressures or mandates but stems from a voluntary, internal acknowledgment of the importance of environmentally sustainable practices.

2.4.1 Definitions of Internal Green Environment Orientation

The realm of environmental sustainability in organizational management has witnessed the emergence of the concept of Internal Green Environment Orientation (IGEO). It is imperative to

understand this construct deeply, given its increasing relevance in modern-day business dynamics. As we delve into its conceptual clarity, it's evident that the term has evolved and been presented in various lights by academicians over the years. Their perspectives bring forth not just its definition but also its nuances, implications, and intrinsic characteristics.

Table 2.1 Definitions of Internal Green Environment Orientation

Scholar	Definitions
Menguc and Ozanne (2005)	The degree to which an organization internally promotes, values, and integrates green practices and sustainability ethos into its operational and strategic frameworks.
Feng et al. (2018)	The propensity of an organization to prioritize and integrate environmental concerns into its decision-making process and culture, driven by internal beliefs and values.
Chan et al. (2012)	An organization's inherent inclination to endorse, incorporate, and foster environmental sustainability, primarily motivated by internal convictions and not external compulsion.

From Table 2.1, it shows that Menguc and Ozanne (2005) articulation of IGEO delves into the depth of organizational commitment. They emphasize the term's inherent focus on internalization, suggesting that organizations do not merely practice green initiatives superficially. Instead, there is a deeper integration where green practices get intertwined with both operational tactics and strategic visions. They define IGEO as "the degree to which an organization internally promotes, values, and integrates green practices and sustainability ethos into its operational and strategic frameworks." Their definition underscores that for a business to truly be oriented towards the green environment internally, it must promote, value, and practically weave sustainability into its daily operations and long-term strategies. Roberts and Wang take a slightly different stance, focusing on the decision-making processes within organizations. Their definition underlines the importance of environmental concerns in the very psyche of an organization. These concerns aren't passive but actively influence and shape the way organizations make decisions and frame their culture. They define IGEO as "the propensity of an organization to prioritize and integrate environmental concerns into its decision-making process and culture, driven by internal beliefs and values." Through this definition, they emphasize the prioritization of environmental consciousness, suggesting that truly green-oriented companies won't relegate such concerns to the background but will actively prioritize them in decisions. Feng et al. (2018) provide an insightful perspective,

bringing the aspect of motivation into the conversation. While many organizations might adopt green practices due to external pressures such as regulations or market demands, Chan et al. (2012) stress the importance of internal motivations. They perceive IGEO as "an organization's inherent inclination to endorse, incorporate, and foster environmental sustainability, primarily motivated by internal convictions and not external compulsion." Their definition shines a light on the genuine commitment to sustainability, suggesting that the most impactful green practices are those rooted in the organization's core beliefs and not just adopted in response to external forces.

In summary, this study discerns a common thread - IGEO isn't about superficially adopting green practices. It's about imbibing them deeply into an organization's DNA, shaping its decisions, strategies, and cultural fabric. The varied definitions, while differing in their focus, collectively elucidate the comprehensive nature of this orientation and its pivotal role in steering organizations toward genuine sustainability.

2.4.2 Theory of Internal Green Environment Orientation

Internal Green Environment Orientation (IGEO) has gained traction in academic circles, with scholars diving deep into its nuances across varied industries. Each sector, given its unique characteristics, manifests IGEO differently, emphasizing distinctive observed variables and the subsequent implications on environmental sustainability and corporate performance.

Table 2.2 Literature Review on Internal Green Environment Orientation

Scholar	**Latent Variables**	**Observed Variables**
Menguc and Ozanne (2005)	Internal Green Environment Orientation	R&D investment and top management support
Yao et al. (2009)	Internal Green Environment Orientation	firm culture, top management support, employee training, and internal green campaigns
Wang et al. (2023)	Internal Green Environment Orientation	R&D, firm culture, and green procurement practices
Chan et al. (2012)	Internal Green Environment Orientation	internal environmental training, top management support, and green innovation culture

The collective insights from these scholars, spread across diverse industries, offer a rich tapestry of IGEO's conceptual depth. It's evident that while certain observed variables like top management support and firm culture are universally pertinent, others emerge based on industry-specific challenges and dynamics. Based on the other scholars research, this study of

IGEO finds its foundation in three critical dimensions that reflect the organization's internal orientation toward the environment:

(1) R&D Investment: Investing in research and development (R&D) is a critical manifestation of IGEO. Firms with a strong internal green orientation prioritize R&D not only to innovate their products or services but also to ensure their processes are environmentally sound. This dimension underscores the strategic importance of green innovation, as companies invest time and resources to design sustainable solutions that cater to both market demands and ecological considerations .

(2) Top Management Support: Leadership plays a pivotal role in shaping organizational behavior. Top management's endorsement and commitment to green practices heavily influence the firm's direction and internal culture. Their proactive stance, strategic direction, and decision-making patterns reflecting environmental concerns embed sustainability in the core of organizational objectives .

(3) Firm’s Culture: The most deep-seated dimension of IGEO is the organizational culture. It encompasses the collective values, beliefs, rituals, and norms that define how a firm views environmental sustainability. A culture that inherently values green practices will naturally exhibit behaviors and strategies aligned with environmental protection. This dimension encapsulates the shared understanding and collective mindset of all organizational members toward the environment.

Based on the Resource-Based Theory View. Given the focus on R&D and top management support, this theory highlights how organizations can leverage their internal resources – be it financial for R&D or human resources like top management – as a competitive advantage. Organizations with robust IGEO can harness these resources to drive environmentally sustainable practices and outcomes.

From the literature, concepts, theory and researchers conducted on the IGEO, the following model was developed for IGEO, which comprised three observed variables, as shown in figure 2.1 below.

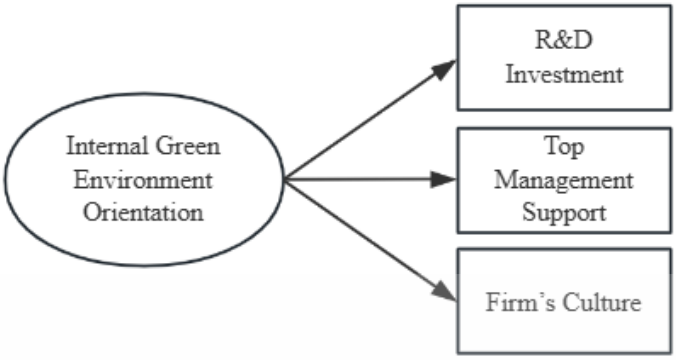

Figure 2.1 Internal Green Environment Orientation

Source: Menguc and Ozanne (2005); Yao et al. (2009);Wang et al. (2023), Chan et al. (2012)

2.5 Concepts and Theories of External Green Environment Orientation

2.5.1 Definitions of External Green Environment Orientation

External Green Environment Orientation (EGEO) offers a complementary perspective to IGEO, focusing on the environmental factors external to the organization and how companies respond, adapt, and integrate these external factors into their strategic operations. Several scholars have laid down definitions that capture the essence of EGEO:

Table 2.3 Definitions of External Green Environment Orientation

Scholar	Definitions
Dangelico and Pontrandolfo (2015)	An organization's responsiveness and adaptability to external environmental pressures and opportunities, where it seeks alignment with stakeholders' environmental expectations and market-driven green initiatives.
Yuan and Cao (2022)	The degree to which an organization perceives, prioritizes, and aligns its strategies based on external environmental stimuli, including regulatory pressures, customer demands, and competitive green benchmarks.
Fatoki (2021)	An organization's strategic orientation that proactively captures and responds to external environmental trends, harnessing opportunities and mitigating risks in the broader ecosystem.

Table 2.3 (Continue)

Scholar	Definitions
Yasir et al. (2020)	The outward-focused strategy of a firm, which actively integrates and aligns its operational frameworks with the dynamic environmental expectations of the market, stakeholders, and regulatory bodies.

These definitions provide a comprehensive understanding of EGEO, emphasizing an organization's proactive and strategic approach to external environmental factors. While IGEO focuses on internal beliefs and values, EGEO underscores the importance of external pressures and opportunities in shaping a company's green strategy.

2.5.2 Theory of External Green Environment Orientation

The study of External Green Environment Orientation (EGEO) has attracted scholars from varied domains, given its relevance to contemporary business environments shaped by environmental considerations. Several pivotal studies have explored the intricate dynamics of EGEO across multiple industries.

Table 2.4 Literature Review on External Green Environment Orientation

Scholar	Latent Variables	Observed Variables
Menguc and Ozanne (2005), Feng et al. (2018)	External Green Environment Orientation	technology adaptation, global trends, investor pressures, international agreements
Wang et al. (2023), Chan et al. (2012)	External Green Environment Orientation	external stakeholder pressures, eco-labeling, and green partnerships with suppliers
Fatoki (2021), Ye et al. (2022)	External Green Environment Orientation	customer demand for green practices, regulatory compliance, and industry benchmarking
Zameer et al. (2022), Bhatti et al. (2023)	External Green Environment Orientation	external certifications, community pressures, and international environmental standards

Table 2.4 (Continue)

Scholar	Latent Variables	Observed Variables
Yasir et al. (2020), Zhou et al. (2020)	External Green Environment Orientation	eco-tourism demand, feedback from international tourists on sustainability, and collaboration with local communities for sustainable tourism practices

Stakeholder Theory underscores the significance of holistic, stakeholder-centric approaches for sustainable performance. Companies that actively engage with stakeholders and integrate their concerns into strategic decision-making are better positioned to foresee environmental challenges, seize green opportunities, and cultivate trust and loyalty among stakeholders. Under the lens of EGEO, Stakeholder Theory shines a light on the intricate web of external influences that shape a company's green orientation. For instance, Environmental Activists and Communities: Their influence can directly shape a company's environmental policies. Ignoring their concerns can lead to protests, boycotts, or negative publicity. Regulators and Policy Makers: These bodies can exert influence by setting environmental standards, offering incentives for green practices, or imposing penalties for non-compliance. Customers: A growing eco-conscious customer base demands sustainable products and practices. Catering to this demand can offer competitive advantages. The theory posits that when organizations neglect the interests of key stakeholders, they may face significant operational and reputational risks. For instance, failing to meet environmental expectations can lead to backlash from communities, activists, or regulators, affecting the company's bottom line and public image.

Therefore, based on the other scholars research, this study of EGEO finds its foundation in three critical dimensions that reflect the organization's external orientation toward the environment:

(1) Perceived Policy Effectiveness: Perceived policy effectiveness pertains to how organizations interpret and gauge the efficacy of environmental regulations and policies imposed by governmental and authoritative bodies. Such perceptions can significantly influence an organization's green strategic choices. If a company perceives these policies as effective, it may be more inclined to align its operations in a manner that conforms to or even surpasses these guidelines. This is because they would view such regulations as beneficial for the environment and, by extension, beneficial for their long-term sustainability and public image. On the other hand, if these policies are perceived as ineffective or merely symbolic, companies might only do the bare minimum to comply, viewing them more as a necessary burden rather than an opportunity.

(2) Competitor Competition: This variable emphasizes the role of competitive pressures in shaping a firm's green orientation. In today's global market, companies are not only competing on

traditional factors like price and quality but also on their green credentials. If competitors are adopting sustainable practices and gaining market share or improved brand reputation as a result, it can push other firms to elevate their own green practices in order to remain competitive. This facet of EGEO underscores that, often, the push towards sustainability isn't solely altruistic or compliance-driven; it can also be a strategic move to retain or capture market position.

(3) Customer Demand: This revolves around the preferences and demands of consumers regarding environmentally friendly products and sustainable business practices. In contemporary markets, informed and environmentally-conscious consumers often seek products that are produced sustainably, have a minimal carbon footprint, or are aligned with broader environmental protection goals. When businesses perceive a strong customer demand for green products or practices, they are more likely to invest in and prioritize EGEO. It's a reflection of the market-driven forces that can shape and guide a company's external green orientation. Furthermore, aligning with customer demands can also enhance brand reputation, foster customer loyalty, and can be a catalyst for driving increased sales or market share.

In essence, these three observed variables offer a comprehensive view of the external pressures and cues that inform and shape an organization's green orientation. Each speaks to a different facet of the external environment, be it regulatory, competitive, or market-based, elucidating the multifaceted nature of EGEO. As shown in figure 2.2 below.

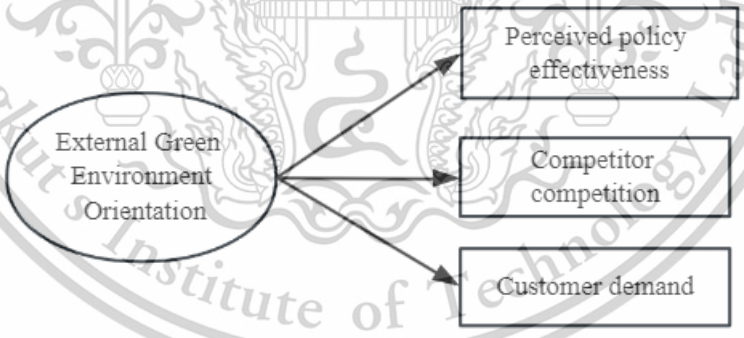

Figure 2.2 External Green Environment Orientation

Source: Zhou et al. (2020);Wang et al. (2023), Chan et al. (2012)

2.6 Concepts and Theories of Sustainable Performance

2.6.1 Definitions of Sustainable Performance

Sustainable Performance, in the corporate context, has emerged as a holistic evaluation metric that extends beyond mere financial metrics to encapsulate environmental and social dimensions. This is rooted in the idea that for an enterprise to thrive long-term, it must balance its economic goals with environmental stewardship and social responsibility. Here are some definitions proposed by scholars over the years, As shown in Table 2.5 below.

Table 2.5 Definitions of Sustainable Performance

Scholar	Definitions
Zhai et al. (2018)	An organization's ability to operate efficiently, maintaining economic viability while concurrently addressing environmental and social concerns. It's the synergy between profit, planet, and people that fosters long-term organizational success.
Li et al. (2022)	The manifestation of strategies and operations that intertwine financial objectives with ecological preservation and societal well-being. It is the equilibrium where an organization's profitability does not come at the expense of environmental and social deficits.
Gao et al. (2025)	A reflection of an organization's comprehensive output, considering not only economic returns but also its environmental footprint and contribution to social equity. It's a multi-pronged approach to assessing organizational success, transcending traditional financial benchmarks.
Ye et al. (2022)	The cumulative result of an organization's endeavors to integrate economic prosperity with environmental and social advancement. It is a forward-thinking metric that values resilience, adaptability, and a broader sense of responsibility towards stakeholders and the planet.

These definitions shed light on the evolving nature of performance measurement in contemporary business contexts. No longer is success solely gauged by profit margins or shareholder returns; today, businesses are being held accountable for their ecological and societal impacts, emphasizing the intertwined nature of financial, environmental, and social performance.

2.6.2 Theory of Sustainable Performance

The conceptualization of Sustainable Performance (SP) has evolved, encompassing a multifaceted spectrum of dimensions that scholars have studied across diverse sectors. A review of this academic terrain reveals the breadth and depth of considerations that characterize sustainable performance (SP). As shown in Table 2.6 below.

Table 2.6 Literature Review on Sustainable Performance

Scholar	Latent Variables	Observed Variables
Shahab et al. (2020)	Sustainable Performance	economic viability, environmental stewardship, and social responsibility
Nasrollahi et al. (2020)	Sustainable Performance	financial robustness, risk management, and community engagement
Zhai et al. (2018)	Sustainable Performance	technological innovation, environmental footprint reduction, and stakeholder inclusivity
Aboalhool et al. (2024)	Sustainable Performance	sustainable supply chain, ethical labor practices, and product longevity
Wang et al. (2022)	Sustainable Performance	Profitability, societal contributions
Li et al. (2022)	Sustainable Performance	environmental performance, economic performance
Ye et al. (2022)	Sustainable Performance	environmental performance, economic performance
Alcouffe et al. (2024)	Sustainable Performance	patient satisfaction, employee well-being, and social performance

The theoretical foundation of Sustainable Performance (SP) is deeply rooted in several established frameworks, primarily the Triple Bottom Line and Environmental Externality Theory

Triple Bottom Line (TBL) which introduced by John Elkington in the 1990s, the TBL concept aligns directly with the three dimensions of SP: economic, environmental, and social. Elkington's premise was that companies should prepare three different (and separate) bottom lines. The first is the traditional financial one, which measures economic performance. The second measures the organization's environmental responsibility, and the third gauges its social justice performance. In the context of manufacturing enterprises, this translates to optimizing economic gains while ensuring environmental stewardship and fostering social equity and community engagement.

Environmental Externality Theory, this theory underscores the external impacts (both positive and negative) an organization's activities can have on the environment. In terms of SP, the environmental performance dimension is a response to these externalities, where manufacturing enterprises take proactive measures to minimize their negative environmental impacts and, wherever possible, contribute positively.

Therefore, based on the scholars research, this study of SP finds its foundation in three critical dimensions that reflect the organization's sustainable performance toward the environment:

(1) Economic Performance: In the context of Sustainable Performance (SP), economic performance pertains to an organization's commitment to realizing optimal economic outcomes while remaining mindful of its broader responsibilities. For manufacturing enterprises, this involves a strategic approach to resource allocation — maximizing profitability while ensuring efficiency in raw material use, inventory management, and cost-effective production processes. It emphasizes the intertwining of profit motives with responsible business practices that ensure long-term economic viability.

(2) Environmental Performance: Environmental performance, within the realm of SP, reflects a manufacturing enterprise's dedication towards green initiatives. Rather than just adhering to environmental regulations, it encompasses a proactive commitment to minimizing negative environmental impacts. For management in the manufacturing sector, this means adopting and promoting practices that reduce waste, optimize resource consumption, and encourage green innovations, all while maintaining production efficiency.

(3)Social Performance: Social performance captures the human-centric initiatives and responsibilities shouldered by a manufacturing enterprise. This dimension extends beyond just the well-being and safety of employees. It encapsulates an organization's commitment to fostering a positive work environment, promoting diversity and inclusion, and ensuring equitable practices. Additionally, it recognizes the enterprise's role within the larger community, highlighting its efforts to engage with and contribute positively to the local communities where it operates.

In conclusion, sustainable performance is not a standalone concept, but one deeply interwoven with established theoretical paradigms. By understanding and applying these theories, manufacturing enterprises can better appreciate the importance and nuances of SP in today's business landscape. These three pillars of Sustainable Performance underscore the multifaceted approach that modern manufacturing enterprises must adopt. Balancing economic goals with environmental stewardship and social responsibility ensures not just short-term gains but the long-term sustainability and reputation of the enterprise. As show in figure 2.3.

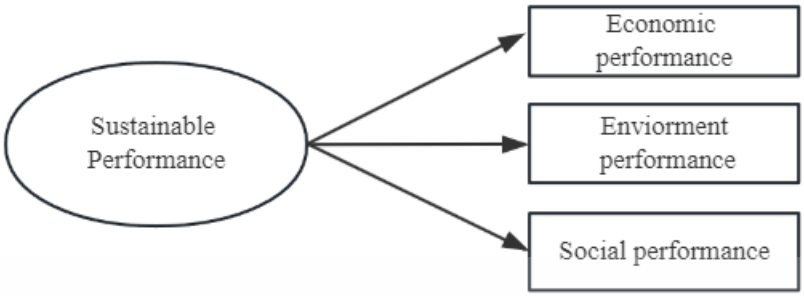

Figure 2.3 Sustainable Performance

Source: Wang et al. (2022); Li et al. (2022); Ye et al. (2022)

2.7 Concepts and Theories of Green Competitive Advantage

2.7.1 Definitions of Green Competitive Advantage

The concept of a competitive advantage has been a cornerstone in the strategic management literature, and when coupled with sustainability, the term "Green Competitive Advantage" emerges. While the notion of gaining a competitive edge through conventional means like cost leadership or differentiation is well understood, the integration of "green" or sustainable aspects into this realm has been relatively recent. This study explores some of the scholarly definitions that encapsulate this progressive approach, as show in table 2.7.

Table 2.7 Definitions of Green Competitive Advantage

Scholar/Researcher	Definitions
Zou and Tamer Cavusgil (1996)	Proactive environmental strategies can act as a catalyst in innovating business processes, leading to a competitive advantage that is environmentally sound.
Zhang and London (2013)	Green Competitive Advantage as "an edge over competitors derived from strategies that align profitability with sustainable operations and product differentiation.

Table 2.7 (Continue)

Scholar/Researcher	Definitions
Lin and Chen (2016)	Green Competitive Advantage as "the ability of a business to differentiate itself positively from its competitors through superior environmental performance, leading to enhanced market position and profitability.
Nasrollahi et al. (2020)	Green Competitive Advantage as a strategic edge that enterprises garner by foreseeing, innovating, and influencing the direction of environmental constraints.

To synthesize, Green Competitive Advantage refers to the strategic edge companies obtain by embedding sustainable, environmentally friendly practices in their operations, products, or services. Such practices not only cater to increasing global concerns about the environment but also resonate with a growing environmentally-conscious consumer base. This shift propels firms to innovate, differentiate, and position themselves distinctively in the market, driving both environmental and economic benefits.

2.7.2 Theory of Green Competitive Advantage

The recognition of the importance of sustainability in strategic management has spurred numerous studies on how green initiatives translate into competitive advantages for firms. Different scholars have approached Green Competitive Advantage (GCA) from various angles, shedding light on its observed variables or dimensions across industries.

Table 2.8 Literature Review on Green Competitive Advantage

Scholar	Latent Variables	Observed Variables
Lin and Chen (2016)	Green Competitive Advantage	differentiation and cost advantage
Fatoki (2021)	Green Competitive Advantage	differentiation and cost advantage
Leonidou et al. (2015)	Green Competitive Advantage	differentiation and cost advantage
Cao et al. (2022)	Green Competitive Advantage	differentiation and cost advantage
Chang (2011)	Green Competitive Advantage	differentiation and cost advantage

The Resource-Based View (RBV) suggests that firms can achieve and sustain a competitive advantage by harnessing their unique resources and capabilities. In the context of GCA, environmental-friendly resources, be it green technologies, sustainable supply chains, or eco-centric organizational culture, can become invaluable assets for firms. When these "green" resources are rare, valuable, inimitable, and non-substitutable, they confer a genuine green competitive advantage.

Through the exploration of these studies, it becomes evident that the duality of differentiation and cost advantage, even within the green competitive landscape, is pervasive across industries. As companies strategically incorporate sustainability, they aren't merely appeasing the environmentally-conscious market segment but are also carving out tangible economic benefits for themselves.

Therefore, In this research, the concept of Green Competitive Advantage (GCA) is primarily dissected into two significant dimensions: Differentiation Advantage and Cost Advantage, both outcomes of the enterprise's green management practices.

(1) The Differentiation Advantage refers to the capacity of businesses to attain a unique market position by offering green products or services distinct from competitors through their green management endeavors. This distinctiveness can manifest in several ways: through the promotion of green packaging or labeling, providing products and services at a competitive price within the industry, or minimizing legal entanglements with energy-saving and environmental government bodies. Furthermore, the harmony and symbiotic relationships between internal departments, sustained and long-term collaborations with pivotal suppliers, and commendable customer satisfaction and reputation play crucial roles. These collective elements craft the green brand image of the enterprise, positioning them favorably in the eyes of an increasingly sustainability-conscious consumer base.

(2) The Cost Advantage encompasses the financial savings achieved by enterprises through green management practices in various facets such as transactions, financing, coordination, emissions reduction or pollution control, waste recycling, energy, and service or production. Specifically, by optimizing resource utilization and enhancing energy efficiency, businesses can substantially reduce operational costs. For instance, refining production processes and techniques allows for diminished consumption of energy and raw materials, leading to a reduction in waste treatment and emission costs. Moreover, compliance with environmental policies and regulations potentially spares companies from legal disputes and consequent fines, further conserving costs. These savings collectively contribute to a company's green cost advantage, bolstering its competitive standing in a price-sensitive market.

In essence, both Differentiation and Cost Advantages are integral facets of Green Competitive Advantage. They echo how businesses, through green management strategies, can thrive in a fiercely competitive market landscape that's gravitating towards environmental sustainability. As show in figure 2.4.

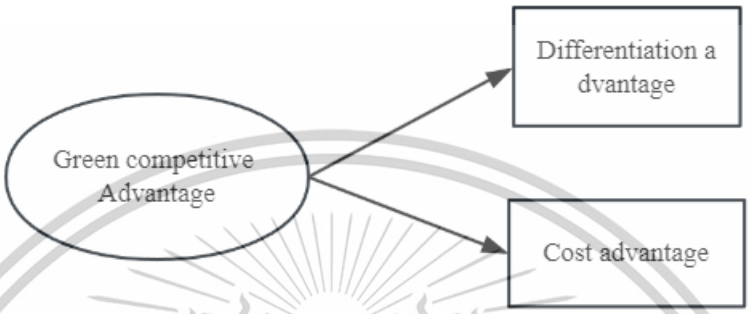

Figure 2.4 Green Competitive Advantage

Source:Lin and Chen (2016); Cao et al. (2022); Chang (2011)

2.8 Concepts and Theories of Green Innovation

2.8.1 Definitions of Green Innovation

Green Innovation, a nexus between sustainability and innovation, is rapidly taking center stage in the business world. This multifaceted concept is essentially about devising novel solutions or enhancing existing processes, products, or methods to ensure they align with ecological sustainability and generate minimal adverse environmental impacts. As global industries strive to harmonize their operations with environmental needs, understanding the underlying principles and implications of Green Innovation becomes imperative. Green Innovation, often interchangeably termed as "eco-innovation," can be viewed from various angles. As show in table 2.9.

Table 2.9 Definitions of Green Innovation

Scholar	Definitions
Akhtar et al. (2021)	Green Innovation encompasses the development and application of products, processes, and systems that reduce environmental degradation and resource consumption while ensuring business profitability.

Table 2.9 (Continue)

Scholar	Definitions
Padilla-Lozano and Collazzo (2022)	the introduction of novel or significantly improved solutions, whether products, processes, or practices, aimed at meeting market needs while minimizing environmental impacts.
Feng et al. (2018)	the strategic introduction of new products or processes that are not only efficient but also environmentally benign.
Xie et al. (2019)	an integrated process where environmentally friendly methods and technologies are embedded at the core of the innovation cycle.
Li et al. (2023b)	Green Innovation as "a holistic approach to innovation that integrates environmental considerations at every stage, from ideation to final product delivery.

These varied definitions, while differing in semantics, emphasize the synthesis of innovation and sustainability, underlining the importance of balancing environmental and economic concerns in today's globalized business environment.

2.8.2 Theory of Green Innovation

Over the past few decades, a plethora of studies have emerged, addressing various dimensions and observed variables of Green Innovation across myriad industries. As show in table 2.10.

Table 2.10 Literature Review on Green Innovation

Scholar	Latent Variables	Observed Variables
Akhtar et al. (2021)	Green Innovation	Green product innovation
Padilla-Lozano and Collazzo (2022) ; Xie et al. (2019)	Green Innovation	Green Process Innovation
Guo et al. (2020), Chang (2011)	Green Innovation	Green product innovation and green process innovation
Skordoulis et al. (2022), Bhatti et al. (2023)	Green Innovation	Green product innovation and green process innovation

Table 2.10 (Continue)

Scholar	Latent Variables	Observed Variables
Irfan et al. (2022)	Green Innovation	Green product innovation and green process innovation

The Diffusion of Innovations Theory maps out how individuals or organizations progress from their initial exposure to an innovation to its ultimate adoption. Within the realm of Green Innovation, this process can be visualized as a company's journey from discovering a sustainable technology to assessing its benefits and finally, incorporating it into their daily operations. This theory is particularly insightful as it categorizes adopters based on the speed of adoption, ranging from swift innovators to more hesitant laggards. By applying this categorization to Green Innovation, industries and companies can be segmented based on their readiness and speed in adopting sustainable technologies and practices. It's interesting to note that while sectors like renewable energy might be categorized as 'innovators' due to their swift adoption rates, other traditional sectors might be more reticent, falling into the 'late majority' or even 'laggards' category. Furthermore, two pivotal concepts from the theory—relative advantage and compatibility—have direct implications for Green Innovation. The former, relative advantage, gauges an innovation's perceived superiority over its predecessor. In the Green Innovation context, this might translate to environmental benefits, long-term cost savings, or an uplift in brand reputation. Compatibility, on the other hand, assesses how seamlessly an innovation aligns with the existing values, experiences, and needs of potential adopters. For Green Innovation, a sustainable practice's compatibility with a company's existing operations and philosophy can significantly influence its adoption rate. Overall, the Diffusion of Innovations Theory offers a comprehensive lens to understand the challenges and accelerators impacting the spread of Green Innovations.

Therefore, In this research, the concept of Green Innovation is primarily dissected into two significant dimensions: Green product innovation and green process innovation, both outcomes of the enterprise's green management practices.

(1) Green Product Innovation: This dimension refers to the incorporation of environmentally friendly principles right from the conceptualization stage to the end product. It is not limited merely to the product's composition or ingredients, but extends to its lifecycle, including production, usage, and eventual disposal. Green product innovation necessitates the rethinking of design, formulation, and packaging in a manner that curtails resource consumption, reduces carbon footprints, enhances energy efficiency, or promotes recycling and reuse. It signifies a company's commitment to

delivering products that are not only superior in terms of functionality but are also aligned with the ethos of environmental preservation.

(2) Green Process Innovation: While green product innovation is externally oriented, focusing on what consumers see and experience, green process innovation is an inward-facing endeavor. It targets the heart of an organization's operations, seeking to revamp and restructure internal processes to be more sustainable. Whether it's adopting waste-reducing methodologies, leveraging energy-efficient technologies, or optimizing supply chain logistics to minimize environmental impact, green process innovation is all about ensuring that the entire lifecycle of a product, right from its inception to its delivery, is environmentally conscious. The goal here is not only to trim costs but to instill an inherent culture of sustainability in the company's operational blueprint.

In essence, while both green product and process innovations target environmental sustainability, their areas of focus differ, with the former targeting the end product and its tangible attributes, and the latter delving deep into the core operational machinations of an organization. As show in figure 2.5.

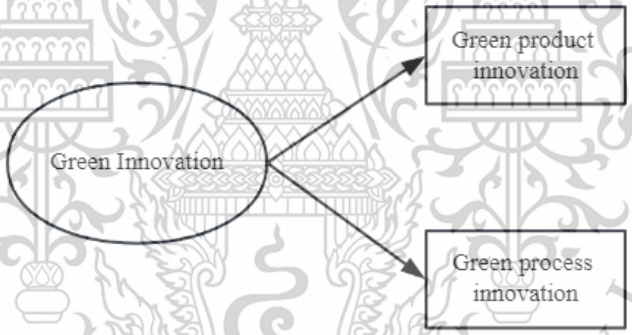

Figure 2.5 Green Innovation

Source: Guo et al. (2020), Chang (2011),Xie et al. (2019)

2.9 Variable Relationship Analysis

2.9.1 Internal Green Environment Orientation and Green Competitive Advantage

The nexus between Internal Green Environment Orientation (IGEO) and Green Competitive Advantage (GCA) is anchored in the evolving discourse surrounding sustainable business practices and their implication for firm positioning in a competitive landscape.

IGEO, as earlier defined, underscores an organization's internal commitment towards environmental sustainability, manifesting in the form of top management support, R&D investment, firm culture, and employee training in sustainability. Such a dedicated orientation towards green practices internally can position a firm uniquely in its industry, setting it apart from competitors. Firms that ingrain environmental sustainability into their internal processes and ethos are better equipped to leverage these practices as competitive advantages. On the other hand, GCA pivots around the two foundational pillars of differentiation advantage and cost advantage, both emanating from green management practices. Green differentiation allows firms to provide distinct green products or services, whereas green cost advantage primarily measures efficiencies in operations, reducing costs associated with waste, emissions, and energy.

Several scholars have delved into the connection between these two constructs. A firm with a strong IGEO invariably gears itself towards a more resource-efficient operation, translating into cost advantages in the long run (Chan et al., 2012). Moreover, the culture of innovation and sustainability often leads to the creation of differentiated products or services, giving firms an edge in markets where consumers increasingly value sustainable offerings (Fatoki, 2021). Furthermore, businesses that have robust internal green initiatives often find it easier to communicate their green values to stakeholders, enhancing their brand's green image. This not only offers a differentiation advantage but also attracts a niche market segment that values environmental sustainability, thereby potentially increasing market share and profitability (Zameer et al., 2022).

Drawing from the above discussions and the literature, it can be posited that a strong IGEO potentially acts as a precursor to gaining a Green Competitive Advantage. Hence, the hypothesis that "Internal Green Environment Orientation has a positive effect on the Green Competitive Advantage" seems well-grounded in academic discourse and empirical findings. Hence, the hypothesis posits:

H1: Internal Green Environment Orientation has a positive effect on the Green Competitive Advantage.

2.9.2 Internal Green Environment Orientation and Green Innovation

The relationship between Internal Green Environment Orientation (IGEO) and Green Innovation (GI) has garnered substantial attention among researchers in recent times. The proposition that an organization's internal orientation towards the environment significantly influences its innovative practices has been explored in various contexts.

Chen and Huang (2015) emphasized the fundamental role of IGEO in fostering a conducive environment for green innovation. They argued that when organizations prioritize eco-friendly policies internally, it naturally stimulates an innovative mindset to develop products and processes that are environmentally sustainable. Feng et al. (2018)supported this view by demonstrating through empirical research that firms with a stronger IGEO were more likely to invest in green product and process innovations. Their study in the electronics industry revealed that firms emphasizing internal green practices showed a higher propensity to innovate in terms of eco-friendly products. In a similar vein, Fatoki (2021) found a positive relationship between IGEO and GI. They posited that internal eco-consciousness drives firms to seek innovative solutions that not only cater to market demands but also adhere to environmental regulations and standards. Additionally, Wang (2020)conducted a cross-industry analysis to further establish the link between IGEO and GI. Their findings suggested that a company's internal commitment to environmental sustainability is a precursor to green innovative activities, emphasizing the need for businesses to ingrain eco-friendliness in their core values and operations.

Building on these insights, it is evident that an organization's internal emphasis on green practices is a significant determinant of its innovative efforts in the domain of environmental sustainability. Hence, the hypothesis posits:

H2: Internal Green Environment Orientation has a positive effect on Green Innovation.

2.9.3 External Green Environment Orientation and Green Competitive Advantage

Understanding the dynamic between External Green Environment Orientation (EGEO) and Green Competitive Advantage (GCA) has become a focal point in contemporary research, especially in the context of increasing environmental pressures from stakeholders, customers, and regulators.

Lopez and Roberts (2016) highlighted the salient role of EGEO in providing companies with a unique competitive edge. They postulated that businesses sensitive to external environmental

stimuli are better equipped to differentiate themselves, yielding substantial competitive advantages. Their empirical study of the automotive industry revealed that companies that actively responded to external environmental pressures by implementing green practices enjoyed superior market positions. In a similar context, Fatoki (2021) explored the retail industry and concluded that businesses with a heightened EGEO tend to develop differentiation advantages through eco-friendly branding and product offerings, ultimately setting them apart from competitors. Their findings pointed to the importance of aligning business strategies with external environmental cues to attain sustainable competitive advantages. Furthering this perspective, Chan et al. (2012)showcased how firms in the energy sector, with strong EGEO, often have reduced costs, as they preemptively adapt to potential environmental regulations and standards. By staying ahead of the curve, these firms avoid potential regulatory fines, benefit from cost savings through green operational efficiencies, and gain a cost advantage in the market. Finally, Zameer et al. (2022) carried out an extensive analysis across various sectors, underlining the critical connection between EGEO and GCA. They found consistent evidence suggesting that firms tuned into external environmental trends and pressures are more likely to carve out both differentiation and cost advantages, positioning them favorably in the marketplace.

Given the compelling evidence, it becomes clear that an organization's orientation towards external green factors is a pivotal driver for attaining a green competitive advantage in the business landscape. Thus, the hypothesis suggests:

H3: External Green Environment Orientation has a positive effect on Green Competitive Advantage.

2.9.4 External Green Environment Orientation and Green Innovation

The interplay between External Green Environment Orientation (EGEO) and Green Innovation (GI) has been the focus of extensive academic scrutiny. As sustainability gains ground in global discourse, understanding how external environmental factors can drive or inhibit green innovation becomes paramount.

For instance, Ardito et al. (2021) studying the electronics sector, found that companies with a keen awareness of their external green environment were more predisposed to adopt innovative green practices and technologies. The regulatory pressures, combined with the market demands, became instrumental in this regard. Further, Nasiri et al. (2022) in their analysis of the small business industry revealed that an external green orientation, especially when perceived customer demand and policy effectiveness align, often catalyzes green innovative strategies. Their findings

demonstrated that firms attuned to their external green environment not only introduce green products but also remodel their processes to be more environmentally friendly. In a broader industry spectrum, Bhatti et al. (2023) postulated that EGEO's role is fundamental in guiding companies towards sustainable innovation. Their cross-industry study unveiled that EGEO components, especially competitor competition and perceived policy effectiveness, played a pivotal role in steering green innovation, be it in products or processes. Bringing in a more recent perspective, Wang (2020), focusing on the consumer goods sector, iterated the significance of EGEO in propelling Green Innovation. They found that companies responding actively to external environmental triggers, whether regulatory or consumer demand-driven, often have a robust green innovation pipeline.

In synthesis, the prevailing literature robustly suggests that an orientation towards the external green environment acts as a catalyst for companies, encouraging them to innovate sustainably, both in terms of products and processes. Thus, the hypothesis suggests:

H4: Internal Green Environment Orientation has a positive effect on the Green Innovation.

2.9.5 Green Competitive Advantage and Green Innovation

The symbiotic relationship between Green Competitive Advantage (GCA) and Green Innovation (GI) has captivated the attention of numerous researchers. As companies increasingly recognize the inherent and long-term benefits of sustainable practices, understanding the dynamic between gaining a competitive edge through green measures and the resultant innovations becomes indispensable.

Zameer et al. (2022) conducted an in-depth study within the electronics industry and posited that firms with a clear green competitive advantage are more inclined to explore and invest in green innovations. Their research uncovered that such firms not only leveraged their unique eco-friendly propositions for market differentiation but also consistently pursued innovative avenues to further their green agendas. Expanding on this, Padilla-Lozano and Collazzo (2022) in a manufacture industry context, asserted that having a green competitive advantage, especially in cost efficiency and differentiation, played a significant role in fostering green innovative mindsets. They observed that organizations that achieved tangible benefits (be it in cost-savings or distinct market positioning) from their green strategies were more proactive in seeking innovative solutions to further consolidate their green advantage. More recently, Lin and Chen (2016) reinforced the nexus between GCA and GI. Their findings showcased that firms that had effectively differentiated themselves in the market through green measures often harbored a vibrant culture of innovation,

continually pushing the boundaries of sustainable practices. Lin and Chen (2017) provided a more nuanced perspective. They contended that while a green competitive advantage does spur green innovation, the extent can be moderated by various factors, including industry maturity, consumer demand dynamics, and regulatory landscapes.

To summarize, the prevailing body of work robustly affirms that firms which establish a green competitive edge are more predisposed to delve into and champion green innovations, ensuring they not only retain their advantage but also further their sustainability missions. Thus, the hypothesis suggests:

H5: Green Competitive Advantage has a positive effect on the Green Innovation.

2.9.6 Green Competitive Advantage and Sustainable Performance

The connection between Green Competitive Advantage (GCA) and Sustainable Performance (SP) has been a focal point of academic and business discussions alike. As sustainability becomes an integral part of strategic management, understanding how green strategies can translate into sustainable performance is paramount.

In their seminal work, Nasrollahi et al. (2020) posited that companies with a pronounced green competitive advantage, be it through cost efficiencies or market differentiation, witness enhanced financial and non-financial performance. Their empirical research, centered on the automotive industry, indicated that such companies not only reaped monetary benefits but also achieved remarkable improvements in environmental and social metrics. Similarly, Zhang and London (2013) illustrated that in the manufacturing sector, firms that could distinguish themselves through green practices and measures also showcased superior performance in terms of resource efficiency, waste reduction, and stakeholder relations. Their study underlined the idea that a green competitive edge inherently fosters a culture of comprehensive sustainability, propelling companies toward holistic sustainable performance. Further reinforcing this link, Fatoki (2021) findings emphasized that retailers with a clear green differentiation strategy, especially those who adopted sustainable sourcing and responsible practices, were more likely to achieve better overall sustainable performance, which encompassed economic, environmental, and social dimensions. Recently, Alam and Islam (2021) conducted a multi-industry analysis, highlighting the universality of this connection. Their research stressed that irrespective of industry, companies that carved a green niche for themselves, either by being cost-effective or offering distinct green products and services, invariably reported better sustainable outcomes in both short and long terms.

To encapsulate, there's a robust consensus within scholarly circles that achieving a green competitive advantage is not just an end in itself. Instead, it acts as a potent catalyst, driving firms toward more comprehensive and sustained performance across economic, environmental, and social realms. Thus, the hypothesis suggests:

H6: Green Competitive Advantage has a positive effect on the Sustainable Performance.

2.9.7 Green Innovation and Sustainable Performance

The synergy between Green Innovation (GI) and Sustainable Performance (SP) encapsulates the very essence of modern sustainable business paradigms. The integration of innovative strategies tailored towards environmental stewardship has been consistently linked with superior sustainable outcomes in both academic and business circles.

Adams and Jeanrenaud (2015) noted that companies embedding green innovation in their core business models not only gain a competitive edge but also see enhanced sustainable performance across multiple dimensions. Their study focused on the tech industry and revealed that firms channeling their innovations toward environmental solutions demonstrated improved efficiency, reduced waste, and a substantial decrease in their carbon footprints. Fatoki (2021) brought attention to the hospitality firms, noting that green innovations, particularly those related to renewable energy technologies and processes, directly correlated with superior sustainability metrics. Companies that led the shift towards cleaner energy solutions reported robust economic performance coupled with significantly reduced environmental externalities. In the realm of consumer goods, Chan et al. (2012) highlighted that companies pushing the boundaries of green product innovations invariably witnessed heightened brand loyalty, better stakeholder relations, and improved triple-bottom-line performance. Their findings accentuated that these firms not only profited economically but also made pronounced positive impacts socially and environmentally. Furthermore, Imran et al. (2023)undertook a comprehensive review of various industries and concluded that irrespective of the sector, green innovation was a critical determinant of sustainable performance. Their work strongly endorsed the idea that innovative practices, geared towards sustainability, are instrumental in driving holistic performance and long-term business viability.

In summary, the pivotal role of green innovation in enhancing sustainable performance is unequivocal. It transcends industries, underscoring the universal tenet that innovative strategies

aligned with environmental and social welfare yield sustained and comprehensive business success. Thus, the hypothesis suggests:

H7: Green Innovation has a positive effect on the Sustainable Performance.

2.9.8 Internal Green Environment Orientation and Sustainable Performance

The linkage between Internal Green Environment Orientation (IGEO) and Sustainable Performance (SP) is increasingly gaining traction in contemporary business literature, reflecting the shift in corporate ethos from purely profit-driven objectives to more holistic, environmentally-conscious paradigms.

Ye et al. (2022) explored the dynamics within manufacturing industries and found a strong correlation between IGEO and enhanced sustainable outcomes. According to their research, firms with a well-defined internal green orientation were more adept at streamlining operations, reducing waste, and enhancing overall efficiency, leading to better sustainable performance metrics. In a seminal study focused on the service sector, Zhou et al. (2020) discovered that companies that prioritize green practices internally witness heightened employee morale, reduced turnover rates, and increased stakeholder satisfaction. Their findings emphasized that an intrinsic commitment to green initiatives promotes an organizational culture that is intrinsically aligned with sustainability. In the fast-paced world of tech startups, Zhai et al. (2018) underscored the significance of IGEO in driving innovation, fostering a collaborative work environment, and ensuring long-term business viability. Their research indicated that startups with a pronounced green orientation from the onset invariably showcased superior performance across economic, social, and environmental dimensions of sustainability. Moreover, Fletcher and Petersen (2019) conducted a cross-industry meta-analysis, concluding that irrespective of the operational domain, a robust internal green orientation serves as a precursor to stellar sustainable performance. Their study highlighted that firms which internalize eco-friendly practices and values as an integral part of their corporate DNA are better positioned to achieve comprehensive and enduring success.

In essence, the inextricable bond between Internal Green Environment Orientation and Sustainable Performance resonates across sectors. It firmly establishes the premise that organizations genuinely committed to eco-conscious practices and values from within are invariably poised to achieve excellence in sustainability. Thus, the hypothesis suggests:

H8: Internal Green Environment Orientation has a positive effect on the Sustainable Performance.

2.9.9 External Green Environment Orientation and Sustainable Performance

External Green Environment Orientation (EGEO) emphasizes an organization's proactive approach in response to external environmental factors, such as regulatory compliance, customer demand for green products, and competitor green strategies. The effect of these external pressures on Sustainable Performance (SP) has been an area of extensive research in the modern corporate environment.

In their research encompassing a spectrum of European firms, Zhou et al. (2020)concluded that those responsive to external environmental pressures, notably from regulatory bodies and eco-conscious consumers, demonstrated a superior sustainability performance. They attributed this to the firms' commitment to meeting and often exceeding environmentally beneficial benchmarks, which eventually contributed to an improved overall performance. A longitudinal study by Wang et al. (2022) point that the perception of green consumer demand invariably steers companies toward green innovations and eco-friendly practices. Such strategic orientation led to enhanced brand reputation, customer loyalty, and overall sustainable performance. Adding a global perspective,Aboalhool et al. (2024) evaluated the influence of international environmental agreements and norms on multinational corporations. Their study found that companies attuned to these external cues not only adapted faster to international markets but also showcased an elevated sustainability performance. In the context of emerging markets, Al Halbusi et al. (2023) explored the dynamics of EGEO and its implications on sustainable performance among firms in Southeast Asia. They discovered that businesses acutely responsive to external green pressures, especially from local communities and environmental activists, outperformed their counterparts in sustainable metrics.

In summation, the pivotal role of External Green Environment Orientation in dictating Sustainable Performance is undeniable. Organizations that are keenly attuned to external environmental cues and pressures and that strategize accordingly are poised for holistic success in the realm of sustainability. Thus, the hypothesis suggests:

H9: External Green Environment Orientation has a positive effect on the Sustainable Performance.

2.9.10 Green Competitive Advantage as Mediating Variable

Green Competitive Advantage (GCA) is positioned as an imperative bridge between environmental orientations and sustainable outcomes. By translating green initiatives into tangible

competitive strengths, it fosters an environment where companies can leverage their sustainable practices into improved performance metrics.

Internal Green Environment Orientation (IGEO) emphasizes the organization's intrinsic motivation and internal practices toward sustainability. However, the direct link between such internal efforts and a firm's overall Sustainable Performance may not be straightforward. Instead, when these efforts translate into a tangible GCA - like cost savings from eco-efficient processes or a differentiated market position due to unique green products - the path to improved sustainable performance becomes more apparent.

In a seminal paper, Nasrollahi et al. (2020) found that while internal green practices were commendable, their direct impact on performance was often diluted unless they translated into definitive competitive advantages. On a similar note, Lee and Choi (2017) observed in their study of the automobile sector that companies with a robust IGEO only reaped significant sustainable benefits when they converted these internal practices into either cost advantages or differentiation advantages.

The impact of External Green Environment Orientation (EGEO) on Sustainable Performance is significantly enhanced when it provides the firm with a GCA. External pressures, like regulatory demands or consumer preferences for eco-friendly products, can drive companies to adopt green practices. However, their impact on sustainable performance is amplified when these practices bestow a genuine competitive edge.

A study by Skordoulis et al. (2022) highlighted that firms that could transform external green pressures into competitive strategies, such as green branding or cost efficiencies, saw a more pronounced uptick in their sustainability metrics. In a broader industry landscape, Fatoki (2021) noted that EGEO's contribution to sustainable performance was often mediated by the kind of competitive advantages firms could carve out in response to these external cues.

In essence, the literature underscores the mediating role of Green Competitive Advantage. Whether driven by internal motivations or external pressures, the tangible benefits of green practices in terms of sustainable performance are often realized through the prism of competitive advantages they offer. Thus, the hypothesis suggests:

H10: Green Competitive Advantage play a mediating role between Internal Green Environment Orientation and Sustainable Performance.

H11: Green Competitive Advantage play a mediating role between External Green Environment Orientation and Sustainable Performance.

2.9.11 Green Innovation as a Mediating Variable

Green Innovation (GI) emerges as a pivotal instrument that channels the influence of green environmental orientations toward enhancing sustainable performance. By transforming environmental orientations into tangible innovative outputs, companies not only address ecological concerns but also cultivate a platform for achieving long-term sustainability.

Internal Green Environment Orientation (IGEO) represents an organization's intrinsic commitment to environmental sustainability. While this commitment sets the foundational drive for green practices, its direct bearing on sustainable performance becomes more pronounced when it materializes into green innovative solutions. Essentially, GI acts as a conduit through which internally-driven green initiatives foster enhanced sustainability.

In their groundbreaking study, Li et al. (2022) investigated firms in the renewable energy sector and identified that those firms with a pronounced IGEO tended to innovate more in green technologies and solutions. More crucially, these green innovations were found to be directly tied to better sustainable performance metrics. Similarly, Skordoulis et al. (2022) found that an internal drive towards the environment significantly spurred green technological innovations, which in turn, improved their sustainable performance.

External Green Environment Orientation (EGEO), reflecting the external pressures and incentives to adopt green practices, becomes truly transformative when it spurs companies to innovate. Whether it's due to regulatory pressures, stakeholder demands, or market dynamics, EGEO's potential in enhancing sustainable performance is profoundly realized when it catalyzes Green Innovation.

A noteworthy study by Fatoki (2021) on the European manufacturing sector highlighted that companies, when responding to external green pressures, often leaned into innovative solutions to not just meet these pressures but also to secure competitive advantages. These innovations subsequently played a significant role in enhancing their overall sustainable performance. Further, Anderson and White (2020) studying the global textile industry, observed that external pressures often act as catalysts for green innovations in materials and processes, eventually leading to improved sustainability outcomes.

In sum, Green Innovation stands out as a significant mediator in the literature. Whether the orientation to adopt green practices is internally driven or externally influenced, it's the innovative green outcomes that frequently determine the realized benefits in terms of sustainable performance. Thus, the hypothesis suggests:

H12: Green Innovation play a mediating role between Internal Green Environment Orientation and Sustainable Performance.

H13: Green Innovation play a mediating role between External Green Environment Orientation and Sustainable Performance.

2.10 Conceptual Framework

From the analysis of the literature review, and the consultation of the concepts, theories, and models regarding the relationship between variables, the following conceptual framework was developed.

The conceptual framework bellows shows that the dependent variable is Sustainable Performance. In contrast, the independent variables include Internal Green Environment Orientation and External Green Environment Orientation. The mediating variables include Green competitive Advantage and Green Innovation. From the below conceptual framework, the following hypothesis was developed.

H1: Internal Green Environment Orientation has a positive effect on the Green Competitive Advantage.

H2: Internal Green Environment Orientation has a positive effect on Green Innovation.

H3: External Green Environment Orientation has a positive effect on Green Competitive Advantage.

H4: External Green Environment Orientation has a positive effect on the Green Innovation.

H5: Green Competitive Advantage has a positive effect on the Green Innovation.

H6: Green Competitive Advantage has a positive effect on the Sustainable Performance.

H7: Green Innovation has a positive effect on the Sustainable Performance.

H8: Internal Green Environment Orientation has a positive effect on the Sustainable Performance.

H9: External Green Environment Orientation has a positive effect on the Sustainable Performance.

H10: Green Competitive Advantage play a mediating role between Internal Green Environment Orientation and Sustainable Performance.

H11: Green Competitive Advantage play a mediating role between External Green Environment Orientation and Sustainable Performance.

H12: Green Innovation play a mediating role between External Green Environment Orientation and Sustainable Performance.

H13: Green Innovation play a mediating role between External Green Environment Orientation and Sustainable Performance.

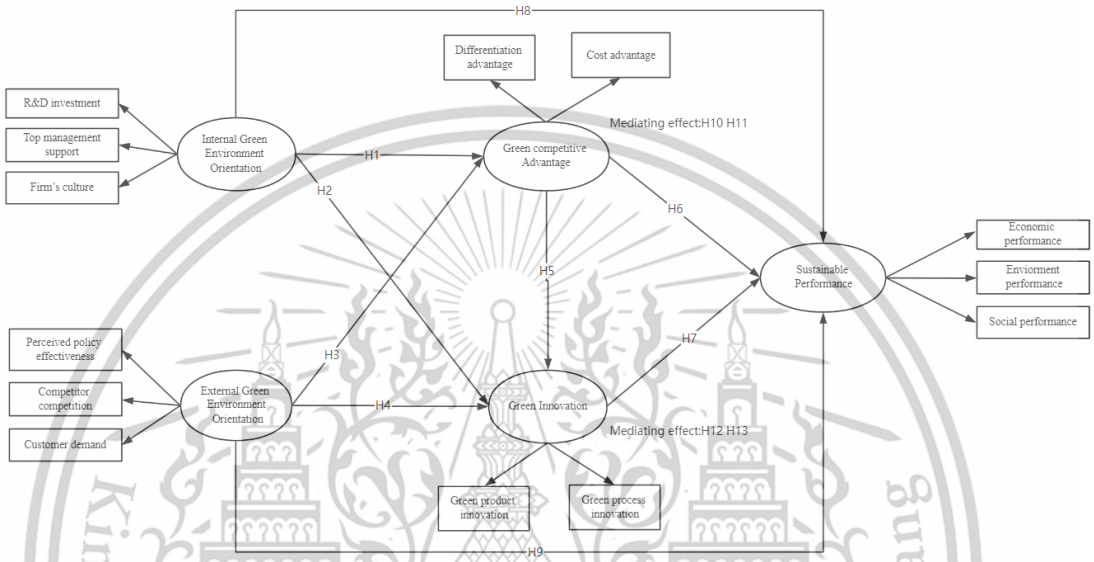

Figure 2.6 Conceptual framework

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

Building upon the extensive literature review in Chapter 2, which synthesized the prevailing academic perspectives on green orientations, innovation, and sustainable performance, it becomes clear that understanding these constructs within the context of China's manufacturing sector remains a pivotal endeavor. The meticulous documentation and analysis of prior research have laid a solid foundation, underscoring the relevance and gaps in current knowledge. As we transition into Chapter 3, we delve into the empirical realm of this study.

For this study, a quantitative research approach was employed. Quantitative research, characterized by its structured questionnaires and standardized measurements, allows for the generalization of results from a sample to a population of interest. This approach is particularly effective for testing hypotheses and identifying patterns in relationships among variables, as in the case of this study. Given the nature of the study and the research questions posed, an explanatory research type was adopted. Explanatory research seeks to clarify why and how there is a relationship between two aspects. It primarily delves into factors leading to specific situations. Here, the aim is to elucidate the relationships between green orientations, Green competitive Advantage, green innovation, and sustainable performance among manufacturing firms in China.

3.2 Quantitative Research

3.2.1 Population

The target population for this study consists of manufacturing firms operating in China. The primary respondents are senior managers and personnel involved in environmental management and strategic planning within these firms. These individuals typically play a pivotal role in shaping corporate environmental strategies and policies, making them highly appropriate for the objectives of this research.

To access this population, a multi-pronged sampling and data collection approach was

employed. First, potential manufacturing firms were identified and shortlisted using authoritative industrial directories, including the 2018 edition of the China Industrial Directory. Following this, by emails or telephone tell these firms detailing the purpose, relevance, and confidentiality assurances of the study, along with the survey questionnaire.

In line with Dillman et al. (2014), who emphasize the importance of mixed-mode strategies and tailored follow-up techniques in improving response rates and data quality, this study incorporated multiple engagement tactics. Follow-up phone calls and, when feasible, in-person visits were conducted to clarify the research goals and encourage participation. Furthermore, questionnaires were distributed at regional forums and industry events focused on sustainability and green manufacturing to capture a broader and more diverse sample. To amplify reach, the study also relied on professional networks within the manufacturing sector, encouraging known industry contacts to share the electronic survey with their peers.

As a result of these integrated efforts, a total of 468 valid responses were collected and deemed suitable for subsequent data analysis.

3.2.2. Sampling Size and technique

The determination of an adequate sample size is essential for ensuring the reliability and generalizability of a study's findings. In line with the exploratory objectives of this research, a combination of judgment sampling and snowball sampling was utilized to gather relevant data. A total of 468 valid responses were ultimately collected from professionals in Chinese manufacturing firms. This sample size is considered sufficiently large to support meaningful statistical analyses and derive generalizable insights within the study's defined scope.

Judgment sampling, also referred to as purposive sampling, is a non-probability technique in which respondents are selected based on the researchers' domain knowledge and pre-identified relevance to the research topic. This technique is particularly useful when targeting experts with specialized knowledge or decision-making responsibilities, such as managers involved in green strategy development or environmental performance management (Etikan et al., 2016). It enabled the researchers to directly contact individuals likely to provide informed and accurate responses.

To broaden the reach beyond initial contacts, snowball sampling was concurrently employed. This method involves asking initial respondents to share the survey with peers or professional contacts who fulfill similar roles. Snowball sampling is particularly effective when dealing with hard-to-reach or dispersed professional populations, such as environmental strategists across diverse manufacturing sectors.

The final sample of 468 respondents surpasses the minimum thresholds suggested in

methodological literature for exploratory studies using structural equation modeling. According to Sarstedt et al. (2021), a sample size above 300 is generally considered robust for partial least squares structural equation modeling (PLS-SEM), especially when model complexity is moderate to high.

While non-probability sampling methods inherently carry a risk of bias, several measures were taken to ensure diversity and balance within the sample. Participants came from a wide range of manufacturing sub-sectors, including heavy machinery and equipment, consumer goods, electronics, chemicals and pharmaceuticals, food and beverage, and textiles and apparel. This sectoral diversity enhances the representativeness of the dataset and supports broader applicability of the findings.

In conclusion, the use of a dual sampling approach—judgment and snowball—combined with a final sample size well above established benchmarks, ensures the methodological soundness of the study. These procedures provide a credible basis for the subsequent empirical analysis and reinforce the validity of the research conclusions.

3.2.3 Variables in the research

The variables used in this study are in three categories, exogenous variables, endogenous variables, and mediating variables. Green Environment Orientation, Green Innovation (comprising green products, processes, and management practices), Green competitive advantage, and Sustainable Performance.

1) The exogenous latent variables consisted of observed variables:
    1.1) Internal Green Environment Orientation
        1.1.1) R&D investment
        1.1.2) Top management support
        1.1.3) Firm's culture
    1.2) External Green Environment Orientation
        1.2.1) Perceived policy effectiveness
        1.2.2) Competitor competition
        1.2.3) Customer demand
2) The mediating latent variable consisted of
    2.1) Green competitive Advantage
        2.1.1) Differentiation advantage
        2.1.2) Cost advantage

2.2) Green Innovation

2.2.1) Green product innovation

2.2.2) Green process innovation

3) Endogenous latent variables consisted of observed variable.

3.1) Sustainable Performance

3.1.1) Economic performance

3.1.2) Environment performance

3.1.3) Social performance

3.3 Research Instruments Development

l. The preparation of the research questionnaire was developed in reference to previous literature, theories, and researches conducted in a similar or most relevant setting.

2. The evaluated models, theories, concepts led to the development of the relationships between the endogenous variables, the exogenous variables, the mediating variables, and the observed variables.

3. The questionnaire, which was used to collect data, was compliant with the recommended structure. Five experts were consulted to evaluate the validity and reliability of the questionnaire, as well as find the item-objective congruence (IOC) of the questionnaire. IOC will help in evaluating the congruence among the questions included in the questionnaire and their ability to address the research objectives and questions. The expected level of acceptance is between 0.5 - 1.0 but is lower than 0.5, the questions will have to be improved in order to fit for objectives and questions of study.

4. revise this item The questionnaire/instrument was used in English language to collect the datasets because English is the official language in China, however, for China, data was collected Thai language translated by a Chinese native speaker with a strong research background to avoid any shortcomings. After the Translated version of questionnaire.revisions were incorporated by 3 1OC Experts, and certified by Dr. Singha Chaveesuk and Dr. Wornchanok Chaiyasoonthorn to ensure the translations are in perfect order.5. The internal consistency or the reliability of the collected data was tested using Cronbach's alpha. This test is used when the questionnaire used in research has Likert questions. In this study, the focus is to determine whether the scale used is consistent and reliable.

3.3.1 The Structure of the Questionnaire and Instruments

The research was conducted based on a set of questionnaires. The questionnaire was developed on the basis of the reviewed previous literature, concepts, theories, and models, and in reference to the research questions. The questionnaire was divided into four sections:

Part 1: Demographic Data - this section was collected the personal data of the respondents such as gender, age, education, year of experience, type of manufacturing, and location of manufacturing. This was aimed to capture the demographic characteristics of the respondents.

Part 2: Latent Variable Questions - this section contained questions, which evaluated the latent variables and their relationships. This section was developed in reference to the previous literature.

Part 3: 3.1 Internal Green Environment Orientation: The questions related to the Internal Green Environment Orientation. Internal Green Environment Orientation is fundamentally rooted in an organization's strategic commitment towards environmentally sustainable practices. At the heart of this orientation lie three critical dimensions: the depth of R&D investment in green practices, the unyielding support from top management, and a culture that ingrains sustainability as a core value. Green R&D investment plays a vital role in driving operational efficiencies and fostering eco-innovations within firms. Similarly, strong and consistent support from top management is crucial for the successful implementation of green strategies, as leadership commitment often sets the tone for organizational priorities. Moreover, a corporate culture that embraces sustainability can significantly influence the direction and effectiveness of green initiatives, embedding environmental responsibility into the core of business operations and decision-making processes.

Table 3.1 Questions on Internal Green Environment Orientation

Question	Researchers
R&D investment	Menguc and Ozanne (2005); Yao et al. (2009);Wang et al. (2023), Chan et al. (2012)
Our firm heavily invests in research and development (R&D) to enhance our green practices.	
The allocation of resources for green R&D projects is a top priority for our firm.	
Our R&D initiatives have played a significant role in advancing our green initiatives and environmental practices.	
Top Management Support	

Table 3.1 (Continue)

Question
Our top management actively promotes and supports green initiatives within our firm.
Green projects and initiatives receive visible endorsement and encouragement from our senior leaders.
The top management's commitment to green practices has positively influenced our environmental performance.
Firm's Culture
Our firm's culture emphasizes the importance of adopting environmentally-friendly practices.
Employees in our firm are encouraged to suggest and contribute to green initiatives.
A sense of environmental responsibility is deeply ingrained in our organizational values and practices.

Part 3: 3.2 External Green Environment Orientation

External Green Environment Orientation encapsulates a firm's response to external pressures and opportunities promoting green practices. This orientation is influenced by the perceived efficacy of environmental regulations, the competitive dynamics in the industry that propel firms to adopt eco-friendly measures, and the evolving consumer landscape that demands environmentally-conscious products. Measuring these dimensions using the Likert 5-point scale aids firms in understanding their stance on green initiatives in relation to external stimuli.

Table 3.2 Questions on External Green Environment Orientation

Times New Roman	Times New Roman
Perceived Policy Effectiveness	Zhou et al. (2020);Wang et al. (2023), Chan et al. (2012)
The environmental regulations in place are effective in guiding our firm's sustainability practices.	
Our organization often modifies its practices to align with updated environmental policies.	

Table 3.2 (Continue)

Question
Our firm believes that the current environmental policies have significantly impacted our industry.
Competitor Competition
Most of our competitors have already adopted green practices in their operations.
We often benchmark our sustainability practices against industry leaders to remain competitive.
Our firm believes that green initiatives provide a competitive advantage in our industry.
Customer Demand
Our customers frequently demand environmentally-friendly products/services.
Customer feedback often includes suggestions or requests related to improving our environmental practices.
Our firm believes that meeting green expectations of customers significantly influences our brand reputation.

Part 3: 3.3 Green competitive Advantage

Green Competitive Advantage refers to the strategic edge a company gains when it incorporates sustainable practices into its business operations, allowing it to distinguish itself from competitors or achieve cost efficiencies. In terms of differentiation advantage, firms can differentiate their products or services based on green attributes, leading to a unique market position . On the cost advantage front, green practices, such as waste reduction and resource efficiency, can lead to considerable operational savings. Firms that effectively employ these green strategies not only see immediate cost benefits but also position themselves for long-term economical operations, often achieving a cost advantage over less sustainable competitors. These study adopt these studies to measure the Green competitive Advantage.

Table 3.3 Questions on Green Competitive Advantage

Question	**Researchers**
Differentiation Advantage	

Table 3.3 (Continue)

Question	
Our firm's green initiatives allow us to offer distinct products/services compared to competitors.	Lin and Chen (2016); Cao et al. (2022); Chang (2011)
Customers recognize and appreciate the unique environmental features of our products/services.	
Our green practices contribute to a positive brand image and reputation in the market.	
Cost Advantage	
Our sustainable practices have led to significant cost savings in production and operations.	
By adopting green strategies, we have been able to reduce waste and improve resource efficiency.	
Our firm believes that in the long term, green practices will lead to more economical operations.	

Part 4: 3.4 Green Innovation

For the Green Innovation scale, the questions are formulated based on established understanding of green product and process innovations. Green Innovation, as a pivotal component of sustainable business strategies, encompasses proactive efforts by firms to develop or improve products and processes with environmental considerations at the core. This concept is commonly divided into two key dimensions: Green Product Innovation and Green Process Innovation. Green Product Innovation focuses on the ideation, development, or modification of products to enhance their environmental sustainability, aiming to reduce carbon footprints or contribute directly to environmental protection. In parallel, Green Process Innovation refers to the transformation of production methods and procedures to minimize waste, lower resource consumption, and reduce emissions. These efforts are increasingly recognized as essential for maintaining a firm's sustainable and competitive advantage in today's business environment.

Table 3.4 Questions on Green Innovation

Question	Researchers
Green Product Innovation	

Table 3.4 (Continue)

Question	
Our firm frequently introduces new products that are environmentally friendly.	Guo et al. (2020), Chang (2011),Xie et al. (2019)
The products we design and develop prioritize minimizing environmental impact.	
The eco-friendly features of our products differentiate us from competitors.	
Green Process Innovation	
Our firm continuously adopts new processes that reduce waste and environmental pollution.	
We frequently invest in technologies that increase our operational eco-efficiency.	
Our production methods are often updated to ensure minimal resource usage and maximal sustainability.	

Part 5: Sustainable Performance

Sustainable Performance encapsulates the multifaceted approach businesses take to ensure longevity and value creation across economic, environmental, and social dimensions. Hart (1995) and Schaltegger and Wagner (2008) highlight the integral nature of economic performance in this triad, emphasizing the role of resources and innovation in driving sustainable profitability. Meanwhile, the environmental dimension, as expounded by Porter and van der Linde (1995) and Russo and Fouts (1997), underscores the need for businesses to adapt and evolve within ecological constraints, recognizing the environment not just as a source of risk, but also as a wellspring of opportunities. Lastly, the social aspect of sustainability, illuminated by Clarkson (1995) and Wood (1991), accentuates the role of businesses in addressing stakeholder needs and societal expectations, with a particular emphasis on ethical and community-centric practices. These references collectively argue for a holistic approach to sustainable performance, where businesses navigate economic viability, environmental stewardship, and societal responsibilities in tandem. Measuring these dimensions using the Likert 5-point scale aids firms in understanding on Sustainable Performance.

Table 3.5 Questions on Sustainable Performance

Question	Researchers
Economic Performance	Wang et al. (2022); Li et al. (2022); Ye et al. (2022)
Our firm's green initiatives have led to increased revenue	
Our firm's green initiatives have led to increased market share.	
The adoption of sustainable practices has resulted in significant cost savings for our company.	
Our firm's profitability has improved due to our focus on sustainable and green innovations.	
Our stakeholders, including investors, view our firm favorably because of our commitment to sustainable practices.	
Environmental Performance	
Our organization has significantly reduced its carbon footprint in recent years.	
We have successfully decreased the waste generated from our operations.	
Our company has taken measurable steps to conserve resources like water and energy.	
The use of green technologies has minimized the environmental impact of our operations.	
Social Performance	
Our company is recognized for its commitment to employee health and safety.	
We actively participate in community development programs and local initiatives.	
Our firm upholds and promotes fair labor practices.	
We prioritize stakeholder engagement and continuously seek feedback to improve our societal contributions.	

3.3.2 Scale Development

The questionnaire was developed in relation to the research questions and in reference to the conceptual framework. The literature review was also consulted to inform the items designed for each observed variable. The scale development of the latent and observed variables is presented in the following table.

Table 3.6 Scale development table

Latent Variables	**Observed Variables**	**Development of Research Variables**	Number of Questions
Internal Green Environment Orientation	R&D investment Top management support Firm's culture	Menguc and Ozanne (2005); Yao et al. (2009);Wang et al. (2023), Chan et al. (2012)	9
External Green Environment Orientation	Perceived policy effectiveness Competitor competition Customer demand	Zhou et al. (2020);Wang et al. (2023), Chan et al. (2012)	9
Green competitive Advantage	Differentiation advantage Cost advantage	Lin and Chen (2016); Cao et al. (2022); Chang (2011)	6
Green Innovation	Green product innovation Green process innovation	Guo et al. (2020), Chang (2011),Xie et al. (2019)	6
Sustainable Performance	Economic performance Environment performance Social performance	Wang et al. (2022); Li et al. (2022); Ye et al. (2022)	12

The analysis data were obtained from the questions, which were designed with a 5 point rating scale (5-point Likert Scale) was set. These questions were developed with reference to the previous literature and other academicians. In the Likert scale, the 5-point scale was containing the following components:

5=Strongly Agree

4=Agree

3=Neutral (Neither Agree nor Disagree)

2=Disagree

1= Strongly Disagree

These sets of questions were set as exclusion. Hence the points obtained were arranged in contrast to the above ones. As a result, the interpretation of the high scales was based on the class intervals, which were obtained as follows.

Class Interval = (Maximum - minimum)/ (Number of Classes)

= (5-1)/5 = 0.80

The above calculation shows that the distance between was 0.80, which was applied in developing the evaluation criteria which is presented in the table below.

Table 3.7 The Variable Explanation Criteria

Level Average Point	Influence/Behavior	Level of Variable
4.24-5.00	Strongly Agree	Strongly Agree
3.43-4.23	Agree	Agree
2.62-3.42	Neutral	Neutral
1.81-2.61	Disagree	Disagree
1.00-1.80	Strongly Disagree	Strongly Disagree

3.4 Research Method and statistical Data Analysis

This study uses SPSS25.0 to analyze the descriptive statistics of data and the reliability and validity of measurement, uses AMOS26.0 to test the overall model of mediating effect based on Green competitive Advantage Green Innovation, the analysis method adopted is as follows.

3.4.1 Data collection

Source of Data: The primary data source for this study was a structured questionnaire, as described in the previous sections, targeting manufacturing firms situated in China. This approach allowed for first-hand, contemporary insights into the various constructs under investigation.

Pilot Study: Prior to the main data collection, a pilot study was conducted involving 30 manufacturing firms. This preliminary step was crucial for understanding the clarity, relevance, and potential ambiguities in the questionnaire. Feedback from the pilot study was used to refine and finalize the questionnaire.

Distribution: The finalized questionnaire was disseminated through various channels. Initially, an email containing a digital copy of the questionnaire, along with a brief about the study's objectives, was sent to senior managers or individuals holding significant positions in the environmental management and strategy divisions within these firms. The firms were sourced from industry databases and directories.

To enhance the response rate, follow-up phone calls were made to the companies a week after the initial mail-out. In addition, face-to-face meetings were organized wherever feasible. Furthermore, the questionnaires were also handed out during regional industry seminars and workshops focusing on sustainability and green practices. These seminars served as valuable platforms for networking and engaging with potential respondents, thus facilitating a higher response rate.

Data Management: Once collected, the data was input into statistical software for storage, coding, and analysis. To ensure data integrity, double-entry of the questionnaires was performed, and any inconsistencies were rectified promptly. Before the actual data analysis, the data was cleaned to handle any missing values, outliers, or errors that might have crept in during the data input process.

Ethical Considerations: Participants' confidentiality and anonymity were guaranteed throughout the data collection process. Consent was obtained prior to data collection, and participants were informed of the study's objectives and their right to withdraw at any stage.

In conclusion, the data collection process for this research was undertaken with the utmost care, ensuring the gathered data's reliability and validity. The robust methodologies adopted at every stage of this process, from designing the questionnaire to handling the collected data, laid a solid foundation for the subsequent analysis and findings.

3.4.2 Descriptive Data Analysis

After receipt of all respondents, analysis was performed to assess their correctness, validity, and reliability. This involves removing missing data, checking for outliers and removing them, and any values that appear to be unaligned with the other data. The study used a significance level of 5%, which implies a statistically significant alpha α = of 0.05. The following analytical procedure was used:

1. The first analysis is the calculation of descriptive statistics. Descriptive statistics refer to the characteristics of the variables used in the calculated data. The purpose of performing the descriptive analysis is to understand the characteristic behavior of the data before conducting an in-depth statistical analysis. Statistics of the interaction and relationship between the competitive strategy and the performance of small and medium-sized manufacturing enterprises.

2. Data were analyzed a second time using . The normality test —— is based on Greene (2008), who believes that the error terms of the linear regression should be normally distributed. Normality was tested using skewness and kurtosis.

3. The third analysis is the correlation analysis. Pearson's correlation analysis was used to assess the correlation between and between study variables. This is the basic analysis of structural equation modeling (SEM) analysis to find the factors that affect the performance of the enterprise. The consideration criteria for the correlation analysis are as follows.

Table 3.8 Level of correlation coefficient

Correlation coefficient (r)	Relationship level
r>0.8	Very high
0.6<r<0.8	Quite high
0.4<r<0.6	Moderate
0.2<r<0.4	Quite low
<0.2	Low

4. Analyze and evaluate the consistency of relevant influencing factors involved. Based on competitive strategy and enterprise performance, starting with multiple mediation variables and regulatory variables, and conducting empirical analysis through the AMOS model.

3.4.3 Analysis and Statistics

For this study, an assortment of sophisticated statistical techniques was utilized to dissect and interpret the gathered data in alignment with the study's objectives.

Goal 1: Exploring the Internal and External Green Environment Orientation on Sustainable Performance:

A Structural Equation Model (SEM) was employed. SEM is especially suited for research that aims to test relationships between multiple variables, making it an ideal choice for exploring the complex interplays between the various constructs defined in this study. For this goal, the primary

interest was to determine the direct relationships of Internal and External Green Environment Orientations with Sustainable Performance among manufacturing firms in China.

Goal 2: Mediating Role of Green Innovation and Green Competitive Advantage:

SEM analysis was again employed, but this time with Green Innovation and Green Competitive Advantage serving as the mediating variables. This analysis aimed to empirically ascertain the indirect effects of the aforementioned orientations on Sustainable Performance through these mediators.

Goal 3: Identifying Dominant and Significant Influencing Factors:

The data was further dissected to discern the dominant and significant factors affecting Sustainable Performance in the context of green orientations. Comparative analyses were executed to highlight the differences and similarities in influence among the various factors.

Goal 4: Proposing Countermeasures for Performance Improvement:

Drawing from the empirical findings and an extensive review of related literature, a comprehensive model was developed that could potentially enhance the Sustainable Performance of small and medium-sized manufacturing enterprises in China. Additionally, a range of countermeasures were proposed, tailored to the unique challenges and opportunities identified in the study.

To address the broader research questions, advanced statistical models were harnessed. For instance, the question related to the nexus between green competitive strategies and sustainable performance in manufacturing enterprises was unraveled using SEM. Similarly, for devising a performance model for manufacturing enterprises, empirical findings were juxtaposed with pertinent literature to craft actionable recommendations.

Ensuring Data Validity: Rigor was maintained throughout the analytical process. Reliability analyses were conducted to ensure the consistency of the data. This was supplemented by a validity analysis of the observed variables to ascertain that they accurately captured the constructs they were supposed to represent. An analysis of covariance was undertaken for all the variables to certify the integrity of the data used in the study, fortifying the robustness of the SEM and confirming the veracity of the derived conclusions.

In essence, the analytical techniques employed in this study were both robust and tailored to the nuanced objectives of the research, ensuring that the findings drawn were both credible and insightful.

3.4.4 Structural equation modeling (SEM)

In this study, Structural Equation Modeling (SEM) served as a pivotal analytical technique, offering profound insights into the intricate relationships among green orientations, green competitive advantage, green innovation, and sustainable performance. SEM's potency in elucidating multifaceted causal relationships ensured a thorough understanding of the underpinnings of our research variables.

SEM's capability to test invariance between distinct groups was invaluable. By facilitating a juxtaposition of the relationships among variables specific to manufacturing enterprises, SEM bolstered the validity of our findings. Through this comparative approach, the distinct impacts of various factors were rendered transparent, enabling the derivation of concrete results and the proposition of targeted countermeasures.

We also instituted a meticulous process to refine our model: insignificant paths were methodically pruned to derive an unconstrained model, with the concomitant chi-square values and degrees of freedom being meticulously recorded. The disparities between these metrics were subsequently evaluated, ascertaining the independence of our dataset.

Furthermore, A dual moderation analysis was performed via SEM. While typical moderation effects are typically assessed using regression analyses supplemented with interaction terms, our choice of SEM ensured a reduction in composite measurement errors, especially when formulating interaction terms between independent and moderating variables. This decision was further bolstered by preceding studies that have championed SEM's efficacy in such scenarios. All statistical computations were executed using the Amos version 26 software suite.

In summation, SEM facilitated a nuanced and comprehensive exploration of our research objectives, ensuring that the intricate relationships among our focal constructs were both comprehensively and accurately mapped.

3.4.5 Analysis of Confirmatory Factors (CFA)

Confirmatory factor analysis (CFA) was used to test the model fitness and accuracy of the scale from the aspects of the relationship among latent variables, observed variables, mediate variables. Statistical analysis includes a covariance analysis of the variance analysis of all variables used in the overall study, which conforms to the SEM, to confirm its accuracy and completeness. Covariance analysis was performed on observed variables, latent variables, internal variables, and intermediate variables. Evaluation of consistency between empirical data and conceptual frameworks. The details of the fit metrics are shown in the following table.

Table 3.9 Agreement evaluation between conceptual framework and empirical data

Statistics	**Symbol**	**Objectives**	**Statistics showing congruence between empirical data and conceptual framework**
Relative Chi-square	X2/df	To test the congruence of empirical data and conceptual framework	X2/df < 5.00
Goodness of Fit Index	GFI	To measure GFI, between 0-1.00	>0.90
Comparative Fit Index	CFI	To Compares the fit of a target model to the fit of an independent, or null, model	>0.90
Normed Fit Index	NFI	Measures NFI between 0 and 1	>0.90
Tucker Lewis index	TLI	To measure TLI, between 0-1.00	>0.90
Root mean square of approximation	RMSEA	To show conceptual framework errors in for of RMSEA between 0-100	<0.05

Source: Wheaton, Muthen, Alwin and Summers (1977)

3.4.6 Reliability Analysis

Cronbach's value of consistency index and the correlation coefficient CITC of each item and each variable item were used to test the reliability of variables involved in the conceptual model. In addition, if one of the variables is deleted, the higher the value a calculated by other variables after deletion, the item is considered deleted. If the consistency index Cronbach of all variables is greater than 0.7 and the CITC of all items is greater than 0.35, there is no significant improvement in the alpha coefficient after deleting any item of any variable. In this way, the internal consistency and reliability of each variable scale is higher.

3.4.7 Validity analysis

The KMO sample adequacy, Baetlett's test of sphericity, and factor loading coefficient were used as the criteria for validity evaluation. Ma and Yuan (2009) KMO sample adequacy measure was used to test the difference between the sum of squares of simple correlation coefficients between all variables in the scale and the sum of squares of partial correlation coefficients between these variables. The closer the value is to 1, the more suitable it is for factor analysis. When the KMO value is less than 0.7, it is not suitable for factor analysis. Bartlett spherical test is used to test whether the correlation matrix is an identity matrix, and H0 is the identity matrix of the correlation coefficient matrix. When the significance probability of the Bartlett statistic is less than or equal to the P value, H0 is rejected, and factor analysis can be performed. In addition, when the load coefficient of each item is greater than 0.5, the test items of the same variable can be combined into one factor for subsequent analysis through factor analysis , the measurement of the variable is valid.

3.4.8 Testing the Mediating Effect of Innovation Behavior

In order to test the hypothesis of the mediating effect of innovation behavior, this study uses the structural equation modeling method. More and more scholars agree and use the structural equation modeling technique to test the mediating effect of variables, which has the advantage that not only the stepwise regression analysis can be obtained, the effect of the method, but also a comprehensive consideration of the impact of measurement errors caused by the project. The mediating effect of variables can be judged only when the following four conditions are met at the same time: first, the regression coefficient of the dependent variable to the mediating variable reaches a significant level; second, the regression coefficient of the mediating variable to the independent variable reaches a significant level; Thirdly, the regression coefficient of the dependent variable to the independent variable reaches a significant level; fourthly, the regression coefficient of the dependent variable to the independent variable and the intermediary variable reaches a significant level, and the regression coefficients of the intermediary variable are not significant or decrease. When the regression coefficient of the independent variable is reduced to a non-significant level, it indicates that the intermediary variable plays a complete intermediary role, and the independent variable completely affects the dependent variable through the intermediary variable; When the regression coefficient of the independent variable decreases but still reaches a significant level, the mediating variable only plays a partial mediating role, that is, the independent variable not only indirectly affects the dependent variable through the mediating variable, but also directly affects the dependent variable. When the regression coefficient from the independent

variable to the assumed mediating variable reaches a significant level, the regression coefficient from the assumed mediating variable to the dependent variable is significant, and that from the independent variable to the dependent variable is not significant, there is a complete mediating effect. If the regression coefficient from the independent variable to the dependent variable is significant, it is considered that there is partial mediation.

In terms of the research content of this study, two structural equations need to be calculated for verification. AMOS 26.0 analysis software was used to test these hypotheses in turn. Structural equation models need to measure the mean, standard deviation, correlation coefficient matrix of variables.

3.5 Conclusions

This study meticulously delineated the research methodology adopted to investigate the nexus between green orientations, innovation, and sustainable performance within manufacturing enterprises in China. Beginning with a clear definition of our target population, the chapter elucidated the sampling techniques, ensuring representativeness across different firm sizes. It then proceeded to detail the survey instruments, emphasizing their underpinning in existing literature, for gauging various constructs, including Internal Green Environment Orientation, External Green Environment Orientation, Green Competitive Advantage, Green Innovation, and Sustainable Performance. The subsequent sections offered an in-depth exposition of the data collection processes and the rigorous analytical framework, chiefly Structural Equation Modeling (SEM), employed to interpret the amassed data. The robust methodology and comprehensive SEM analysis, underpinned by scholarly literature, ensure that the study's findings are both credible and insightful.

CHAPTER 4
ANALYSIS AND RESULTS

This chapter presents the comprehensive analysis and findings derived from the empirical data collected through surveys and other quantitative methods. The chapter begins by outlining the demographic characteristics of the study participants, followed by detailed statistical analyses that address the research hypotheses. Utilizing advanced statistical techniques such as Structural Equation Modeling (SEM), the chapter examines the relationships between internal and external green environment orientations, green competitive advantage, green innovation, and sustainable performance. The results highlight key insights and patterns, providing a robust understanding of how green practices influence organizational performance.

4.1 Demographic Characteristics

The table 4.1 shows the demographic distribution of the study participants.

Firstly, the gender distribution indicates that 53.36% of the participants are male, while 37.35% are female. This suggests that males have a slightly higher participation rate in this study compared to females.

Secondly, the age distribution of the participants shows the number and percentage of individuals in different age groups. Most participants fall within the 31 to 40 years age range (47.22% of the total) and the 41 to 50 years age range (31.20% of the total). This likely reflects the typical age of professionals in this field, who are often in leadership or senior management positions. Participants aged 20 to 30 years are relatively fewer, comprising only 18.16% of the total. Those aged 51 to 60 and over 60 are even less common, representing just 2.56% and 0.85% of the total, respectively. This aligns with the description of the study's subjects as senior managers, as these roles typically require significant work experience and thus have older age distributions.

From an educational perspective, the majority of participants hold a bachelor's degree or lower, accounting for 63.03% of the total. Additionally, 32.26% of participants have a master's degree, while only 4.70% possess a doctoral degree. This indicates that most participants' educational levels are oriented towards undergraduate degrees or lower, with fewer individuals having advanced graduate or doctoral degrees.

Regarding work experience, most participants have between 5 to 10 years and 11 to 15 years of experience, making up 54.70% and 22.22% of the total, respectively. This likely reflects that professionals in environmental management and strategic fields typically need a certain level of work experience to hold senior positions or engage in related research. Conversely, participants with less than 5 years of experience comprise 18.38%, while those with more than 20 years of experience represent only 1.28% of the total. This is consistent with the study's focus on senior managers or individuals engaged in relevant fields, as these positions usually require extensive work experience.

Table 4.1 Demographics Characteristics (N=468)

Variables	**Items**	**Frequency**	**Percentage (%)**
Gender	Male	323	53.36
	Female	145	37.35
Age	20-30 years	85	18.16
	31-40 years	221	47.22
	41-50 years	146	31.20
	51-60 years	12	2.56
	Older than 60 years	4	0.85
Education	Bachelor Degree or Lower	295	63.03
	Master's Degree	151	32.26
	Doctoral Degree	22	4.70
Year of Experience	Less than 5 years	86	18.38
	5-10 years	256	54.70
	11-15 years	104	22.22
	16-20 years	16	3.42
	More than 20 years	6	1.28
Type of Manufacturing	Heavy machinery and equipment	63	13.46
	Consumer goods	61	13.03
	Electronics	58	12.39
	Chemicals and Pharmaceuticals	75	16.03
	Food and Beverage	66	14.10
	Textiles and Apparel	68	14.53
	Other	77	16.45

Table 4.1 (Continue)

Variables	Items	Frequency	Percentage (%)
Location of the enterprise	North China	68	14.53
	South China	78	16.67
	East China	68	14.53
	Central China	65	13.89
	northwest	54	11.54
	Southwest	60	12.82
	southeast	45	9.62
	northeast	30	6.41
Total		468	100.0

4.2 Opinion Level of the Variables

The six variables in the research framework are described in the following section. All variables are measured using a 5-point Likert scale, with the mean value indicated as follows:

Mean value between 1.00 -1.80 is “Strongly Disagree"

Mean value between 1.81 -2.60 is “Disagree”

Mean value between 2.61 -3.40 is "Neutral"

Mean value between 3.41 -4.20 is “Agree"

Mean value between 4.21 -5 .00 is “Strongly Agree"

The descriptive analysis of these variables is then presented as follows:

4.2.1 Internal Green Environment Orientation

The table 4.2 presents the survey results regarding Internal Green Environment Orientation (IGEO) across three main areas: R&D investment, top management support, and firm's culture. Each area is evaluated based on opinion levels, mean scores, standard deviation, and overall agreement level.

In terms of R&D investment, the results show that the majority of participants agree that their firms invest heavily in research and development to enhance green practices. Specifically, 32.48% of respondents are neutral, 29.91% agree, and 21.37% strongly agree, with a mean score of 3.506 and a standard deviation of 1.112. Similarly, when asked if the allocation of resources for green R&D projects is a top priority, the mean score is 3.489 with a standard deviation of 1.164, indicating

overall agreement. Additionally, participants agree that their R&D initiatives significantly advance green practices, reflected by a mean score of 3.545 and a standard deviation of 0.937. The overall mean for R&D investment is 3.514, suggesting a strong consensus that R&D investments support green practices.

Top management support for green initiatives also receives strong agreement from the participants. The statement "Our top management actively promotes and supports green initiatives within our firm" shows that 34.62% agree and 22.44% strongly agree, with a mean score of 3.594 and a standard deviation of 1.048. Similarly, 44.23% of participants strongly agree that green projects receive visible endorsement from senior leaders, resulting in a mean score of 3.778 and a standard deviation of 1.316. Additionally, the commitment of top management to green practices positively influences environmental performance, as indicated by a mean score of 3.645 and a standard deviation of 0.915. The overall mean for top management support is 3.672, indicating strong agreement that senior leadership actively supports green initiatives.

The firm's culture is another critical aspect of IGEO. The survey results indicate that the firm's culture emphasizes adopting environmentally-friendly practices, with 46.15% of respondents strongly agreeing and 16.45% agreeing, leading to a mean score of 3.942 and a standard deviation of 1.150. Employees are encouraged to contribute to green initiatives, reflected by a mean score of 3.658 and a standard deviation of 1.050, with 42.31% agreeing and 21.58% strongly agreeing. Additionally, a sense of environmental responsibility is ingrained in the organizational values and practices, although with a slightly lower mean score of 3.182 and a standard deviation of 1.236. The overall mean for the firm's culture is 3.594, suggesting a strong cultural support for green practices.

In summary, the table reflects a generally positive internal green environment orientation within the firm. There is significant investment in R&D, strong support from top management, and a culture that emphasizes green practices, all contributing to the organization's overall commitment to environmental sustainability.

Table 4.2 The Basic Information of Internal Green Environment Orientation

Internal Green Environment Orientation	**Opinion Levels**					**Mean**	**Std. dev**	**Level**
	1	**2**	**3**	**4**	**5**			
	Frequency (n) & Percent (%)							
R&D investment						3.51	0.95	Agree

Table 4.2 (Continue)

Internal Green Environment Orientation		**Opinion Levels**					**Mean**	**Std. dev**	**Level**
		1	**2**	**3**	**4**	**5**			
		Frequency (n) & Percent (%)							
Our firm heavily invests in research and development (R&D) to enhance our green practices.	n	27	49	152	140	100	3.50	1.11	Agree
	%	5.77	10.47	32.48	29.91	21.37			Agree
The allocation of resources for green R&D projects is a top priority for our firm.	n	23	82	113	143	107	3.48	1.16	Agree
	%	4.91	17.52	24.15	30.56	22.86			Agree
Our R&D initiatives have played a significant role in advancing our green initiatives and environmental practices.	n	9	40	186	153	80	3.54	0.93	Agree
	%	1.92	8.55	39.74	32.69	17.09			Agree
Top Management Support							3.67	0.96	Agree
Our top management actively promotes and supports green initiatives within our firm.	n	1	92	108	162	105	3.59	1.04	Agree
	%	0.21	19.66	23.08	34.62	22.44			Agree
Green projects and initiatives receive visible endorsement and encouragement from our senior leaders.	n	40	37	117	67	207	3.77	1.31	Agree
	%	8.55	7.91	25.00	14.32	44.23			Agree
The top management's commitment to green practices has positively influenced our environmental performance.	n	3	39	173	159	94	3.64	0.91	Agree
	%	0.64	8.33	36.97	33.97	20.09			

Table 4.2 (Continue)

Internal Green Environment Orientation		Opinion Levels 1	2	3	4	5	Mean	Std. dev	Level
		Frequency (n) & Percent (%)							
Firm's Culture							3.594	1.00	Agree
Our firm's culture emphasizes the importance of adopting environmentally-friendly practices.	n	12	44	119	77	216	3.94	1.15	Agree
	%	2.56	9.40	25.43	16.45	46.15			
Employees in our firm are encouraged to suggest and contribute to green initiatives.	n	12	68	89	198	101	3.65	1.05	Agree
	%	2.56	14.53	19.02	42.31	21.58			
A sense of environmental responsibility is deeply ingrained in our organizational values and practices.	n	63	73	108	164	60	3.18	1.23	Neutral
	%	13.46	15.60	23.08	35.04	12.82			

4.2.2 External Green Environment Orientation

The table 4.3 provides insights into the External Green Environment Orientation (EGEO) of firms, focusing on perceived policy effectiveness, competitor competition, and customer demand. Each area is assessed based on opinion levels, mean scores, standard deviation, and overall agreement level.

Regarding perceived policy effectiveness, the data indicates that most participants agree that environmental regulations effectively guide their firm's sustainability practices. Specifically, 30.98% of respondents agree, and 27.78% strongly agree, resulting in a mean score of 3.55 and a standard deviation of 1.25. Additionally, firms frequently modify their practices to align with updated environmental policies, as reflected by a mean score of 3.37 and a standard deviation of 1.25. Furthermore, 30.98% of participants agree, and 24.57% strongly agree that current environmental policies significantly impact their industry, leading to a mean score of 3.54 and a

standard deviation of 1.17. The overall mean for perceived policy effectiveness is 3.49, indicating a general agreement that environmental policies are effective and impactful.

In terms of competitor competition, the results show that a significant number of competitors have adopted green practices in their operations, with 30.98% of respondents agreeing and 24.36% strongly agreeing, leading to a mean score of 3.60 and a standard deviation of 1.07. Firms often benchmark their sustainability practices against industry leaders to remain competitive, reflected by a mean score of 3.52 and a standard deviation of 1.28. Moreover, 30.56% of participants agree, and 26.07% strongly agree that green initiatives provide a competitive advantage, resulting in a mean score of 3.59 and a standard deviation of 1.10. The overall mean for competitor competition is 3.57, suggesting that green practices are widely adopted and provide a competitive edge in the industry.

Customer demand for environmentally-friendly products and services is another crucial aspect of EGEO. The survey results indicate that customers frequently demand such products/services, with 34.19% of respondents agreeing and 29.70% strongly agreeing, leading to a mean score of 3.75 and a standard deviation of 1.09. Customer feedback often includes suggestions for improving environmental practices, as reflected by a mean score of 3.59 and a standard deviation of 1.19. Additionally, meeting green expectations of customers significantly influences brand reputation, with 30.77% of participants agreeing and 27.56% strongly agreeing, resulting in a mean score of 3.55 and a standard deviation of 1.25. The overall mean for customer demand is 3.63, indicating strong agreement that customer expectations drive firms to adopt green practices.

In summary, the table reflects a positive external green environment orientation among firms. Environmental regulations, competitive pressures, and customer demands all play significant roles in shaping firms' sustainability practices. There is a general consensus that these external factors are effective in guiding, influencing, and encouraging firms to adopt and enhance their green initiatives.

Table 4.3 The basic information of External Green Environment Orientation

External Green Environment Orientation	**Opinion Levels**					**Mean**	**Std. dev**	**Level**
	1	**2**	**3**	**4**	**5**			
	Frequency (n) & Percent (%)							
Perceived Policy Effectiveness						3.49	1.05	Agree

Table 4.3 (Continue)

External Green Environment Orientation	**Opinion Levels**						**Mean**	**Std. dev**	**Level**
		1	**2**	**3**	**4**	**5**			
		Frequency (n) & Percent (%)							
The environmental regulations in place are effective in guiding our firm's sustainability practices.	n	36	73	84	145	130	3.55	1.25	Agree
	%	7.69	15.60	17.95	30.98	27.78			Agree
Our organization often modifies its practices to align with updated environmental policies.	n	50	65	110	144	99	3.37	1.25	Agree
	%	10.68	13.89	23.50	30.77	21.15			Agree
Our firm believes that the current environmental policies have significantly impacted our industry.	n	29	60	119	145	115	3.54	1.17	Agree
	%	6.20	12.82	25.43	30.98	24.57			Agree
Competitor Competition							3.57	0.96	Agree
Most of our competitors have already adopted green practices in their operations.	n	16	53	145	140	114	3.60	1.07	Agree
	%	3.42	11.32	30.98	29.91	24.36			Agree
We often benchmark our sustainability practices against industry leaders to remain competitive.	n	48	52	105	132	131	3.52	1.28	Agree
	%	10.26	11.11	22.44	28.21	27.99			Agree
Our firm believes that green initiatives provide a competitive advantage in our industry.	n	16	60	143	127	122	3.59	1.10	Agree
	%	3.42	12.82	30.56	27.14	26.07			
Customer Demand							3.63	1.04	Agree

Table 4.3 (Continue)

Green Competitive Advantage	Opinion Levels					Mean	Std. dev	Level
	1	2	3	4	5			
	Frequency (n) & Percent (%)							
Our customers frequently demand environmentally-friendly products/services.	n 13	58	98	160	139	3.75	1.09	Agree
	% 2.78	12.39	20.94	34.19	29.70			
Customer feedback often includes suggestions or requests related to improving our environmental practices.	n 18	91	87	141	131	3.59	1.19	Agree
	% 3.85	19.44	18.59	30.13	27.99			
Our firm believes that meeting green expectations of customers significantly influences our brand reputation.	n 38	68	89	144	129	3.55	1.25	Agree
	% 27.99	14.53	19.02	30.77	27.56			

4.2.3 Green Competitive Advantage

The table 4.4 provides an overview of the opinions related to Green Competitive Advantage, focusing on two main aspects: differentiation advantage and cost advantage. Each aspect is evaluated based on opinion levels, mean scores, standard deviation, and overall agreement level.

Regarding differentiation advantage, the data reveals that the majority of participants agree that their firm's green initiatives enable them to offer distinct products or services compared to competitors. Specifically, 40.81% of respondents agree, and 25.85% strongly agree, leading to a mean score of 3.859 and a standard deviation of 0.910. Additionally, 39.74% of participants agree, and 23.08% strongly agree that customers recognize and appreciate the unique environmental features of their products or services, resulting in a mean score of 3.624 and a standard deviation of 0.992. Furthermore, 33.97% of respondents agree, and 23.29% strongly agree that their green practices contribute to a positive brand image and reputation in the market, leading to a mean score of 3.688 and a standard deviation of 0.962. The overall mean for differentiation advantage is 3.724, indicating a general consensus that green initiatives provide a significant differentiation advantage in the market.

In terms of cost advantage, the results show that sustainable practices have led to significant cost savings in production and operations. Specifically, 34.62% of respondents agree, and 23.72%

strongly agree, resulting in a mean score of 3.605 and a standard deviation of 1.120. Additionally, 34.62% of participants agree, and 16.03% strongly agree that adopting green strategies has reduced waste and improved resource efficiency, leading to a mean score of 3.515 and a standard deviation of 1.019. Moreover, 38.89% of respondents agree, and 19.44% strongly agree that in the long term, green practices will lead to more economical operations, resulting in a mean score of 3.694 and a standard deviation of 0.896. The overall mean for cost advantage is 3.605, reflecting a general agreement that green practices contribute to cost savings and more efficient operations.

In summary, the table highlights that firms perceive significant benefits from their green initiatives, both in terms of differentiation and cost advantages. The data indicates that green practices not only help firms stand out in the market by offering unique products and enhancing their brand image but also lead to substantial cost savings and improved operational efficiency. There is a strong consensus among participants that green competitive advantages are crucial for their firm's success and sustainability in the long term.

Table 4.4 The basic information of Green Competitive Advantage

Green Competitive Advantage	**Opinion Levels**						**Mean**	**Std. dev**	**Level**
	1	**2**	**3**	**4**	**5**				
	Frequency(n), Percent(%)								
Differentiation Advantage							3.72	0.85	Agree
Our firm's green initiatives allow us to offer distinct products/services compared to competitors.	n	13	5	138	191	121	3.85	0.91	Agree
	%	2.78	1.07	29.49	40.81	25.85			
Customers recognize and appreciate the unique environmental features of our products/services.	n	12	31	186	131	108	3.62	0.99	Agree
	%	2.56	6.62	39.74	27.99	23.08			
Our green practices contribute to a positive brand image and reputation in the market.	n	6	39	159	155	109	3.68	0.96	Agree
	%	1.28	8.33	33.97	33.12	23.29			
Cost Advantage							3.60	0.87	Agree

Table 4.4 (Continue)

Green Competitive Advantage	Opinion Levels						Mean	Std. dev	Level
		1	2	3	4	5			
		Frequency(n), Percent(%)							
Our sustainable practices have led to significant cost savings in production and operations.	n	25	51	119	162	111	3.60	1.12	Agree
	%	5.34	10.90	25.43	34.62	23.72			
By adopting green strategies, we have been able to reduce waste and improve resource efficiency.	n	26	31	162	174	75	3.51	1.01	Agree
	%	5.56	6.62	34.62	37.18	16.03			
Our firm believes that in the long term, green practices will lead to more economical operations.	n	8	23	164	182	91	3.69	0.89	Agree
	%	1.71	4.91	35.04	38.89	19.44			

4.2.4 Green Innovation

The table 4.5 presents insights into Green Innovation across two dimensions: Green Product Innovation and Green Process Innovation. Each dimension is analyzed based on opinion levels, mean scores, standard deviation, and overall agreement levels among respondents.

In terms of Green Product Innovation, the data shows that a significant proportion of participants agree that their firm frequently introduces new products that are environmentally friendly. Specifically, 33.76% agree, and 18.80% strongly agree, resulting in a mean score of 3.54 and a standard deviation of 1.01. Additionally, 32.48% of respondents agree, and 19.66% strongly agree that the products they design and develop prioritize minimizing environmental impact, leading to a mean score of 3.52 and a standard deviation of 1.12. Moreover, 39.32% agree, and 23.29% strongly agree that the eco-friendly features of their products differentiate them from competitors, resulting in a mean score of 3.58 and a standard deviation of 1.18. The overall mean for Green Product Innovation is 3.54, indicating a general consensus that firms prioritize developing environmentally friendly products and perceive differentiation benefits in the market.

Regarding Green Process Innovation, the results reveal that many respondents agree their firm continuously adopts new processes to reduce waste and environmental pollution. Specifically, 31.20% agree, and 29.49% strongly agree, resulting in a mean score of 3.72 and a standard deviation of 1.09. Additionally, 31.84% agree, and 24.15% strongly agree that their firm frequently invests in technologies to increase operational eco-efficiency, leading to a mean score of 3.50 and a standard deviation of 1.21. Moreover, 38.89% agree, and 24.79% strongly agree that their production methods are often updated to ensure minimal resource usage and maximal sustainability, resulting in a mean score of 3.65 and a standard deviation of 1.00. The overall mean for Green Process Innovation is 3.62, indicating a strong agreement that firms actively pursue innovative processes to enhance eco-efficiency and sustainability in operations.

In summary, the table highlights that firms perceive significant benefits from both Green Product Innovation and Green Process Innovation. The data indicates that firms are actively developing environmentally friendly products and adopting innovative processes to reduce environmental impact and enhance operational efficiency. These green innovations not only align with environmental goals but also contribute to differentiation in the competitive market, suggesting a strategic focus on sustainability as a driver of business success.

Table 4.5 The basic information of Green Innovation

Green Innovation	**Opinion Levels**						**Mean**	**Std. dev**	**Level**
	1	**2**	**3**	**4**	**5**				
	Frequency(n), Percent(%)								
Green Product Innovation							3.54	0.98	Agree
Our firm frequently introduces new products that are environmentally friendly.	n	13	53	158	156	88	3.54	1.01	Agree
	%	2.78	11.32	33.76	33.33	18.80			
The products we design and develop prioritize minimizing environmental impact.	n	44	15	152	165	92	3.52	1.12	Agree
	%	9.40	3.21	32.48	35.26	19.66			

Table 4.5 (Continue)

Green Innovation	Opinion Levels						Mean	Std. dev	Level
		1	2	3	4	5			
		Frequency(n), Percent(%)							
The eco-friendly features of our products differentiate us from competitors.	n	34	62	79	184	109	3.58	1.18	Agree
	%	7.26	13.25	16.88	39.32	23.29			
Green Process Innovation							3.62	0.96	Agree
Our firm continuously adopts new processes that reduce waste and environmental pollution.	n	23	27	146	134	138	3.72	1.09	Agree
	%	4.91	5.77	31.20	28.63	29.49			
We frequently invest in technologies that increase our operational eco-efficiency.	n	50	22	149	134	113	3.50	1.21	Agree
	%	10.68	4.70	31.84	28.63	24.15			
Our production methods are often updated to ensure minimal resource usage and maximal sustainability.	n	14	26	182	130	116	3.65	1.00	Agree
	%	2.99	5.56	38.89	27.78	24.79			

4.2.5 Sustainable Performance

The table 4.6 provides a comprehensive overview of Sustainable Performance across economic, environmental, and social dimensions within organizations. Each dimension is evaluated based on opinion levels, mean scores, standard deviations, and overall agreement levels among respondents.

In terms of Economic Performance, the data reveals that a notable proportion of respondents agree that their firm's green initiatives have positively impacted financial metrics. Specifically, 28.42% agree, and 28.63% strongly agree that these initiatives have led to increased revenue, resulting in a mean score of 3.85 with a standard deviation of 0.97. Similarly, 26.71% agree, and 29.91% strongly agree that green initiatives have contributed to increased market share, with a mean score of 3.75 and a standard deviation of 1.09. Moreover, 27.99% agree, and 44.23% strongly agree that adopting sustainable practices has resulted in significant cost savings, leading to a mean score of 4.04 and a standard deviation of 1.09. Overall, these findings indicate a strong alignment between sustainable practices and economic performance metrics within organizations.

Regarding Environmental Performance, respondents indicate positive outcomes related to reducing environmental footprint and resource conservation. For instance, 30.98% agree, and 25.21% strongly agree that their organization has significantly reduced its carbon footprint, resulting in a mean score of 3.67 and a standard deviation of 1.08. Furthermore, 35.68% agree, and 18.80% strongly agree that waste generated from operations has decreased, with a mean score of 3.46 and a standard deviation of 1.12. Additionally, 36.11% agree, and 24.57% strongly agree that the use of green technologies has minimized environmental impact, leading to a mean score of 3.56 and a standard deviation of 1.10. These results underscore the effectiveness of green technologies and practices in enhancing environmental performance metrics.

In terms of Social Performance, respondents highlight positive perceptions regarding employee health and safety, community engagement, fair labor practices, and stakeholder engagement. Notably, 36.11% agree, and 28.63% strongly agree that their company is recognized for its commitment to employee health and safety, resulting in a mean score of 3.80 and a standard deviation of 1.18. Moreover, 26.50% agree, and 28.63% strongly agree that their firm actively participates in community development programs, with a mean score of 3.58 and a standard deviation of 1.23. Additionally, 38.46% agree, and 20.94% strongly agree that their firm upholds fair labor practices, leading to a mean score of 3.83 and a standard deviation of 1.22. The data also shows a strong commitment to stakeholder engagement, with 31.84% agreeing and 30.13% strongly agreeing that their organization prioritizes seeking feedback to improve societal contributions, resulting in a mean score of 3.70 and a standard deviation of 1.17.

In summary, the table underscores the multifaceted benefits of sustainable practices across economic, environmental, and social dimensions within organizations. The findings suggest that integrating sustainability into business strategies not only enhances financial performance and operational efficiency but also fosters environmental stewardship and social responsibility, contributing to overall organizational success and positive stakeholder perceptions.

Table 4.6 The basic information of Sustainable Performance

Sustainable Performance	Opinion Levels					Mean	Std. dev	Level
	1	2	3	4	5			
	Frequency(n), Percent(%)							
Economic Performance						3.84	0.85	Agree
Our firm's green initiatives have led to increased revenue	n 15	12	133	174	134	3.85	0.97	Agree
	% 3.21	2.56	28.42	37.18	28.63			
Our firm's green initiatives have led to increased market share.	n 21	33	125	149	140	3.75	1.09	Agree
	% 4.49	7.05	26.71	31.84	29.91			
The adoption of sustainable practices has resulted in significant cost savings for our company.	n 23	12	95	131	207	4.04	1.09	Agree
	% 4.91	2.56	20.30	27.99	44.23			
Our firm's profitability has improved due to our focus on sustainable and green innovations.	n 11	21	135	162	139	3.84	0.97	Agree
	% 2.35	4.49	28.85	34.62	29.70			
Our stakeholders, including investors, view our firm favorably because of our commitment to sustainable practices.	n 18	44	102	201	103	3.69	1.03	Agree
	% 3.85	9.40	21.79	42.95	22.01			
Environmental Performance						3.55	0.92	Agree
Our organization has significantly reduced its carbon footprint in recent years.	n 27	22	145	156	118	3.67	1.08	Agree
	% 5.77	4.70	30.98	33.33	25.21			
	n 41	25	167	147	88	3.46	1.12	Agree

Table 4.6 (Continue)

Sustainable Performance	Opinion Levels					Mean	Std. dev	Level
	1	2	3	4	5			
	Frequency(n), Percent(%)							
We have successfully decreased the waste generated from our operations.	%	8.76	5.34	35.68	31.41	18.80			
Our company has taken measurable steps to conserve resources like water and energy.	n	35	24	155	161	93	3.54	1.09	Agree
	%	7.48	5.13	33.12	34.40	19.87			
The use of green technologies has minimized the environmental impact of our operations.	n	24	40	169	120	115	3.56	1.10	Agree
	%	5.13	8.55	36.11	25.64	24.57			
Social Performance							3.67	1.08	
Our company is recognized for its commitment to employee health and safety.	n	33	22	116	128	169	3.73	0.97	Agree
	%	7.05	4.70	24.79	27.35	36.11			
We actively participate in community development programs and local initiatives.	n	42	39	124	129	134	3.80	1.18	Agree
	%	8.97	8.33	26.50	27.56	28.63			
Our firm upholds and promotes fair labor practices.	n	38	23	98	129	180	3.58	1.23	Agree
	%	8.12	4.91	20.94	20.94	38.46			
We prioritize stakeholder engagement and continuously seek feedback to improve our societal contributions.	n	34	32	112	149	141	3.83	1.22	Agree
	%	7.26	6.84	6.84	31.84	30.13			
							3.70	1.17	Agree

4.3 Data Analysis

This section presents the results of the normality tests, evaluated using the skewness and kurtosis criteria, and the correlation analysis of the variables. To understand the results of normality test: “Yes” means that the variable is normally distributed while “No” means the variable violates the normal distribution's assumption.

4.3.1 Basic Statistical Values of Internal Green Environment Orientation

Table 4.7 presents the skewness and kurtosis values for three observed variables related to Internal Green Environment Orientation: R&D investment, Top management support, and Firm’s culture. According to Hooland's (1998) guidelines, which suggest that skewness should ideally not exceed an absolute value of 0.75 and kurtosis should not exceed an absolute value of 1.5 to maintain approximate normality, the variables in this table conform well to these standards.

For skewness, which measures the symmetry of the distribution around the mean, all variables exhibit values within acceptable limits. R&D investment has a skewness of -0.174, Top management support shows -0.327, and Firm’s culture displays -0.423. These values indicate slight negative skewness, suggesting a tendency towards higher agreement with internal green practices but well within the acceptable range of normality.

Regarding kurtosis, which assesses the peakedness of the distribution, the variables also meet the criterion set by Hooland (1998). R&D investment has a kurtosis of -0.933, Top management support is -1.128, and Firm’s culture shows -1.045. These negative kurtosis values indicate a slightly flatter distribution than a normal curve, yet they remain comfortably within the permissible range for maintaining normality.

Furthermore, the assessment of normal distribution for these variables confirms their adherence to a near-normal distribution, which is crucial for ensuring the validity of statistical analyses conducted on these data points. These findings affirm that the data related to Internal Green Environment Orientation in Table 4.7 exhibit acceptable levels of skewness and kurtosis as per established research standards, thereby supporting reliable statistical interpretations and conclusions within the context of green organizational practices.

Table 4.7 Basic Statistical Values of Internal Green Environment Orientation

Latent Variable	Observed Variable	Skewness	Kurtosis	Normal Distribution
Internal Green Environment Orientation	R&D investment	-0.174	-0.933	Yes
	Top management support	-0.327	-1.128	Yes
	Firm's culture	-0.423	-1.045	Yes

4.3.2 Basic Statistical Values of External Green Environment Orientation

Table 4.8 provides the skewness and kurtosis values for three observed variables associated with External Green Environment Orientation: Perceived policy effectiveness, Competitor competition, and Customer demand. These statistical measures are essential in assessing the distributional properties of the variables, ensuring they adhere to normality assumptions critical for robust statistical analyses.

According to established criteria by Hooland (1998), skewness values should ideally not exceed an absolute value of 0.75, and kurtosis values should not exceed an absolute value of 1.5 to maintain approximate normality. In Table 4.8, all observed variables meet these standards, indicating their suitability for subsequent statistical modeling and interpretation.

Starting with skewness, which measures the symmetry of the distribution around the mean, all variables demonstrate values within acceptable limits. Perceived policy effectiveness shows a skewness of -0.342, Competitor competition has -0.267, and Customer demand exhibits -0.323. These negative skewness values indicate a slight leftward skew, suggesting a tendency towards higher agreement or positive perception regarding external environmental factors, but well within the acceptable range of normal distribution.

Regarding kurtosis, which evaluates the peakedness of the distribution, the variables also adhere to the recommended guidelines. Perceived policy effectiveness has a kurtosis of -0.933, Competitor competition shows -0.831, and Customer demand displays -1.096. These negative kurtosis values imply a flatter distribution compared to a normal curve, yet they remain comfortably within the acceptable range, indicating no excessive or unusual patterns in the data distribution.

The confirmation of normal distribution for these variables underscores their statistical reliability and appropriateness for further analysis in the context of understanding external green environment orientation. These findings validate the robustness of the data and support the accurate

interpretation of results related to how organizations perceive and respond to external environmental pressures such as policies, competitive landscape, and customer expectations.

Table 4.8 Basic Statistical Values of External Green Environment Orientation

Latent Variable	Observed Variable	Skewness	Kurtosis	Normal Distribution
External Green Environment Orientation	Perceived policy effectiveness	-0.342	-0.933	Yes
	Competitor competition	-0.267	-0.831	Yes
	Customer demand	-0.323	-1.096	Yes

4.3.3 Basic Statistical Values of Green Competitive Advantage

Table 4.9 presents the skewness and kurtosis values for two observed variables associated with Green Competitive Advantage: Differentiation advantage and Cost advantage. These statistical measures are crucial for assessing the distributional characteristics of the variables, ensuring they meet the assumptions required for reliable statistical analyses.

In accordance with the criteria established by Hooland (1998), skewness values ideally should not exceed an absolute value of 0.75, and kurtosis values should stay within an absolute value of 1.5 to maintain approximate normality. Both observed variables in Table 4.9 demonstrate values that adhere to these standards, indicating their suitability for subsequent statistical modeling and interpretation.

Starting with skewness, which measures the symmetry of the distribution around the mean, Differentiation advantage shows a skewness of -0.195, and Cost advantage exhibits -0.323. These negative skewness values suggest a slight leftward skew, indicating a tendency towards higher agreement or positive perception regarding the competitive advantages derived from green practices. These values are well within the acceptable range for normal distribution, indicating no significant deviation from the expected pattern.

Moving to kurtosis, which assesses the peakedness of the distribution, both variables also demonstrate values within acceptable limits. Differentiation advantage has a kurtosis of -0.773, while Cost advantage shows -0.811. These negative kurtosis values indicate a distribution that is flatter than a normal curve but still well within the acceptable range for robust statistical analysis.

They suggest a relatively moderate degree of peakedness, implying that the data distribution does not exhibit excessive or unusual patterns.

The confirmation of normal distribution for Differentiation advantage and Cost advantage variables affirms their statistical reliability and appropriateness for further analysis in exploring how green practices contribute to competitive advantages. These findings underscore the soundness of the data and support accurate interpretations related to how organizations differentiate themselves and achieve cost efficiencies through their environmental initiatives.

Table 4.9 Basic Statistical Values of Green competitive Advantage

Latent Variable	Observed Variable	Skewness	Kurtosis	Normal Distribution
Green competitive Advantage	Differentiation advantage	-0.195	-0.773	Yes
	Cost advantage	-0.323	-0.811	Yes

4.3.4 Basic Statistical Values of Green Innovation

Table 4.10 provides the skewness and kurtosis values for two observed variables under the latent variable Green Innovation: Green product innovation and Green process innovation. These statistical measures are crucial for assessing the distributional characteristics of the variables, ensuring they meet the assumptions necessary for reliable statistical analyses in research.

According to Hooland's (1998) criteria, skewness values ideally should not exceed an absolute value of 0.75, and kurtosis values should be within an absolute value of 1.5 to maintain approximate normality. In Table 4.10, both observed variables demonstrate skewness and kurtosis values that adhere to these standards, indicating their suitability for subsequent statistical modeling and interpretation.

Starting with skewness, which measures the symmetry of the distribution around the mean, Green product innovation shows a skewness of -0.430, while Green process innovation exhibits -0.300. These negative skewness values indicate a slight leftward skew, suggesting a tendency towards higher agreement or positive perception regarding the innovation in green products and processes. This skewness is within the acceptable range for normal distribution, indicating no significant departure from the expected distributional pattern.

Moving to kurtosis, which assesses the peakedness of the distribution, both variables also demonstrate values within acceptable limits. Green product innovation has a kurtosis of -0.667, and

Green process innovation shows -0.808. These negative kurtosis values indicate a distribution that is flatter than a normal curve but still within the acceptable range for robust statistical analysis. This suggests a moderate degree of peakedness, reflecting a distribution that is not overly heavy-tailed or too sharply peaked.

The confirmation of normal distribution for Green product innovation and Green process innovation variables supports their statistical reliability and appropriateness for further analysis. These findings underscore the soundness of the data and provide confidence in interpreting how organizations innovate in green products and processes, contributing to environmental sustainability and competitive advantage. This statistical validation ensures that subsequent research conclusions drawn from these variables are based on solid analytical foundations.

Table 4.10 Basic Statistical Values of Green Innovation

Latent Variable	Observed Variable	Skewness	Kurtosis	Normal Distribution
Green Innovation	Green product innovation	-0.430	-0.667	Yes
	Green process innovation	-0.300	-0.808	Yes

4.3.5 Basic Statistical Values of Sustainable Performance

Table 4.11 presents the skewness and kurtosis values for three observed variables under the latent variable Sustainable Performance: Economic performance, Environmental performance, and Social performance. These statistical measures are essential for evaluating the distributional characteristics of the variables and ensuring they meet the assumptions necessary for reliable statistical analyses in research.

According to Hooland's (1998) guidelines, skewness values ideally should not exceed an absolute value of 0.75, and kurtosis values should be within an absolute value of 1.5 to maintain approximately normal distribution. In Table 4.11, all observed variables demonstrate skewness and kurtosis values that adhere to these standards, indicating their suitability for subsequent statistical modeling and interpretation.

Starting with skewness, which measures the symmetry of the distribution around the mean, Economic performance exhibits a skewness of -0.384, Environmental performance shows -0.281, and Social performance demonstrates -0.452. These negative skewness values indicate a slight leftward skew, suggesting a tendency towards higher agreement or positive perception regarding sustainable economic, environmental, and social practices. This skewness falls within the

acceptable range for normal distribution, indicating no significant departure from the expected distributional pattern.

Moving to kurtosis, which assesses the peakedness of the distribution, all variables also demonstrate values within acceptable limits. Economic performance has a kurtosis of -0.819, Environmental performance shows -0.741, and Social performance exhibits -0.874. These negative kurtosis values indicate a distribution that is flatter than a normal curve but still within the acceptable range for robust statistical analysis. This suggests a moderate degree of peakedness, reflecting distributions that are not overly heavy-tailed or too sharply peaked.

The confirmation of normal distribution for Economic performance, Environmental performance, and Social performance variables supports their statistical reliability and appropriateness for further analysis. These findings underscore the soundness of the data and provide confidence in interpreting how organizations perform economically, environmentally, and socially within the framework of sustainability. This statistical validation ensures that conclusions drawn from these variables in research are based on solid analytical foundations, contributing to a comprehensive understanding of sustainable performance across different dimensions.

Table 4.11 Basic Statistical Values of Sustainable Performance

Latent Variable	Observed Variable	Skewness	Kurtosis	Normal Distribution
Sustainable Performance	Economic performance	-0.384	-0.819	Yes
	Environment performance	-0.281	-0.741	Yes
	Social performance	-0.452	-0.874	Yes

4.4 Correlation Coefficient

According to Table 4.12, In this study, the relationships between Sustainable Performance (SP) and four key variables—Internal Green Environment Orientation (IGEO), External Green Environment Orientation (EGEO), Green Competitive Advantage (GCA), and Green Innovation (GI)—were examined using Pearson correlation coefficients to represent the strength of these relationships. The results are presented in Table 4.17 and discussed below.

The analysis reveals that the Pearson correlation coefficient between SP and IGEO is 0.467, which is significant at the 0.01 level. This indicates a significant positive correlation between SP and IGEO, suggesting that as internal green environment orientation increases, sustainable performance also improves. The positive correlation implies that investments in green practices, support from top management, and a green-oriented firm culture contribute positively to the overall sustainable performance of the firm.

Similarly, the Pearson correlation coefficient between SP and EGEO is 0.454, also significant at the 0.01 level. This significant positive correlation suggests that the external green environment orientation, including perceived policy effectiveness, competitor competition, and customer demand, positively influences sustainable performance. Firms that align their practices with environmental policies, monitor and adopt industry best practices, and respond to customer demand for green products tend to achieve higher sustainable performance.

The correlation between SP and GCA is 0.557, which is significant at the 0.01 level, indicating a strong positive relationship. This demonstrates that green competitive advantage, characterized by differentiation and cost advantages through green initiatives, significantly enhances sustainable performance. Firms that successfully implement green practices to differentiate their products or achieve cost savings tend to perform better sustainably.

Finally, the Pearson correlation coefficient between SP and GI is 0.570, also significant at the 0.01 level, suggesting a significant positive relationship. This indicates that green innovation, encompassing both green product and process innovation, is a key driver of sustainable performance. Firms that continuously introduce eco-friendly products and adopt environmentally efficient processes tend to achieve higher levels of sustainability. In summary, the correlation analysis using Pearson correlation coefficients reveals significant positive relationships between sustainable performance and the four key variables: IGEO, EGEO, GCA, and GI. These findings underscore the importance of both internal and external green orientations, green competitive advantage, and green innovation in enhancing the sustainable performance of firms.

Discriminant validity assesses the extent to which a concept or measurement is truly distinct from other concepts or measurements. It ensures that constructs that are supposed to be unrelated are, in fact, distinct. In this study, the discriminant validity of the constructs was evaluated using the square root of the Average Variance Extracted (AVE) compared to the maximum absolute value of the inter-factor correlations. According to Fornell and Larcker's (1981) criterion, discriminant validity is established if the square root of the AVE for each construct is greater than the correlations between that construct and any other construct. For Internal Green Environment Orientation (IGEO), the square root of the AVE is 0.669, which exceeds the maximum absolute

value of the inter-factor correlations (0.467). This indicates that IGEO has good discriminant validity, meaning it is sufficiently distinct from the other constructs measured. For External Green Environment Orientation (EGEO), the square root of the AVE is 0.653, which is greater than the highest absolute inter-factor correlation (0.454). This demonstrates that EGEO also possesses good discriminant validity, confirming that it is a distinct construct within the model. Green Competitive Advantage (GCA) shows a square root of the AVE of 0.706, which surpasses the highest inter-factor correlation absolute value of 0.557. This result indicates that GCA has good discriminant validity, signifying that it is well-differentiated from the other constructs. Green Innovation (GI) has a square root of the AVE of 0.704, which is higher than the maximum absolute inter-factor correlation value of 0.570. This suggests that GI has good discriminant validity, ensuring that it stands apart from other constructs in the model. Lastly, Sustainable Performance (SP) has a square root of the AVE of 0.634, which is greater than the highest absolute value of the inter-factor correlations (0.570). This confirms that SP has good discriminant validity, indicating it is distinct from other constructs measured.

The Average Variance Extracted (AVE) and Composite Reliability (CR) are essential metrics for assessing the validity and reliability of constructs in a structural equation model. According to Fornell and Larcker (1981), an AVE value between 0.36 and 0.5 is considered acceptable, while a CR value above 0.6 is recommended. The following analysis discusses the AVE and CR values for the constructs measured in this study, ensuring their reliability and validity. For the construct of Internal Green Environment Orientation (IGEO), the AVE value is 0.448, which is above the acceptable threshold of 0.36. This indicates that a reasonable amount of variance in the observed variables is captured by the latent construct. The CR value of 0.879 is well above the recommended 0.6, demonstrating high internal consistency and reliability of the construct. External Green Environment Orientation (EGEO) has an AVE value of 0.426, which is within the acceptable range, suggesting sufficient variance capture. The CR value of 0.869 indicates robust internal consistency, ensuring the reliability of the measurement items associated with this construct. The construct of Green Competitive Advantage (GCA) has an AVE value of 0.498, close to the upper limit of the acceptable range. This signifies that nearly half of the variance in the observed variables is explained by the latent construct. The CR value of 0.854 confirms the high reliability and consistency of the construct. Green Innovation (GI) exhibits an AVE value of 0.495, indicating adequate variance capture by the latent construct. The CR value of 0.853 further validates the internal consistency and reliability of the items measuring green innovation. Lastly, Sustainable Performance (SP) has an AVE value of 0.402, which is above the minimum threshold, suggesting

a satisfactory level of variance explanation by the construct. The CR value of 0.896 indicates excellent reliability and internal consistency, making SP a highly reliable construct.

In summary, all constructs in the model—IGEO, EGEO, GCA, GI, and SP—meet the acceptable thresholds for AVE and CR values based on Fornell and Larcker's (1981) criteria. The AVE values are all above the minimum acceptable limit of 0.36, ensuring that a significant portion of the variance is captured by the latent constructs. Furthermore, the CR values for all constructs are well above the recommended 0.6, indicating high internal consistency and reliability of the measurement items. This demonstrates that the constructs are both valid and reliable, supporting the robustness and integrity of the model used in this study.

Table 4.12 Correlation Analysis and Discriminant Validity Among Variables

	CR	**AVE**	**IGEO**	**EGEO**	**GCA**	**GI**	**SP**
IGEO	0.879	0.448	0.669				
EGEO	0.869	0.426	0.177**	0.653			
GCA	0.854	0.498	0.406**	0.422**	0.706		
	CR	**AVE**	**IGEO**	**EGEO**	**GCA**	**GI**	**SP**
GI	0.853	0.495	0.416**	0.405**	0.484**	0.704	
SP	0.896	0.402	0.467**	0.454**	0.557**	0.570**	0.634

Note: *p<0.05 **p<0.01 The diagonal blue numbers are the square root values of AVE

4.5 The Kaiser-Meyer-Olkin (KMO)

The validity test will evaluate how well the constructs are measured (Hair et al., 2012). According to Chin (1998), the validity test of latent variables needs to be performed to prove that the constructs are measured in what they are supposed to measure and do not measure what they should not measure, the author performed the validity check for all instruments.

The Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity are two statistical tests used to assess the suitability of data for factor analysis.

The KMO value for this analysis is 0.904, which is well above the commonly accepted threshold of 0.6. This high value indicates that the sample is adequate for factor analysis, suggesting that the variables share a common factor structure and are likely to yield reliable and distinct factors.

Bartlett's test of sphericity tests the null hypothesis that the correlation matrix is an identity matrix, which would indicate that variables are unrelated and unsuitable for structure detection. The approximate chi-square value for Bartlett's test is 26,652.451 with 946 degrees of freedom, and the p-value is 0.000. This highly significant result ($p < 0.01$) leads to the rejection of the null hypothesis, indicating that the correlation matrix is not an identity matrix. Therefore, there are significant relationships among the variables, justifying the use of factor analysis.

In summary, the KMO value of 0.904 and the significant result from Bartlett's test of sphericity demonstrate that the data is suitable for factor analysis. The high KMO value indicates excellent sampling adequacy, while the significant Bartlett's test confirms that the variables have enough common variance to be grouped into factors. These results support the validity and reliability of the subsequent factor analysis in this study.

Table 4.13 KMO and Bartlett Test

KMO and Bartlett Test		
KMO Value		0.904
Bartlett's test of sphericity	Approximate chi-square	26652.451
	df	946
	p value	0.000

4.6 Confirmatory Factor Analysis

4.6.1 CFA of Internal Green Environment Orientation

Confirmatory Factor Analysis (CFA) can be used to study convergent validity, discriminant validity, and common method variance (CMV), among other aspects. This analysis involves a three-factor structure with a total of nine measurement items (second-order). The effective sample size for this analysis is 468, which is more than ten times the number of measurement items, indicating an adequate sample size.

The fit indices for the model assessing Internal Green Environment Orientation indicate an overall good model fit. Each statistical value meets the established criteria, suggesting that the model accurately represents the data. The chi-square to degrees of freedom ratio (χ^2/df) is 2.45, which is below the threshold of 3, indicating a good fit as values less than 3 generally suggest an

acceptable model fit relative to the degrees of freedom. The Goodness-of-Fit Index (GFI) value is 0.96, significantly higher than the minimum acceptable value of 0.8, suggesting that a high proportion of variance is accounted for by the model. The Adjusted Goodness-of-Fit Index (AGFI) is 0.93, also above the 0.8 threshold, indicating a good fit while adjusting for the degrees of freedom.

The Comparative Fit Index (CFI) value is 0.97, which exceeds the benchmark of 0.9, showing that the model has a good fit compared to an independent model (one where variables are uncorrelated). The Root Mean Square Error of Approximation (RMSEA) value is 0.07, below the acceptable limit of 0.08, suggesting a close fit of the model in relation to the degrees of freedom. The Normed Fit Index (NFI) value is 0.96, well above the acceptable level of 0.9, indicating that the model has a good fit relative to the null model. Lastly, the Incremental Fit Index (IFI) is 0.97, which is also above the 0.9 criterion, further indicating a good fit of the model.

In conclusion, all fit indices demonstrate that the model for Internal Green Environment Orientation fits the data well. The values of χ^2/df, GFI, AGFI, CFI, RMSEA, NFI, and IFI all meet or exceed the recommended criteria, indicating that the model is robust and reliable in representing the data. This supports the validity of the constructs measured within the Internal Green Environment Orientation.

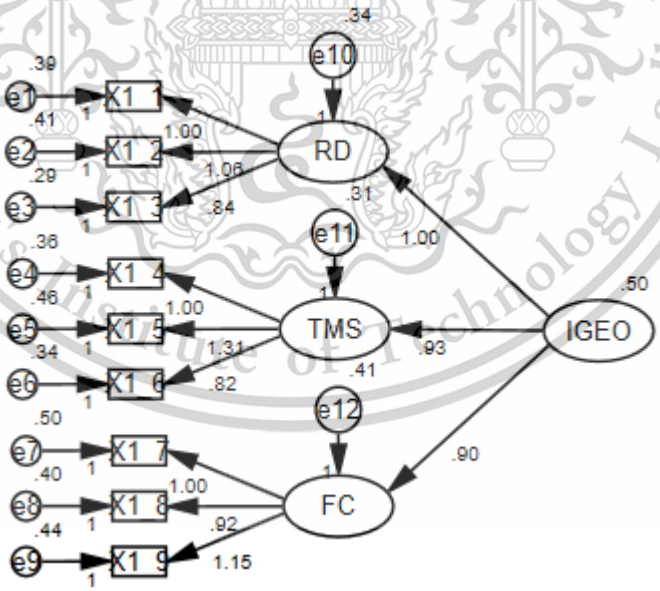

Figure 4.1 CFA of Internal Green Environment Orientation

Table 4.14 Indicators of Internal Green Environment Orientation

Indices	Criteria	Statistics Values
$\chi 2/df$	<3	2.45
GFI	>0.8	0.96
AGFI	>0.8	0.93
CFI	>0.9	0.97
RMSEA	＜0.08	0.07
NFI	>0.9	0.96
IFI	＞0.9	0.97

The table 4.15 presents the Average Variance Extracted (AVE) and Composite Reliability (CR) values for three dimensions of Internal Green Environment Orientation: R&D investment, Top management support, and Firm's culture. The AVE values are 0.68, 0.67, and 0.65 respectively, all exceeding the common threshold of 0.5. This indicates that a substantial amount of variance in the indicators is captured by the respective latent constructs. The CR values for these dimensions are 0.87, 0.86, and 0.85 respectively, all surpassing the recommended threshold of 0.7. This demonstrates a high level of internal consistency and reliability among the items measuring each construct.

Typically, an AVE greater than 0.5 combined with a CR value greater than 0.7 suggests a high degree of convergent validity. In this study, Confirmatory Factor Analysis (CFA) was conducted to assess these properties across three factors and nine analytical items. The results, as shown in the table, indicate that all three factors have AVE values above 0.5 and CR values above 0.7. This implies that the data collected for R&D investment, Top management support, and Firm's culture exhibit excellent convergent validity, affirming that the items reliably measure their respective constructs and that the constructs are well-represented by their indicators.

Table 4.15 AVE and CR Value of Internal Green Environment Orientation

Dimensions	AVE	CR
R&D investment	0.68	0.87
Top management support	0.67	0.86
Firm's culture	0.65	0.85

4.6.2 CFA of External Green Environment Orientation

Table 4.16 presents the fit indices for the model assessing External Green Environment Orientation. The model's goodness-of-fit is evaluated using several key indices, and all values meet or exceed the recommended thresholds, indicating a strong model fit.

The chi-square to degrees of freedom ratio ($\chi 2/df$) is 2.46, which is well below the maximum recommended value of 3, suggesting an acceptable level of model fit relative to the complexity of the model. The Goodness of Fit Index (GFI) is 0.96, and the Adjusted Goodness of Fit Index (AGFI) is 0.93, both significantly higher than the minimum criterion of 0.8, demonstrating that a large proportion of the observed variance and covariance is accounted for by the model.

The Comparative Fit Index (CFI) is 0.97, exceeding the benchmark of 0.9, which indicates that the model fits the data well compared to an independent baseline model. Similarly, the Normed Fit Index (NFI) is 0.95, and the Incremental Fit Index (IFI) is 0.97, both surpassing the threshold of 0.9, further confirming the robustness of the model fit.

Additionally, the Root Mean Square Error of Approximation (RMSEA) is 0.07, which is below the acceptable limit of 0.08, indicating a reasonable error of approximation in the population and further supporting the model's adequacy.

Overall, the fit indices collectively demonstrate that the model for External Green Environment Orientation has excellent fit to the data, suggesting that the proposed factor structure is appropriate and that the measured variables adequately represent the underlying constructs.

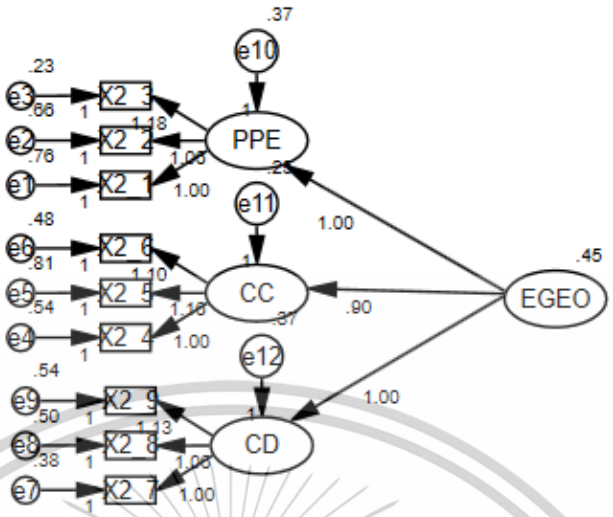

Figure 4.2 CFA of External Green Environment Orientation

Table 4.16 Indicators of External Green Environment Orientation

Indices	**Criteria**	**Statistics Values**
$\chi 2/df$	<3	2.46
GFI	>0.8	0.96
AGFI	>0.8	0.93
CFI	>0.9	0.97
RMSEA	＜0.08	0.07
NFI	>0.9	0.95
IFI	＞0.9	0.97

Table 4.17 presents the Average Variance Extracted (AVE) and Composite Reliability (CR) values for the dimensions of External Green Environment Orientation. The dimensions evaluated include Perceived Policy Effectiveness, Competitor Competition, and Customer Demand. These metrics are crucial for assessing the convergent validity and reliability of the constructs.

The AVE values for all three dimensions exceed the commonly accepted threshold of 0.50, which indicates that more than half of the variance in the observed variables is captured by the underlying construct. Specifically, Perceived Policy Effectiveness has an AVE of 0.64, Competitor Competition has an AVE of 0.55, and Customer Demand has an AVE of 0.66. These values suggest a satisfactory level of convergent validity, meaning that the items associated with each construct are well correlated and accurately represent the latent variables they are intended to measure.

The CR values for the dimensions are also above the recommended minimum of 0.70, demonstrating good internal consistency and reliability of the constructs. The CR values are 0.84 for Perceived Policy Effectiveness, 0.78 for Competitor Competition, and 0.85 for Customer Demand. These high CR values indicate that the items within each dimension consistently reflect the intended construct, and there is a strong degree of reliability in the measurements.

In summary, the AVE and CR values provided in Table 4.17 indicate that the dimensions of External Green Environment Orientation have both good convergent validity and reliability. The constructs of Perceived Policy Effectiveness, Competitor Competition, and Customer Demand are measured accurately and consistently, supporting the robustness of the factor structure in the model.

Table 4.17 AVE and CR Value of External Green Environment Orientation

Dimensions	**AVE**	**CR**
Perceived policy effectiveness	0.64	0.84
Competitor competition	0.55	0.78
Customer demand	0.66	0.85

4.6.3 CFA of Green competitive Advantage

Table 4.18 presents the fit indices for the model of Green Competitive Advantage, which are crucial for assessing the goodness of fit between the model and the observed data. The specific indices include the chi-square divided by degrees of freedom ($\chi 2/df$), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), Normed Fit Index (NFI), and Incremental Fit Index (IFI).

Firstly, the chi-square divided by degrees of freedom ($\chi 2/df$) is 2.84, which is below the recommended threshold of 3, indicating a good fit between the model and the observed data.

Secondly, the Goodness of Fit Index (GFI) is 0.97, which exceeds the acceptable threshold of 0.80, suggesting that the model has an excellent fit with the observed data.

The Adjusted Goodness of Fit Index (AGFI) is 0.94, also above the threshold of 0.80, indicating that even after adjusting for degrees of freedom, the model maintains a good fit.

The Comparative Fit Index (CFI) stands at 0.98, which is well above the recommended threshold of 0.90. This demonstrates that the model has a superior fit compared to a null model with no relationships among variables.

The Root Mean Square Error of Approximation (RMSEA) value is 0.07, which is below the threshold of 0.08, indicating that the model's approximation error is within an acceptable range, further supporting the model's good fit.

The Normed Fit Index (NFI) is 0.97, surpassing the minimum acceptable value of 0.90. This further confirms the model's good fit by showing its superiority over a null model.

Lastly, the Incremental Fit Index (IFI) is 0.98, which exceeds the threshold of 0.90, indicating that the model is an excellent fit and significantly better than the baseline model.

In summary, the fit indices presented in Table 4.18 demonstrate that the model of Green Competitive Advantage has an outstanding fit with the observed data. All indices exceed their respective standards, indicating that the model is highly effective and reliable in capturing the concept of green competitive advantage.

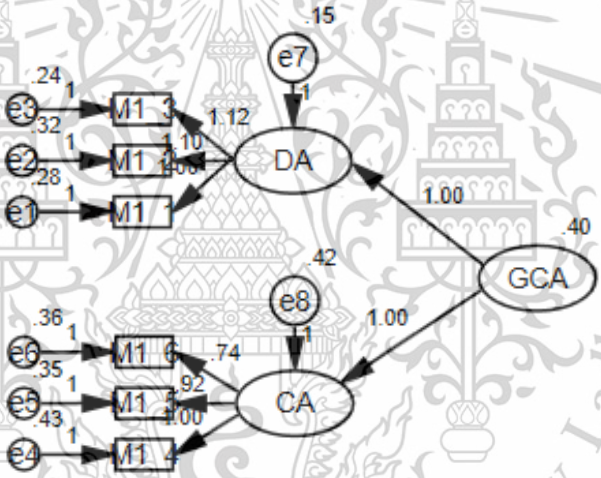

Figure 4.3 CFA of Green competitive Advantage

Table 4.18 Indicators of Green competitive Advantage

Indices	Criteria	Statistics Values
χ2/df	<3	2.84
GFI	>0.8	0.97
AGFI	>0.8	0.94
CFI	>0.9	0.98
RMSEA	＜0.08	0.07

Table 4.18 (Continue)

Indices	Criteria	Statistics Values
NFI	>0.9	0.97
IFI	＞0.9	0.98

Table 4.19 presents the Average Variance Extracted (AVE) and Composite Reliability (CR) values for the dimensions of Green Competitive Advantage, specifically focusing on Differentiation Advantage and Cost Advantage.

The AVE value for Differentiation Advantage is 0.69, which exceeds the commonly accepted threshold of 0.50, indicating that a significant proportion of the variance in the observed variables is explained by this latent construct. This high AVE value suggests that the items measuring Differentiation Advantage are well correlated and effectively capture the essence of this dimension.

Similarly, the AVE value for Cost Advantage is 0.62, also above the threshold of 0.50. This implies that the latent construct of Cost Advantage explains a substantial amount of variance in the observed variables, confirming the construct's reliability and validity.

In terms of Composite Reliability (CR), Differentiation Advantage has a CR value of 0.87, which is well above the recommended threshold of 0.70. This high CR value indicates that the items measuring Differentiation Advantage are consistently reliable and the construct is stable.

The CR value for Cost Advantage is 0.83, which also surpasses the threshold of 0.70, suggesting a high level of internal consistency and reliability among the items measuring this dimension.

In summary, the values presented in Table 4.19 demonstrate that both Differentiation Advantage and Cost Advantage possess high levels of convergent validity and reliability. The AVE values exceeding 0.50 and CR values well above 0.70 indicate that these constructs are both valid and reliable, meaning they effectively capture the dimensions of green competitive advantage and are consistent in their measurement.

Table 4.19 AVE and CR Value of Green competitive Advantage

Dimensions	AVE	CR
Differentiation advantage	0.69	0.87
Cost advantage	0.62	0.83

4.6.4 CFA of Green Innovation

Table 4.20 presents the statistical values for various indices used to evaluate the fit of the Green Innovation model. These indices include the chi-square to degrees of freedom ratio ($\chi 2/df$), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), Normed Fit Index (NFI), and Incremental Fit Index (IFI).

The chi-square to degrees of freedom ratio ($\chi 2/df$) is 2.81, which is less than the acceptable threshold of 3. This indicates a good fit between the model and the observed data.

The Goodness of Fit Index (GFI) is 0.98, which is well above the minimum acceptable value of 0.80. This high GFI value suggests that the model fits the data very well.

The Adjusted Goodness of Fit Index (AGFI) is 0.95, also exceeding the threshold of 0.80. This indicates a high level of model fit, adjusted for the number of parameters in the model.

The Comparative Fit Index (CFI) is 0.99, which is above the recommended threshold of 0.90. This high CFI value indicates an excellent fit of the model to the data, suggesting that the model captures the underlying data structure effectively.

The Root Mean Square Error of Approximation (RMSEA) is 0.06, which is below the acceptable limit of 0.08. This low RMSEA value indicates a good fit, with the model adequately approximating the data.

The Normed Fit Index (NFI) is 0.98, exceeding the threshold of 0.90. This high NFI value suggests that the model fits the data well relative to a null model.

The Incremental Fit Index (IFI) is 0.99, which is above the threshold of 0.90, further confirming that the model has a good fit.

In summary, the values presented in Table 4.20 demonstrate that the Green Innovation model exhibits an excellent fit across multiple indices. All the values meet or exceed the recommended criteria, indicating that the model is robust and well-suited to represent the underlying data structure related to green innovation.

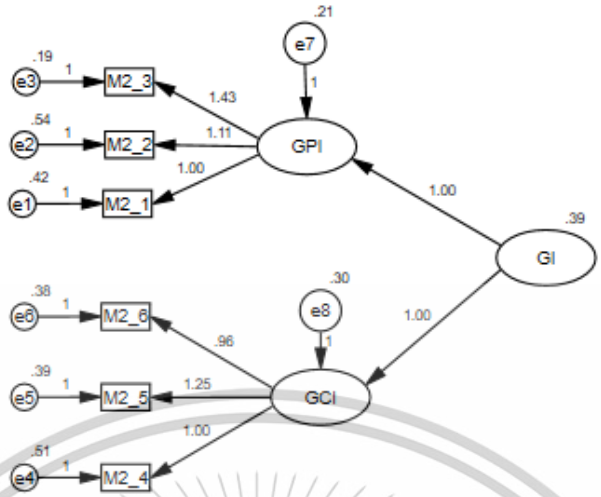

Figure 4.4 CFA of Green Innovation

Table 4.20 Indicators of Green Innovation

Indices	**Criteria**	**Statistics Values**
$\chi 2/df$	<3	2.81
GFI	>0.8	0.98
AGFI	>0.8	0.95
CFI	>0.9	0.99
RMSEA	<0.08	0.06
NFI	<0.9	0.98
IFI	>0.9	0.99

Table 4.21 provides the Average Variance Extracted (AVE) and Composite Reliability (CR) values for two dimensions within the Green Innovation construct: Green product innovation and Green process innovation.

The AVE values for both dimensions are 0.67 and 0.64, respectively. These AVE values indicate that the dimensions capture more variance from their respective indicators than from measurement error, as they exceed the threshold of 0.50, suggesting good convergent validity. Specifically, Green product innovation has an AVE of 0.67, indicating that 67% of the variance in the observed variables is explained by the latent construct of Green product innovation. Similarly, Green process innovation has an AVE of 0.64, indicating that 64% of the variance in its observed variables is attributable to the latent construct of Green process innovation.

The CR values for Green product innovation and Green process innovation are 0.86 and 0.84, respectively. These values exceed the recommended threshold of 0.70, indicating good reliability and internal consistency of the measurement scales. The CR values suggest that the observed variables within each dimension reliably reflect the underlying constructs.

In summary, Table 4.21 demonstrates that both Green product innovation and Green process innovation exhibit satisfactory convergent validity and reliability. The AVE values indicate that these dimensions adequately capture variance from their respective indicators, while the CR values confirm the internal consistency of the measurement scales. These findings support the validity and reliability of the Green Innovation construct as assessed in the study.

Table 4.21 AVE and CR Value of Green Innovation

Dimensions	**AVE**	**CR**
Green product innovation	0.67	0.86
Green process innovation	0.64	0.84

4.6.5 CFA of Sustainable Performance

Table 4.22 presents various fit indices used to assess the goodness of fit of the Sustainable Performance model. These indices include the Comparative Fit Index (CFI), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Root Mean Square Error of Approximation (RMSEA), Normed Fit Index (NFI), and Incremental Fit Index (IFI).

Firstly, the Chi-square to degrees of freedom ratio ($\chi 2/df$) is 2.22, which is below the recommended threshold of 3. This suggests that the model fits the data adequately, considering that lower values indicate better fit, especially in large sample sizes.

Secondly, the GFI and AGFI values are both above 0.8, with GFI at 0.96 and AGFI at 0.94. These indices assess how well the model reproduces the sample covariance matrix, with values closer to 1 indicating better fit. The high values of GFI and AGFI in this table suggest that the Sustainable Performance model fits the data well.

Thirdly, the CFI, NFI, and IFI are all above 0.9, with CFI and IFI at 0.97 and NFI at 0.95. These indices compare the model with a null model (which assumes no relationships among variables) and indicate incremental fit improvements. Higher values indicate better fit, and in this case, the values suggest that the Sustainable Performance model provides a good fit to the data.

Lastly, the RMSEA is 0.05, which is below the threshold of 0.08, indicating a close fit of the model to the data. RMSEA measures the discrepancy between the observed data and the model, with smaller values indicating better fit.

In summary, Table 4.22 demonstrates that the Sustainable Performance model exhibits favorable fit indices across various criteria. The model shows good fit based on χ2/df, GFI, AGFI, CFI, NFI, IFI, and RMSEA values, indicating that it effectively represents the relationships among variables related to Sustainable Performance as assessed in the study. These findings support the validity and adequacy of the model in explaining the constructs under investigation.

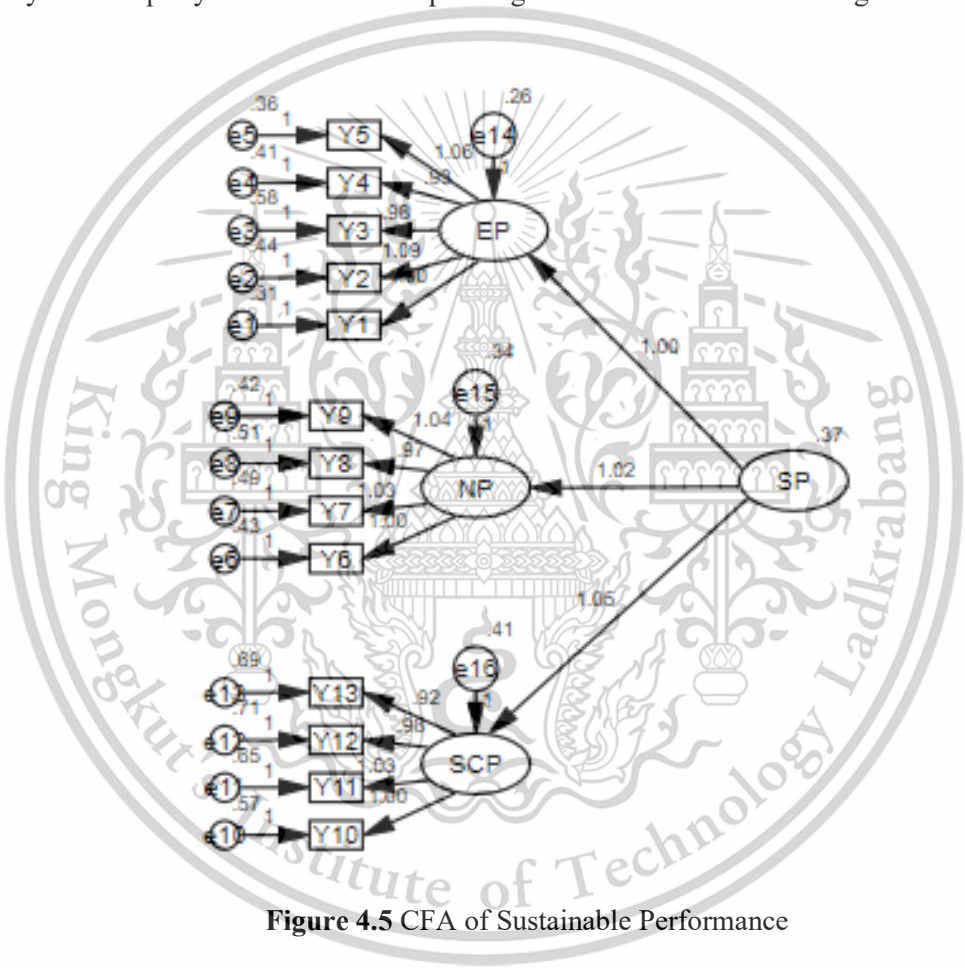

Figure 4.5 CFA of Sustainable Performance

Table 4.22 Indicators of Sustainable Performance

Indices	Criteria	Statistics Values
χ2/df	<3	2.22
GFI	>0.8	0.96
AGFI	>0.8	0.94
CFI	>0.9	0.97

Table 4.22 (Continue)

Indices	Criteria	Statistics Values
RMSEA	＜0.08	0.05
NFI	>0.9	0.95
IFI	＞0.9	0.97

Table 4.23 presents the Average Variance Extracted (AVE) and Composite Reliability (CR) values for the dimensions of Sustainable Performance: Economic performance, Environment performance, and Social performance. These values are crucial indicators used in Confirmatory Factor Analysis (CFA) to assess the reliability and convergent validity of latent constructs.

Firstly, the AVE values represent the amount of variance captured by the latent variables relative to the measurement error. For Economic performance, the AVE is 0.61, for Environment performance it is 0.62, and for Social performance it is 0.55. According to the criteria typically used in structural equation modeling, AVE values above 0.5 indicate that the constructs explain more variance than measurement error, suggesting adequate convergent validity.

Secondly, the CR values measure the internal consistency reliability of the constructs, reflecting how well the items within each construct correlate with each other. The CR values for Economic performance, Environment performance, and Social performance are 0.89, 0.86, and 0.83, respectively. These values are well above the recommended threshold of 0.7, indicating high reliability of the constructs.

In summary, Table 4.23 indicates that the dimensions of Sustainable Performance in the model exhibit strong convergent validity and reliability. The AVE values exceed 0.5 for all dimensions, indicating that they capture substantial variance relative to measurement error. Additionally, the CR values are well above 0.7, suggesting robust internal consistency within each dimension. These findings support the suitability of the Sustainable Performance model for explaining the relationships among Economic performance, Environment performance, and Social performance constructs in the context of the study.

Table 4.23 AVE and CR Value of Sustainable Performance

Dimensions	AVE	CR
Economic performance	0.61	0.89
Environment performance	0.62	0.86

Table 4.23 (Continue)

Dimensions	AVE	CR
Social performance	0.55	0.83

4.7 The Structural Equation Model of Variables

The Structural Equation Modelling (SEM) was applied to evaluate the effects of various variables on the Non-profit Performance and Profit Performance of small and medium-sized manufacturing enterprises in China. The variables applied were both latent variables and observed variables. The table below shows the symbols used to represent the variables and their relationship.

Table 4.24 Overview of Terms

Symbol	Meaning
	Latent Variable
	Observed Variable
	Causal Relationship
	Non-causal relationship

Table 4.25 Model framework developed for Performance

Variables Symbol		
Latent Variable	**Observed Variable**	**Variable names**
IGEO	RD	R&D investment
	TMS	Top Management Support
	FC	Firm's Culture
EGEO	PPE	Perceived Policy Effectiveness
	CC	Competitor Competition
	CD	Customer Demand
GCA	DA	Differentiation Advantage
	CA	Cost Advantage

Table 4.25 (Continue)

Variables Symbol Variables Symbol	Observed Variable	Variables Symbol
GI	GPI	Green Product Innovation
	GCI	Green Process Innovation
SP	EP	Economic Performance
	NP	Environmental Performance
	SCP	Social Performance

Based on the review of the literature and with reference to the developed hypothesis of the study, the following model frame for SEM was developed.

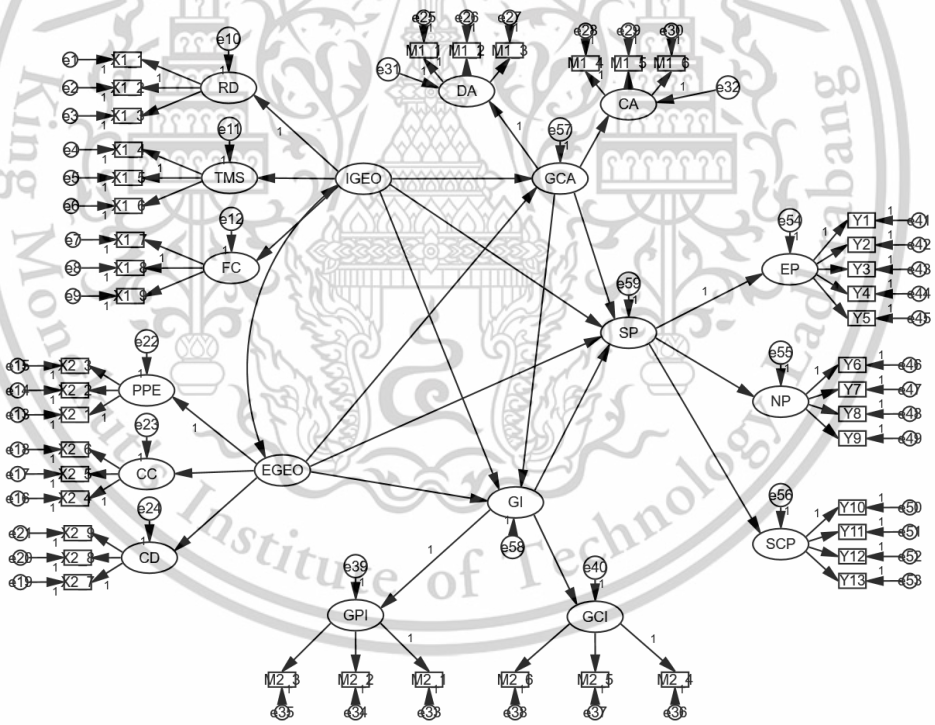

Figure 4.6.Measurement Model of Factors

After the analysis of the SEM model, the following SEM model output was obtained.

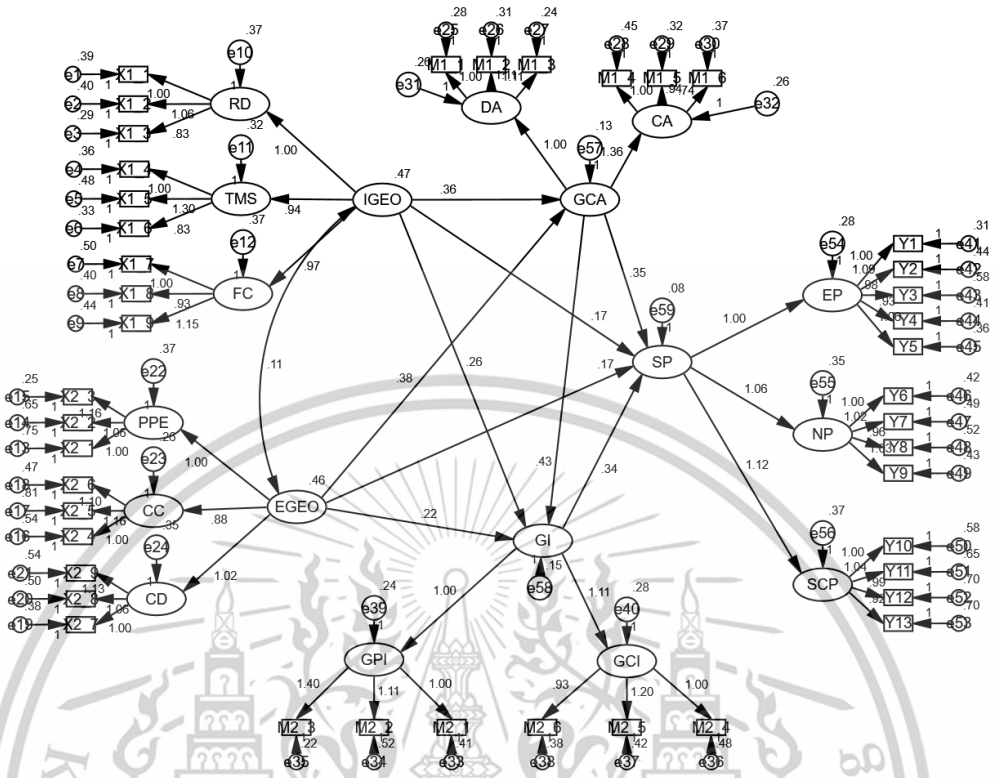

Figure 4.7 Analysis Results Measurement Model Factors

Table 4.26 Fit Indices for SEM

Indices	**Criteria**	**Statistics Values**
$\chi 2/df$	<3	1.01
GFI	>0.8	0.98
AGFI	>0.8	0.97
CFI	>0.9	0.99
RMSEA	＜0.08	0.01
RMR	＜0.08	0.02
IFI	＞0.9	0.99

4.8 Test of Hypothesis

4.8.1 Direct Effects

The following analysis examines the relationships between Competitive Strategy (CS) and several key factors that are hypothesized to impact Enterprise Performance (EP). The study uses path analysis to determine the strength and significance of these relationships, with standardized path coefficients indicating the degree of impact and significance levels providing statistical validation. The R-square values are used to understand how much of the variance in Enterprise Performance is explained by each factor.

Table 4.27 The Result of Direct Effects

X	→ Y	Beta	SE	z (CR Value)	p	Hypothesis testing results
IGEO	→ GCA	0.358	0.055	6.445	0.000	H1 support
IGEO	→ GI	0.261	0.076	3.594	0.000	H2 support
EGEO	→ GCA	0.385	0.059	6.499	0.000	H3 support
EGEO	→ GI	0.222	0.073	2.941	0.003	H4 support
GCA	→ GI	0.433	0.128	3.393	0.000	H5 support
GCA	→ SP	0.345	0.119	2.909	0.004	H6 support
GI	→ SP	0.345	0.102	3.380	0.000	H7 support
IGEO	→ SP	0.174	0.065	2.672	0.008	H8 support
EGEO	→ SP	0.170	0.067	3.380	0.011	H9 support

Note: → indicates path influence relationship

Table 4.27 presents the results of the direct effects analysis, illustrating the relationships between various latent variables in the model and their impact on each other. The table provides estimates, standard errors (SE), z-values (CR values), p-values, and the results of hypothesis testing.

Hypothesis 1 is supported, as Internal Green Environment Orientation (IGEO) has a significant positive effect on Green Competitive Advantage (GCA) ($\beta = 0.358$, $p < 0.001$). This indicates that firms with strong internal green environment orientation are more likely to achieve a green competitive advantage.

Hypothesis 2 is supported, with Internal Green Environment Orientation (IGEO) positively influencing Green Innovation (GI) ($\beta = 0.261$, $p < 0.001$). This suggests that firms emphasizing internal green environment orientation are more likely to develop innovative green products and processes.

Hypothesis 3 is supported, as External Green Environment Orientation (EGEO) has a significant positive effect on Green Competitive Advantage (GCA) ($\beta = 0.385$, $p < 0.001$). This finding implies that external pressures, such as environmental regulations and market expectations, drive firms to develop a green competitive advantage.

Hypothesis 4 is supported, as External Green Environment Orientation (EGEO) positively affects Green Innovation (GI) ($\beta = 0.222$, $p = 0.003$). This suggests that firms responding to external green environment orientation are more likely to engage in green innovation.

Hypothesis 5 is supported, with Green Competitive Advantage (GCA) significantly influencing Green Innovation (GI) ($\beta = 0.433$, $p < 0.001$). This indicates that firms with a green competitive advantage are more likely to invest in and implement green innovations.

Hypothesis 6 is supported, as Green Competitive Advantage (GCA) has a positive effect on Sustainable Performance (SP) ($\beta = 0.345$, $p = 0.004$). This suggests that firms leveraging their green competitive advantage tend to improve overall sustainable performance.

Hypothesis 7 is supported, with Green Innovation (GI) positively affecting Sustainable Performance (SP) ($\beta = 0.345$, $p < 0.001$). This demonstrates that green innovation contributes directly to better economic performance, environmental performance, and social performance.

Hypothesis 8 is supported, as Internal Green Environment Orientation (IGEO) positively influences Sustainable Performance (SP) ($\beta = 0.174$, $p = 0.008$). This indicates that firms with strong internal green environment orientation achieve better sustainable performance.

Hypothesis 9 is supported, with External Green Environment Orientation (EGEO) positively affecting Sustainable Performance (SP) ($\beta = 0.170$, $p = 0.011$). This suggests that external green environment orientation also plays a role in improving firms' sustainable performance.

In summary, all the hypothesized direct effects in the model are supported by the data, with significant p-values indicating strong relationships between the variables. This confirms the robustness of the model in explaining the dynamics of green environment orientation, green competitive advantage, green innovation, and sustainable performance.

4.8.2 Mediating Effect

The bootstrap function in AMOS was utilized to estimate the mediating effects. Specifically, the “Number of bootstrap samples” was set to 2,000, and “Percentile confidence intervals” were

set at 95%, with maximum likelihood estimation as the method of analysis. The results were considered significant if the bootstrap confidence intervals did not contain zero, thereby rejecting the null hypothesis that the effects did not exist and confirming the presence of the hypothesized effects. The mediating effects report, summarized in Table 4.28, presents the calculated total, direct, and indirect effects between the latent variables.

Table 4.28 Mediating Effect Test

Hypothesis		**Point Estimate**	**Bootstrapping**		**P-value**	**Result**
			Bias-Corrected 95% CI			
			Lower	Upper		
H10	IGEO→GCA→SP	0.124	0.032	0.238	0.014	Supported
H11	EGEO→GCA→SP	0.133	0.030	0.264	0.016	Supported
H12	IGEO→GI→SP	0.090	0.027	0.192	0.002	Supported
H13	EGEO→GI→SP	0.077	0.016	0.170	0.008	Supported

Hypothesis 10 is supported, as Green Competitive Advantage (GCA) significantly mediates the relationship between Internal Green Environment Orientation (IGEO) and Sustainable Performance (SP), with a point estimate of 0.124 and a 95% confidence interval [0.032, 0.238]. Since the confidence interval does not include zero (p = 0.014), this confirms that Green Competitive Advantage serves as a mediating factor in this relationship.

Hypothesis 11 is confirmed, as Green Competitive Advantage (GCA) mediates the effect of External Green Environment Orientation (EGEO) on Sustainable Performance (SP), with a point estimate of 0.133 and a 95% confidence interval [0.030, 0.264]. The confidence interval excludes zero (p = 0.016), indicating that External Green Environment Orientation enhances Sustainable Performance through Green Competitive Advantage.

Hypothesis 12 is supported, as Green Innovation (GI) plays a mediating role between Internal Green Environment Orientation (IGEO) and Sustainable Performance (SP), with a point estimate of 0.090 and a 95% confidence interval [0.027, 0.192]. Since the confidence interval does not contain zero (p = 0.002), this result confirms that Internal Green Environment Orientation positively influences Sustainable Performance through Green Innovation.

Hypothesis 13 is validated, as Green Innovation (GI) mediates the relationship between External Green Environment Orientation (EGEO) and Sustainable Performance (SP), with a point estimate of 0.077 and a 95% confidence interval [0.016, 0.170]. The confidence interval excludes

zero (p = 0.008), indicating that External Green Environment Orientation contributes to Sustainable Performance through Green Innovation.

In summary, the mediation analysis confirms that both Green Competitive Advantage and Green Innovation serve as significant mediators between Internal Green Environment Orientation, External Green Environment Orientation, and Sustainable Performance. The results indicate that organizations with a strong internal and external green environment orientation can enhance their Sustainable Performance not only directly but also indirectly through improved Green Competitive Advantage and Green Innovation.

Table 4.29 Summary of Proposed Hypothesis Testing

Hypothesis	Result
H1: Internal Green Environment Orientation has a positive effect on the Green Competitive Advantage.	Support
H2: Internal Green Environment Orientation has a positive effect on Green Innovation.	Support
H3: External Green Environment Orientation has a positive effect on Green Competitive Advantage.	Support
H4: External Green Environment Orientation has a positive effect on the Green Innovation.	Support
H5: Green Competitive Advantage has a positive effect on the Green Innovation.	Support
H6: Green Competitive Advantage has a positive effect on the Sustainable Performance.	Support
H7: Green Innovation has a positive effect on the Sustainable Performance.	Support
H8: Internal Green Environment Orientation has a positive effect on the Sustainable Performance.	Support
H9: External Green Environment Orientation has a positive effect on the Sustainable Performance.	Support
H10: Green Competitive Advantage play a mediating role between Internal Green Environment Orientation and Sustainable Performance.	Support
H11: Green Competitive Advantage play a mediating role between External Green Environment Orientation and Sustainable Performance.	Support

Table 4.29 (Continue)

Hypothesis	Result
H12: Green Innovation play a mediating role between Internal Green Environment Orientation and Sustainable Performance.	Support
H13: Green Innovation play a mediating role between External Green Environment Orientation and Sustainable Performance.	Support

CHAPTER 5
CONCLUSION AND DISCUSSION

5.1 Introduction

This chapter presents a comprehensive analysis of the empirical findings based on the testing of the 13 hypotheses proposed in earlier chapters. The primary objective of this study was to investigate how green environment orientation influences sustainable performance in manufacturing firms, with particular attention to the mediating roles of green competitive advantage and green innovation. In pursuit of this objective, this study developed a conceptual framework grounded in the Resource-Based View (RBV) theory, incorporating four core constructs: green environment orientation, green competitive advantage, green innovation, and sustainable performance.

To test the proposed hypotheses, a quantitative research methodology was employed. Data were collected through structured questionnaires distributed to senior managers and individuals responsible for environmental management and strategic decision-making within Chinese manufacturing firms. A total of 468 valid responses were obtained using a combination of judgment sampling and snowball sampling techniques. The data were then analyzed using Structural Equation Modeling (SEM) to assess the relationships among the constructs and examine the mediating effects.

The results provide strong support for the hypothesized relationships. Specifically, green environment orientation was found to have a significant positive effect on both green competitive advantage and green innovation. In turn, both green competitive advantage and green innovation demonstrated significant positive effects on sustainable performance. Furthermore, the mediating analyses confirmed that green competitive advantage and green innovation partially mediate the relationship between green environment orientation and sustainable performance. These findings validate the proposed research model and highlight the strategic importance of integrating environmental orientation into business operations.

Overall, the empirical results underscore the pivotal roles of green competitive advantage and green innovation in translating environmental commitment into tangible sustainability outcomes. These findings carry important implications for theory and practice, which will be further explored in the following sections. The chapter also offers practical recommendations for manufacturing

firms seeking to enhance their sustainability performance through green strategies and innovation initiatives, while suggesting future research directions that build upon the current study.

5.2 Discussion of the Findings

The main research findings, based on the hypothesis testing summarized in chapter 4, reveal several significant relationships among Internal Green Environment Orientation (IGEO),External Green Environment Orientation(EGEO), Green competitive Advantage(GCA), Green Innovation(GI), and Sustainable Performance(SP).

5.2.1 Factors Influencing the IGEO and EGEO to Sustainable Performance

The empirical analysis of this study reveals significant and positive relationships between both Internal Green Environment Orientation (IGEO) and External Green Environment Orientation (EGEO) with Sustainable Performance (SP). Specifically, the results show that IGEO has a positive influence on SP with a standardized beta coefficient ($\beta = 0.174$), while EGEO also positively affects SP with a beta coefficient ($\beta = 0.170$).

The observed positive effect of IGEO on sustainable performance underscores the importance of internal organizational capabilities, such as green research and development initiatives, top management commitment, and a corporate culture that prioritizes environmental sustainability. These findings are consistent with the Resource-Based View (RBV) theory, which posits that unique and valuable internal resources—such as green capabilities and culture—serve as a basis for achieving competitive and sustainable advantage (Nayak et al., 2023). This study's findings reinforce prior research by (Menguc & Ozanne, 2005), who argue that internal environmental orientation significantly influences firms' sustainable practices by fostering long-term environmental commitment and strategic alignment. Therefore, organizations that embed green principles into their internal systems and culture are more likely to experience enhanced economic, environmental, and social outcomes.

Likewise, the positive relationship between EGEO and SP supports the notion that external drivers—such as government regulations, stakeholder expectations, customer pressure, and industry competition—play an equally pivotal role in shaping sustainable business behavior. This aligns with stakeholder theory (Valentinov, 2023), which emphasizes that firms must respond to the expectations of external stakeholders to ensure legitimacy and long-term survival. The findings of this study are also in agreement with the work of Yao et al. (2009), who suggest that perceived

environmental pressures from the external environment can encourage firms to implement proactive environmental strategies that improve sustainability performance. The beta coefficient for EGEO (β = 0.170) suggests that while internal factors are slightly more influential, external orientations are nearly as critical in driving sustainability outcomes.

Taken together, these findings confirm the dual importance of both internally and externally oriented green strategies. Firms that cultivate strong internal capabilities for environmental management, while simultaneously responding to external sustainability pressures, are better positioned to achieve superior sustainable performance. This holistic approach is consistent with the Triple Bottom Line (TBL) perspective (Corral Granados & Granados Gámez, 2010), which advocates balancing internal operations with external social and environmental responsibilities to ensure long-term sustainability. Therefore, manufacturing firms should integrate both internal and external dimensions of environmental orientation to optimize their sustainable development outcomes.

5.2.2 Factors Influencing the IGEO and EGEO to Green Competitive Advantage

The empirical analysis of this study highlights the differential impacts of Internal Green Environment Orientation (IGEO) and External Green Environment Orientation (EGEO) on Green Competitive Advantage (GCA). The results show that IGEO has a moderately positive influence on GCA, with a standardized beta coefficient (β = 0.358), while EGEO exhibits a slightly stronger positive impact with a beta coefficient (β = 0.385).

The moderate relationship between IGEO and GCA suggests that internal sustainability efforts—such as green R&D investment, managerial commitment, and fostering an environmentally conscious organizational culture—form a necessary foundation for green competitiveness. However, this relationship may not always directly translate into competitive advantage unless such internal capabilities are strategically aligned with market-oriented actions. This interpretation aligns with the Resource-Based View (RBV) theory, which argues that internal resources must be valuable, rare, and difficult to imitate in order to yield a sustained competitive advantage (Menguc & Ozanne, 2005). While green capabilities are increasingly considered strategic assets, their competitive impact may be limited if not properly deployed in response to external market conditions. This view is consistent with the findings of Chen (2008), who emphasized that internal green innovation alone is insufficient to build competitive advantage without external engagement and market responsiveness.

In contrast, the stronger influence of EGEO on GCA underscores the pivotal role of external environmental pressures and stakeholder expectations in shaping competitive advantage. External drivers such as regulatory frameworks, customer environmental consciousness, and peer competition not only compel firms to adopt green practices but also create opportunities for differentiation in the marketplace. Moreover, this result is echoed in the study by Dangelico and Pontrandolfo (2015), who demonstrated that firms responsive to external environmental regulations and consumer pressures tend to perform better in green product innovation and brand differentiation, thereby achieving a more pronounced green competitive edge.

Furthermore, the results resonate with Environmental Externality Theory (Pang & Xie, 2024), suggesting that a firm's ability to sense and respond to external environmental changes is crucial for transforming internal resources into a sustainable advantage. The relatively higher beta value for EGEO ($\beta = 0.385$) reinforces the notion that adaptability and responsiveness to external stimuli are key enablers of green competitive advantage.

In summary, while IGEO provides the foundational infrastructure for environmental performance, EGEO appears to be the driving force that translates these internal efforts into tangible competitive benefits. Firms aiming to strengthen their green competitive advantage should not only build robust internal environmental capacities but also actively monitor and respond to external environmental trends and stakeholder expectations. A strategic integration of both internal and external orientations is therefore essential for achieving and sustaining a competitive position in the increasingly green-conscious marketplace.

5.2.3 Factors Influencing the IGEO and EGEO to Green Innovation

The analysis of the relationships between Internal Green Environment Orientation (IGEO), External Green Environment Orientation (EGEO), and Green Innovation (GI) provides significant insights into how internal and external environmental orientations drive innovation within firms. The findings indicate that both IGEO and EGEO have positive impacts on Green Innovation, with IGEO showing a slightly stronger influence ($\beta=0.261$) compared to EGEO ($\beta=0.222$).

The positive relationship between IGEO and GI suggests that internal efforts towards sustainability are crucial for fostering innovation within the firm. This result highlights the importance of internal factors such as R&D investment, top management support, and a strong sustainable firm culture in driving green innovation. When a firm prioritizes internal green practices and commits resources towards sustainability, it creates an environment conducive to innovation. These internal initiatives provide the necessary foundation, resources, and organizational support needed for developing new green products and processes. The relatively high beta coefficient

(β=0.261) reflects the significant role of internal green practices in cultivating an innovative mindset and capability within the firm.

Similarly, the positive impact of EGEO on GI underscores the importance of external factors in driving green innovation. External elements such as perceived policy effectiveness, competitive pressures, and customer demand for environmentally friendly products and services encourage firms to innovate. The beta coefficient (β=0.222) for EGEO, although slightly lower than IGEO, still indicates a strong influence. Firms that are responsive to external environmental factors are more likely to engage in innovative activities to meet regulatory requirements, gain competitive advantage, and satisfy evolving customer preferences. These external pressures and opportunities act as catalysts for firms to pursue green innovation, ensuring they remain competitive and compliant in the marketplace.

The findings suggest that a firm's green innovation capabilities are significantly influenced by both internal and external green orientations. While internal green practices provide the necessary resources and organizational support for innovation, external factors create the pressures and opportunities that drive the need for innovative solutions. Therefore, firms aiming to enhance their green innovation should adopt a dual approach that strengthens internal green practices while staying responsive to external environmental dynamics. This balanced strategy will enable firms to effectively develop and implement innovative green solutions, ensuring sustainability and competitiveness in the market.

5.2.4 Factors Influencing the GCA and GI to Sustainable Performance

The analysis of the relationships between Internal Green Environment Orientation (IGEO), External Green Environment Orientation (EGEO), and Green Innovation (GI) provides valuable insights into how different organizational orientations foster sustainability-driven innovation. The empirical findings indicate that both IGEO and EGEO positively impact Green Innovation, with IGEO showing a slightly stronger influence (β = 0.261) than EGEO (β = 0.222).

The positive influence of IGEO on GI suggests that internal sustainability efforts play a critical role in stimulating innovation within firms. Elements such as R&D investment, strong top management commitment, and a culture supportive of environmental initiatives foster an internal atmosphere conducive to innovation. This observation is consistent with the Resource-Based View (RBV) theory (Mondal et al., 2024), which posits that firm-specific resources and capabilities—such as a sustainability-oriented culture and knowledge base—can lead to competitive advantage through innovation. Empirical evidence supports this relationship, for example, found that firms

with internal green competencies, including environmental R&D and knowledge sharing, are more capable of generating green innovations.

In addition, the significant, though slightly weaker, influence of EGEO on GI underscores the importance of external environmental stimuli in driving green innovation. Firms that are attentive to external forces such as environmental regulations, market trends, and customer demand for sustainable products are more likely to engage in green innovation activities to comply with expectations and remain competitive. These findings highlight that green innovation is not driven by internal or external orientation alone, but rather by the interaction of both. While internal orientation builds the capabilities and resources necessary for innovation, external orientation provides the motivation and direction. Therefore, firms aiming to strengthen their green innovation outcomes should adopt a dual focus: cultivating strong internal environmental practices while remaining alert and responsive to external environmental demands.

5.2.5 The mediating effect of Green Competitive Advantage

The analysis of the mediating role of Green Competitive Advantage (GCA) in the relationship between Internal Green Environment Orientation (IGEO) and Sustainable Performance (SP), as well as between External Green Environment Orientation (EGEO) and SP, provides valuable theoretical and empirical insights. The findings demonstrate that GCA significantly mediates both relationships, with a mediating effect of $\beta = 0.124$ from IGEO to SP and $\beta = 0.133$ from EGEO to SP.

The mediating effect of GCA in the IGEO–SP relationship ($\beta = 0.124$) suggests that a firm's internal commitment to environmental sustainability—through dimensions such as top management support, R&D investment, and a culture of ecological responsibility—enhances its green competitive edge, which in turn contributes to superior sustainable performance. This supports earlier studies by Skordoulis et al. (2022), who found that internal green strategic orientations influence firm competitiveness by embedding sustainability into operational capabilities and innovation capacity. However, the present findings go a step further by showing that internal green efforts do not translate directly into sustainable performance unless channeled through a clear competitive advantage mechanism.

Similarly, the mediating effect of GCA in the EGEO–SP relationship ($\beta = 0.133$) highlights the significant role of external environmental drivers—such as regulatory expectations, industry competition, and customer environmental preferences—in shaping firms' sustainability outcomes. These findings are consistent with the conclusions of Lin and Chen (2016), who argued that external green pressures often serve as triggers for organizational change, compelling firms to adopt

green practices that yield both compliance and market-based competitive returns. Furthermore, the results echo the arguments of Porter and van der Linde (1995), who posited that well-designed environmental standards can enhance competitiveness by fostering innovation and efficiency—ultimately reinforcing the indirect path from external pressures to performance via competitive advantage.

The comparable magnitude of the mediating effects—β = 0.124 for IGEO and β = 0.133 for EGEO—suggests a balanced impact of both internal and external green orientations in realizing sustainability goals. This finding nuances the simplistic assumption that either internal commitment or external responsiveness alone drives performance, instead emphasizing the importance of an integrated strategy. Firms must not only develop internal green capacities but also remain vigilant and adaptive to external environmental dynamics to sustain their competitive edge and meet triple bottom-line performance objectives.

In contrast with earlier research that often considered internal and external orientations in isolation (Ardito et al., 2021), this study integrates both perspectives within a mediating framework, showing how GCA functions as a strategic conduit linking green orientations to sustainable outcomes. The results reinforce the notion that sustainability-oriented firms derive real performance benefits not just from green practices per se, but from the strategic advantage they can build upon them.

In conclusion, the mediating role of Green Competitive Advantage reinforces its strategic importance in converting green environmental orientations—both internal and external—into tangible performance outcomes. To maximize sustainable performance, firms must adopt a dual-focused strategy that enhances internal capabilities while leveraging external environmental drivers. By doing so, organizations can move beyond compliance and reputation-building, using GCA as a springboard for long-term competitiveness and sustainable success.

5.2.6 The mediating effect of Green Innovation

The investigation into the mediating role of Green Innovation (GI) in the relationships between Internal Green Environment Orientation (IGEO) and Sustainable Performance (SP), as well as between External Green Environment Orientation (EGEO) and SP, provides compelling insights into how green-oriented strategies translate into tangible sustainability outcomes. The results reveal that GI significantly mediates both relationships, with a mediating effect of β = 0.090 from IGEO to SP and β = 0.077 from EGEO to SP.

In the relationship between IGEO and SP, the mediating effect of GI (β = 0.090) underscores that internal environmental initiatives—such as top management commitment, investment in green

R&D, and cultivating a sustainability-driven corporate culture—can only fully realize their potential when they lead to innovation. These innovations often manifest in the form of eco-friendly products, cleaner production processes, or circular economy practices. This finding aligns with Lin and Chen (2017), who emphasized that internal environmental commitment provides the necessary resources and motivation for firms to develop green innovations that serve as a source of differentiation and enhanced performance. Moreover, this mediating mechanism also supports the Resource-Based View (RBV), which argues that unique, firm-specific capabilities such as innovation, when built upon green internal resources, are critical for gaining sustainable competitive advantage and performance.

Likewise, the mediating effect of GI in the EGEO–SP relationship ($\beta = 0.077$) highlights the strategic role of external pressures and incentives in catalyzing innovation. External Green Environment Orientation includes factors such as regulatory frameworks, industry competition, and green consumer demand, all of which exert pressure on firms to innovate in environmentally responsible ways. This corresponds with institutional theory, which suggests that firms respond to normative and coercive pressures by adopting new practices to gain legitimacy. The present findings extend this logic by illustrating that the most effective response to external green demands occurs when firms translate these pressures into innovation, thereby achieving improved environmental, economic, and even social performance. These findings are consistent with the work of Xie et al. (2019), who found that regulatory and market-based environmental pressures are positively related to green innovation, which in turn boosts sustainable outcomes.

The relatively comparable mediating effects of GI ($\beta = 0.090$ for IGEO and $\beta = 0.077$ for EGEO) suggest that both internal and external green orientations play nearly equal roles in fostering innovation. This reflects a balanced view that effective green innovation arises not from internal capability alone, nor solely from external stimuli, but from the dynamic interplay between the two. As noted by Chang (2011), successful green innovation typically requires firms to align internal processes with external market and regulatory expectations.

In conclusion, this study reinforces the central role of Green Innovation as a mediating mechanism linking both internal and external environmental orientations to Sustainable Performance. Firms should not only invest in internal green capabilities but also remain agile in responding to external green drivers to maximize their innovation output. By fostering a culture of environmental innovation, firms can achieve superior performance across economic, environmental, and social dimensions, thereby advancing broader sustainability objectives.

5.3 Conclusion

This study provides a comprehensive examination of the relationships among Internal Green Environment Orientation (IGEO), External Green Environment Orientation (EGEO), Green Competitive Advantage (GCA), Green Innovation (GI), and Sustainable Performance (SP). The empirical findings offer significant insights into the mechanisms through which green strategic orientations influence corporate sustainability outcomes.

The results indicate that both IGEO and EGEO exert direct positive effects on SP, with IGEO (β=0.174, p=0.008) and EGEO (β=0.170, p=0.011) demonstrating statistically significant contributions. These findings underscore the dual importance of internal environmental initiatives and external ecological pressures in fostering sustainability. Internally, firms that integrate green management principles into their operational framework experience enhanced sustainability outcomes. Externally, market forces, regulatory policies, and stakeholder expectations serve as catalysts for achieving superior sustainable performance.

Furthermore, both IGEO and EGEO significantly enhance GCA, with EGEO (β=0.385, p=0.000) exerting a stronger impact than IGEO (β=0.358, p=0.000). This suggests that external market and policy pressures are more influential in shaping firms' competitive advantages through green practices than internal organizational commitments alone. Firms that proactively respond to external green imperatives by differentiating their products and optimizing eco-friendly operational processes gain a substantial competitive edge.

Similarly, IGEO and EGEO positively affect GI, with IGEO (β=0.261, p=0.000) having a slightly greater influence than EGEO (β=0.222, p=0.003). This indicates that while external pressures contribute to green innovation, internal factors—such as R&D investments, leadership support, and an organizational culture of sustainability—are more instrumental in driving green technological advancements. This highlights the necessity for firms to cultivate internal capabilities that foster innovation in green products, processes, and business models.

Additionally, both GCA (β=0.345, p=0.004) and GI (β=0.345, p=0.000) have significant positive impacts on SP, demonstrating that sustainable performance is contingent on both maintaining a competitive advantage through green differentiation and continuously innovating in environmentally friendly practices. These results suggest that an integrated strategy, balancing competitive positioning with innovation-driven sustainability initiatives, is essential for long-term corporate success.

The mediation analysis further substantiates the role of GCA and GI as mechanisms linking green orientations to SP. The mediating effect of GCA between IGEO and SP (β=0.124, p=0.014)

and between EGEO and SP (β=0.133, p=0.016) confirms that firms leveraging green competitive advantages can amplify the impact of green orientations on sustainable performance. Similarly, GI mediates the relationship between IGEO and SP (β=0.090, p=0.002) and between EGEO and SP (β=0.077, p=0.008), further demonstrating that innovation serves as a critical pathway for translating green orientations into sustainability outcomes.

In conclusion, this study underscores the strategic significance of green orientations in enhancing sustainable performance through competitive advantage and innovation. Firms should adopt a dual-focused approach by integrating internal green practices while actively responding to external environmental demands to optimize sustainability outcomes. By fostering a culture of continuous green innovation and capitalizing on green competitive advantages, firms can achieve superior sustainability performance, thereby contributing to broader environmental and social objectives. These findings provide valuable guidance for corporate decision-makers and policymakers seeking to formulate effective sustainability strategies in a competitive business landscape.

5.4 Implications

5.4.1 Implications for Internal Management Practices

The findings of this study underscore the importance of Internal Green Environment Orientation (IGEO) in promoting sustainable performance. To effectively integrate green practices within an organization, companies must focus on several key areas.

First, enhancing R&D investment is crucial for fostering innovation and developing environmentally friendly technologies. Companies should allocate sufficient resources to R&D to explore and implement green solutions. By establishing dedicated R&D departments focused on green technologies, encouraging collaboration with academic institutions and research organizations, and implementing incentive programs to motivate employees to contribute to green projects, companies can improve their environmental footprint and enhance their competitiveness in the market.

Second, strengthening top management support is essential for driving the green agenda within an organization. Top management's commitment and support are vital for the successful implementation of green initiatives. Companies can achieve this by incorporating sustainability goals into the overall business strategy and objectives, providing training and awareness programs

for top executives, and setting up a sustainability committee comprising senior leaders to oversee and guide green initiatives.

Third, fostering a green organizational culture is fundamental to achieving long-term sustainable performance. Creating a culture that values and prioritizes sustainability involves communicating the importance of sustainability to all employees and stakeholders, recognizing and rewarding employees who contribute to the company's green goals, and promoting environmentally friendly practices in daily operations, such as reducing waste, conserving energy, and encouraging recycling.

Fourth, integrating green practices into daily operations ensures that green initiatives are effective and sustainable. Companies can adopt green procurement practices that prioritize environmentally friendly products and services, implement energy-efficient technologies and processes to reduce the company's carbon footprint, and regularly monitor and report on sustainability metrics to track progress and identify areas for improvement.

Finally, encouraging employee engagement is critical for the successful implementation of green practices. Involving employees in the planning and execution of green initiatives fosters a sense of ownership and commitment. Providing training and resources to help employees understand and implement green practices in their roles, and creating a platform for employees to share their ideas and suggestions for improving the company's sustainability efforts, can significantly enhance employee engagement.

By focusing on these areas, companies can enhance their internal management practices to better align with green environment orientation. This alignment will lead to improved sustainable performance, benefiting not only the company but also the broader community and environment.

5.4.2 Implications for External Collaboration and Policy Making

The study highlights the significant impact of External Green Environment Orientation (EGEO) on a company's competitive advantage and innovation. To leverage this impact, it is essential for companies to engage in external collaborations and for policymakers to create a supportive environment through effective policies and incentives.

First, fostering collaborations with external stakeholders, such as suppliers, customers, and competitors, is crucial for driving green innovation. Companies can establish partnerships with suppliers to ensure the availability of sustainable raw materials and products, engage with customers to understand their preferences for green products, and collaborate with competitors in pre-competitive areas to share knowledge and resources. These collaborations can help companies stay ahead of the curve in green innovation and enhance their competitive advantage.

Second, participating in industry associations and sustainability networks provides companies with valuable insights into emerging green technologies and practices. These platforms facilitate knowledge sharing, offer opportunities for joint research and development projects, and help companies keep abreast of regulatory changes and industry trends. By actively engaging in such networks, companies can accelerate their green innovation efforts and improve their market position.

Third, policymakers play a critical role in promoting green innovation and sustainable development. Effective policies and incentives can create a favorable environment for companies to invest in green initiatives. Policymakers should consider implementing regulations that mandate sustainable practices, such as carbon emission reduction targets, waste management standards, and energy efficiency requirements. These regulations can drive companies to adopt green practices and technologies.

Fourth, providing financial incentives, such as tax credits, grants, and subsidies, can encourage companies to invest in green innovation. Policymakers can design incentive programs that reward companies for their efforts in developing and adopting sustainable technologies. These incentives can reduce the financial burden on companies and accelerate the adoption of green practices.

Fifth, establishing public-private partnerships (PPPs) can facilitate large-scale green projects and infrastructure development. Policymakers can collaborate with private companies to develop green infrastructure, such as renewable energy plants, public transportation systems, and waste recycling facilities. These partnerships can leverage the strengths of both sectors to achieve sustainable development goals.

Sixth, promoting education and awareness about sustainability is essential for driving green innovation. Policymakers can support educational programs that focus on environmental science, sustainable business practices, and green technologies. By raising awareness and building expertise, these programs can create a skilled workforce capable of driving green innovation in various industries.

Finally, creating a stable and predictable regulatory environment is crucial for encouraging long-term investments in green innovation. Policymakers should ensure that regulations and policies are consistent, transparent, and predictable to provide companies with the confidence to invest in sustainable technologies and practices.

By focusing on these areas, external collaborations and supportive policies can significantly enhance a company's green competitive advantage and innovation capabilities. Policymakers and companies working together can create a synergistic effect that promotes sustainable development and drives the transition towards a greener economy.

5.4.3 Implications for Enhancing Green Competitive Advantage

Enhancing green competitive advantage requires strategic integration of internal and external green environment orientations to achieve both differentiation and cost advantages, ultimately leading to improved sustainable performance.

Firstly, companies can enhance their green competitive advantage through internal green environment orientation (IGEO). By prioritizing investments in research and development (R&D) for green technologies and processes, companies can innovate sustainable products that meet consumer demand for eco-friendly alternatives. R&D investments enable companies to differentiate themselves in the market by offering unique green products that appeal to environmentally conscious consumers.

Secondly, internal green environment orientation also involves fostering a supportive corporate culture that values sustainability. Companies can cultivate a culture where employees are encouraged to contribute ideas for green initiatives and are rewarded for implementing sustainable practices. This cultural shift promotes innovation and operational efficiency aligned with environmental goals, contributing to overall competitiveness in the market.

Thirdly, external green environment orientation (EGEO) plays a crucial role in enhancing green competitive advantage by leveraging external resources and partnerships. Companies can collaborate with suppliers to source sustainable materials and establish green supply chains, thereby reducing environmental impacts across the value chain. Collaborations with external stakeholders, including customers and industry peers, enable knowledge sharing and collective efforts towards sustainability goals.

Fourthly, achieving cost advantages through green practices is another strategy to enhance competitive advantage. Companies can implement energy-efficient technologies, optimize resource use, and adopt sustainable production processes to reduce operational costs. Cost savings from sustainable practices not only improve profit margins but also enhance competitiveness by offering competitively priced green products to consumers.

Fifthly, integrating sustainability into strategic planning and decision-making processes ensures that green initiatives are aligned with business objectives. Companies should embed sustainability metrics into performance evaluations and incentive structures to drive continuous improvement in environmental performance. This strategic alignment enables companies to respond effectively to market demands for sustainable products and services, thereby strengthening their competitive position.

Lastly, regulatory compliance and adherence to international standards for environmental management further enhance green competitive advantage. Companies should proactively monitor and comply with regulations related to environmental protection, emissions reduction, and waste management. Adherence to standards such as ISO 14001 demonstrates commitment to environmental stewardship and enhances credibility among stakeholders, including customers and investors.

In conclusion, enhancing green competitive advantage requires a holistic approach that integrates internal and external green environment orientations. By investing in R&D, fostering a supportive corporate culture, collaborating with external partners, achieving cost efficiencies, aligning sustainability with strategic goals, and complying with regulatory standards, companies can effectively differentiate themselves in the market, reduce environmental impacts, and improve sustainable performance. These strategies not only enhance competitiveness but also contribute to the long-term viability and resilience of businesses in a sustainable economy.

5.4.4 Implications for Promoting Green Innovation

Green innovation plays a pivotal role in enhancing sustainable performance by fostering creativity and advancing environmental stewardship within organizations. Companies can leverage green innovation to develop innovative products and processes that contribute to overall sustainable development.

Firstly, promoting green innovation requires a commitment to research and development (R&D) investments aimed at creating environmentally friendly technologies and solutions. By allocating resources to R&D, companies can drive innovation in green product design, incorporating renewable materials, energy-efficient technologies, and eco-friendly manufacturing processes. These innovations not only address environmental challenges but also meet consumer preferences for sustainable products, thereby enhancing market competitiveness.

Secondly, fostering a culture of innovation within the organization is essential for promoting green innovation. Companies should encourage employees at all levels to contribute ideas and participate in green initiatives. By fostering a supportive environment that values creativity and sustainability, organizations can harness diverse perspectives and expertise to generate novel solutions for environmental challenges.

Thirdly, collaboration with external stakeholders, including suppliers, research institutions, and government agencies, is crucial for promoting green innovation. Partnerships enable knowledge sharing, access to specialized expertise, and joint research initiatives focused on

sustainability. Collaborative efforts facilitate the development of breakthrough technologies and scalable solutions that contribute to environmental conservation and resource efficiency.

Fourthly, integrating sustainability into product development processes ensures that green innovation aligns with strategic business objectives. Companies should incorporate life cycle assessments and eco-design principles into product development stages to minimize environmental impacts from conception to disposal. By considering sustainability criteria in product design and development, organizations can optimize resource use, reduce waste generation, and enhance product performance in terms of environmental attributes.

Fifthly, fostering an innovation ecosystem that supports green startups and entrepreneurs is essential for driving continuous advancements in green technologies. Companies can collaborate with startups and venture capital firms focused on sustainability to nurture innovative ideas and accelerate the commercialization of green products. Supporting green entrepreneurs fosters a dynamic ecosystem that promotes competitiveness and resilience in addressing global environmental challenges.

Lastly, advocacy for supportive policies and incentives from policymakers is crucial for fostering an enabling environment for green innovation. Companies should actively engage in advocacy efforts to influence policies that promote renewable energy adoption, incentivize sustainable practices, and facilitate market access for green technologies. Policy support enhances the scalability and adoption of green innovations, driving systemic changes towards sustainable development goals.

In conclusion, promoting green innovation requires a multifaceted approach that integrates R&D investments, fosters a culture of innovation, collaborates with external stakeholders, integrates sustainability into product development, supports green startups, and advocates for supportive policies. By embracing green innovation, companies can lead in sustainable development efforts, enhance competitiveness, and contribute to a resilient and sustainable future for society and the environment. These strategies not only drive business growth but also pave the way for transformative changes towards a low-carbon economy.

5.4.5 Implications for Future Research Directions

Future research in the field of green management and sustainability can build upon the findings and implications derived from this study, addressing several key areas for further exploration and advancement.

Firstly, there is a need to investigate the long-term relationship between green orientation and firm performance across different organizational contexts and industries. While this study provides

insights into the immediate impacts of internal and external green orientations on sustainable performance, longitudinal studies can offer valuable insights into how these relationships evolve over time. Longitudinal research can capture dynamic changes in environmental practices, performance outcomes, and competitive advantages, providing deeper understanding of the sustainability journey within organizations.

Secondly, future research should delve into understanding the effectiveness of green practices in diverse industry settings. Different industries may face unique challenges and opportunities related to sustainability and green initiatives. Therefore, examining how green practices influence performance metrics such as profitability, market share, and innovation capabilities across sectors (e.g., manufacturing, service, technology) can uncover sector-specific dynamics and strategies for sustainable development.

Thirdly, exploring the optimization of green orientation strategies in varying market environments is essential. Market conditions, regulatory frameworks, consumer preferences, and competitive landscapes significantly impact the adoption and effectiveness of green practices. Research can investigate how companies adapt their green strategies to different market contexts, including emerging markets, mature markets, and global supply chains. Understanding these nuances can guide companies in tailoring their green initiatives to maximize environmental benefits and business outcomes across diverse market scenarios.

Fourthly, there is a growing opportunity to explore the role of technology and digitalization in enhancing green management practices. Advances in digital technologies, such as big data analytics, artificial intelligence, Internet of Things (IoT), and blockchain, offer new avenues for improving environmental monitoring, resource efficiency, and sustainability performance. Future research can explore how these technologies facilitate real-time data-driven decision-making, enhance transparency in supply chains, and enable predictive modeling for sustainable practices.

Fifthly, investigating the influence of external factors such as government policies, industry standards, and stakeholder pressures on organizational green strategies merits attention. Understanding how regulatory frameworks and stakeholder expectations shape green practices and their impact on firm performance can provide insights into effective policy interventions and corporate governance strategies for sustainability.

Lastly, future research should also focus on comparative studies across regions and countries to explore the cultural, institutional, and economic factors influencing green management practices and outcomes. Cross-national studies can identify best practices, benchmarks, and policy insights that contribute to global sustainability goals and foster international collaboration in addressing environmental challenges.

In conclusion, advancing research in these areas will contribute to the development of robust theoretical frameworks, empirical evidence, and practical guidelines for fostering sustainable business practices. By addressing these research directions, scholars can support businesses, policymakers, and stakeholders in making informed decisions and accelerating the transition towards a more sustainable and resilient global economy.

5.5 Academic Contribution

5.5.1 Advancement of Resource-Based View Theory

This study significantly advances the Resource-Based View (RBV) theory by analyzing the impact of internal and external green environment orientations on corporate competitive advantage and innovation. Traditionally, RBV focuses on the strategic importance of valuable, rare, inimitable, and non-substitutable resources within a firm to achieve and sustain a competitive advantage. Our research extends this theoretical framework by integrating green practices and sustainability as critical resources in the context of modern business environments.

Firstly, our findings highlight that internal green environment orientation, which includes R&D investment, top management support, and a pro-environmental corporate culture, acts as a crucial strategic resource. These elements, when aligned with RBV, demonstrate how internal capabilities and resources devoted to green practices can create substantial competitive advantages. The empirical evidence suggests that companies investing in these internal green resources can enhance their market position by differentiating themselves from competitors and responding more effectively to stakeholder demands for sustainability.

Secondly, the study broadens the RBV perspective by incorporating external green environment orientation, which encompasses perceived policy effectiveness, competitor actions, and customer demand for sustainability. By treating these external factors as part of the strategic resource pool, we provide a nuanced understanding of how external pressures and opportunities can be leveraged to gain a competitive edge. Companies that proactively engage with external green drivers can better navigate regulatory landscapes, anticipate market trends, and align their offerings with evolving customer expectations, thus securing a more robust competitive position.

The research validates the RBV theory in the context of green management and sustainability. By empirically demonstrating that both internal and external green orientations contribute to competitive advantage and innovation, we affirm that green resources meet the RBV criteria of being valuable, rare, inimitable, and non-substitutable. The study's findings show that companies

with strong green orientations not only achieve better environmental performance but also experience enhanced economic and social outcomes, thereby supporting the RBV premise that well-managed resources lead to sustained competitive advantage.

From a practical standpoint, the advancement of RBV theory through this research offers valuable insights for resource management in businesses. Companies are encouraged to view green initiatives not merely as compliance or cost factors but as strategic resources that can drive long-term success. By investing in green R&D, fostering top management support for sustainability, and cultivating a corporate culture that prioritizes environmental responsibility, businesses can build unique capabilities that are difficult for competitors to replicate.

In conclusion, this study significantly enriches the Resource-Based View theory by demonstrating the strategic importance of green environment orientations. It provides empirical support for the idea that green resources are critical for achieving sustainable competitive advantage. This advancement underscores the necessity for firms to integrate green practices into their core resource strategies, thereby aligning with broader sustainability goals while maintaining competitive strength.

5.5.2 Contribution to Sustainable Development Theory

This study significantly contributes to Sustainable Development Theory by examining how internal and external green environment orientations impact sustainable performance. Traditionally, Sustainable Development Theory emphasizes the need to balance economic growth, environmental protection, and social equity. Our research extends the application of this theory into the domain of corporate practices, demonstrating how companies can integrate sustainability into their internal management and external collaborations to achieve comprehensive sustainable development goals.

Firstly, the study elucidates the role of internal green environment orientation, encompassing R&D investment, top management support, and a green corporate culture, in driving sustainable performance. By focusing on these internal factors, we provide a deeper understanding of how internal corporate practices can be strategically aligned with sustainability objectives. The findings show that companies with strong internal green practices are better positioned to achieve sustainable economic, environmental, and social outcomes. This supports the notion that sustainability must be ingrained in the core operations and culture of an organization to drive meaningful and lasting impact.

Secondly, the research highlights the importance of external green environment orientation, which includes perceived policy effectiveness, competitor actions, and customer demand for sustainability. By incorporating these external factors, we expand the Sustainable Development

Theory to account for the dynamic interactions between businesses and their external environments. The study reveals that external pressures and opportunities significantly influence a company's ability to innovate and maintain a competitive edge. Effective collaboration with external stakeholders, including policymakers, competitors, and customers, is shown to be critical in fostering green innovation and competitive advantage, thus enhancing overall sustainable performance.

The empirical evidence presented in this study provides new theoretical insights into how businesses can achieve sustainable development. By demonstrating the synergistic effects of internal and external green orientations, we show that sustainable performance is not solely a function of internal capabilities but also of how well a company engages with its external environment. This holistic approach aligns with the principles of Sustainable Development Theory, which advocate for an integrated perspective on economic, environmental, and social progress.

From a practical perspective, the study offers valuable guidance for businesses and policymakers. For businesses, it emphasizes the need to develop robust internal green practices while actively engaging with external stakeholders to leverage policy incentives, meet competitive benchmarks, and satisfy customer expectations for sustainability. For policymakers, the findings suggest that creating supportive regulatory frameworks and incentives for green practices can significantly enhance corporate contributions to sustainable development.

In conclusion, this study advances Sustainable Development Theory by providing empirical support for the critical role of both internal and external green orientations in achieving sustainable performance. It offers a comprehensive framework for understanding how businesses can strategically align their operations with sustainable development goals, contributing to the broader theoretical and practical discourse on sustainability. This contribution underscores the necessity for an integrated approach to sustainability, where internal practices and external collaborations work in tandem to drive economic, environmental, and social progress.

5.5.3 Insights into Environmental Externality Theory

This study offers significant insights into Environmental Externality Theory by examining how corporate green orientations can mitigate negative environmental impacts. Environmental Externality Theory addresses the unintended side effects of economic activities on the environment, often resulting in costs not borne by the entity causing the impact. By analyzing the role of green innovation and environmental protection measures, this research enhances our understanding of how businesses can internalize these external costs and improve their environmental footprint.

Firstly, the study demonstrates that companies with a strong internal green environment orientation, characterized by substantial R&D investment in green technologies, top management support for sustainability initiatives, and a pervasive green culture, are more effective in reducing their environmental externalities. These companies are shown to adopt innovative practices that not only comply with environmental regulations but also go beyond compliance to proactively reduce emissions, waste, and resource consumption. This proactive stance significantly decreases the negative environmental impacts associated with their production and operational activities, thereby internalizing what would otherwise be external costs.

Secondly, the findings highlight the critical role of external green environment orientation in mitigating environmental externalities. External factors such as perceived policy effectiveness, competitive pressures, and customer demand for sustainable products compel companies to adopt greener practices. The study reveals that when companies perceive strong regulatory frameworks and customer preferences for sustainability, they are more likely to engage in green innovation and adopt practices that reduce their environmental impact. This alignment with external pressures not only helps in minimizing environmental harm but also fosters a positive image and enhances corporate social responsibility.

Moreover, the research provides empirical evidence that green innovations, whether in products or processes, are essential mechanisms for reducing environmental externalities. Green product innovation focuses on developing eco-friendly products that minimize resource use and environmental impact throughout their lifecycle. Green process innovation, on the other hand, involves adopting cleaner production technologies and practices that reduce waste and emissions. Both types of innovation contribute significantly to lowering the external environmental costs associated with business operations.

The study's results underscore the importance of integrating environmental considerations into corporate strategy. By doing so, companies not only comply with environmental regulations but also take a leadership role in sustainability, which can enhance their sustainable competitive advantage. This approach aligns with Environmental Externality Theory by demonstrating how internalizing environmental costs through green practices can lead to better environmental outcomes and sustainable business success.

In conclusion, this study enriches Environmental Externality Theory by providing concrete evidence on how internal and external green orientations help businesses reduce their negative environmental impacts. By implementing green innovations and adhering to environmental protection measures, companies can effectively internalize external environmental costs, thus improving their sustainability performance and social responsibility. These insights reinforce the

importance of proactive environmental management in achieving sustainable development and highlight the role of businesses in addressing environmental externalities.

5.5.4 Contribution to Diffusion of Innovations Theory

This study makes a significant contribution to the Diffusion of Innovations Theory by examining the role of green innovation in the dissemination and adoption processes within and outside the firm, offering new empirical evidence for the theory's application in the context of sustainable development. The Diffusion of Innovations Theory, which explains how new ideas and technologies spread through cultures, is expanded in this research to incorporate the dynamics of green innovation within the corporate sector.

Firstly, the study highlights the critical mechanisms by which green innovation enhances corporate competitive advantage and performance. By analyzing the pathways through which green innovation impacts firms, the research reveals that green product and process innovations are pivotal in creating differentiation and cost advantages. Green product innovation involves developing new products that meet environmental standards and consumer expectations for sustainability, which can lead to increased market share and customer loyalty. Green process innovation focuses on implementing eco-friendly production processes that reduce waste and increase efficiency, thereby lowering operational costs. These innovations are not only beneficial for the environment but also enhance the firm's overall performance, aligning with the principles of the Diffusion of Innovations Theory that emphasize the benefits and perceived advantages of new innovations.

Secondly, the research underscores the importance of internal and external factors in the diffusion of green innovations. Internally, the study identifies that a firm's green environment orientation, characterized by top management support, organizational culture, and R&D investments, significantly influences the adoption and diffusion of green innovations. Companies that prioritize sustainability and invest in green technologies are more likely to successfully implement and diffuse these innovations throughout their operations. Externally, factors such as regulatory policies, competitive pressure, and customer demand play a crucial role in the diffusion process. Firms are more inclined to adopt green innovations when they perceive strong regulatory support and market demand for sustainable products, as well as when they face competitive pressures to innovate.

Moreover, the study provides empirical evidence on the stages and processes involved in the diffusion of green innovations within the firm. It illustrates how early adopters within the organization, often driven by top management and dedicated R&D teams, experiment with and

refine green innovations before they are widely adopted across the company. This internal diffusion process is critical for ensuring that green innovations are effectively integrated into the firm's operations and contribute to its sustainable performance.

In addition, the research extends the Diffusion of Innovations Theory by demonstrating the long-term impact of green innovations on corporate strategy and sustainability. The findings show that green innovations not only provide immediate competitive advantages but also drive the long-term strategic transformation towards sustainability. By adopting and diffusing green innovations, firms can achieve sustained competitive advantages, improve their environmental performance, and enhance their corporate reputation. This strategic shift towards sustainability is essential for long-term success and aligns with the broader goals of sustainable development.

In conclusion, this study enriches the Diffusion of Innovations Theory by providing new insights into the role of green innovation in corporate sustainability. By examining the internal and external factors influencing the adoption and diffusion of green innovations, and their impact on competitive advantage and performance, the research offers a comprehensive understanding of how innovations can drive the transition towards sustainable business practices. These findings contribute to the theoretical foundation of innovation diffusion in the context of environmental protection and corporate sustainability strategies, highlighting the crucial role of green innovation in achieving sustainable development goals.

5.5.5 Insights from Corporate Competitiveness and Stakeholder Theories

This study provides valuable insights into Corporate Competitiveness Theory and Stakeholder Theory by examining the impact of green competitive advantage on firm performance, thereby deepening the understanding of these theories in the context of sustainable development. The findings reveal that firms responding to stakeholder expectations and improving environmental performance can not only enhance their competitiveness and innovation capabilities but also increase their overall long-term economic, social, and environmental value.

Firstly, the research emphasizes the critical role of green competitive advantage in enhancing corporate competitiveness. By adopting green practices and innovations, firms can achieve differentiation and cost leadership, which are essential components of competitive strategy. Differentiation advantage is achieved through the development of unique, eco-friendly products that meet the growing consumer demand for sustainable options. These products not only attract environmentally conscious customers but also allow firms to command premium prices, thereby increasing profitability. On the other hand, cost advantage is realized through efficient resource utilization and waste reduction, which lower operational costs and improve overall efficiency. This

dual approach of differentiation and cost leadership strengthens a firm's market position and enhances its competitiveness.

Secondly, the study underscores the importance of stakeholder engagement in achieving sustainable competitive advantage. Stakeholder Theory posits that firms must consider the interests of all stakeholders, including customers, employees, suppliers, communities, and shareholders, to achieve long-term success. The research findings indicate that firms actively responding to stakeholder expectations regarding environmental and social responsibility are more likely to gain stakeholder support and trust. This, in turn, leads to increased customer loyalty, employee satisfaction, and investor confidence, all of which are critical for sustaining competitive advantage. By aligning business strategies with stakeholder expectations, firms can create a positive feedback loop that enhances both competitiveness and sustainability.

Moreover, the study highlights the interconnectedness of economic, social, and environmental performance, as suggested by Corporate Competitiveness and Stakeholder Theories. Firms that prioritize green competitive advantage are not only able to improve their financial performance but also contribute to social and environmental well-being. For instance, by reducing carbon emissions and minimizing waste, firms can mitigate their environmental impact, thus contributing to global sustainability goals. Additionally, by fostering a culture of innovation and sustainability, firms can attract and retain top talent, thereby enhancing their innovative capacity and long-term competitiveness. This holistic approach to performance underscores the importance of integrating economic, social, and environmental considerations into corporate strategy.

Furthermore, the research provides empirical evidence supporting the idea that green competitive advantage is a key driver of sustainable development. Firms that successfully implement green strategies are better positioned to adapt to regulatory changes, meet evolving consumer preferences, and mitigate environmental risks. This adaptability not only ensures compliance with environmental regulations but also enhances the firm's resilience and long-term viability. By demonstrating how green competitive advantage translates into tangible business benefits, the study reinforces the relevance of Corporate Competitiveness and Stakeholder Theories in the contemporary business landscape.

In conclusion, this study enriches the understanding of Corporate Competitiveness and Stakeholder Theories by elucidating the mechanisms through which green competitive advantage enhances firm performance and sustainability. By highlighting the strategic importance of stakeholder engagement and the integration of economic, social, and environmental goals, the research offers a comprehensive framework for firms aiming to achieve sustainable competitive advantage. These insights contribute to the theoretical foundations of sustainable development,

providing practical guidance for firms seeking to balance competitiveness with social and environmental responsibility.

5.7 Limitation and Future research

5.7.1 Limitation

While this study provides valuable insights into the impact of internal and external green environment orientation on sustainable performance, competitive advantage, and green innovation, several limitations should be acknowledged.

Firstly, the study relies on cross-sectional data, which captures the relationships between variables at a single point in time. This limits the ability to infer causality and track changes over time. Future research could employ longitudinal designs to better understand the dynamic nature of these relationships and how they evolve.

Secondly, the data was collected from a specific geographic region and industry sector, which may limit the generalizability of the findings to other contexts. The cultural, regulatory, and market conditions specific to the region and industry might influence the outcomes. Expanding the study to include diverse geographic regions and industry sectors could provide more comprehensive insights and enhance the generalizability of the results.

Thirdly, the study primarily relies on self-reported data from firms, which may be subject to social desirability bias. Respondents might overstate their commitment to green practices or sustainable performance due to the increasing societal and regulatory pressures to appear environmentally responsible. Incorporating objective measures of environmental performance and triangulating data from multiple sources could mitigate this bias.

Fourthly, while the study incorporates key variables related to green environment orientation, competitive advantage, and sustainable performance, it may not capture all relevant factors. Other variables, such as technological capabilities, financial resources, and firm size, could also play significant roles and should be considered in future research. Additionally, exploring the interactions between these factors could provide a more nuanced understanding of their impact on sustainable performance.

Lastly, the study's theoretical framework is based on established theories such as Resource-Based View, Sustainable Development Theory, and Stakeholder Theory. However, emerging theories and perspectives on sustainability and green innovation could offer additional insights.

Future research could integrate these new theoretical perspectives to enrich the understanding of green environment orientation and its implications.

In summary, while this study makes significant contributions to the understanding of green environment orientation and its effects on sustainable performance, competitive advantage, and green innovation, the limitations highlighted above suggest avenues for future research. Addressing these limitations could provide a more comprehensive and nuanced understanding of the complex relationships between green practices and organizational outcomes.

5.7.2 Future Research

Building on the findings and limitations of this study, several avenues for future research are suggested to deepen the understanding of the relationships between green environment orientation, competitive advantage, innovation, and sustainable performance.

Firstly, future research should consider employing longitudinal designs to capture the dynamic nature of the relationships examined in this study. Longitudinal studies can provide insights into how internal and external green environment orientations influence sustainable performance over time, and how firms adapt their green practices in response to changing environmental, regulatory, and market conditions.

Secondly, expanding the scope of the study to include a more diverse set of geographic regions and industry sectors would enhance the generalizability of the findings. Different cultural, regulatory, and market environments can significantly impact the effectiveness of green practices. Comparative studies across regions and industries could reveal context-specific factors and best practices for implementing green strategies.

Thirdly, future research could benefit from incorporating objective measures of environmental performance. While self-reported data provides valuable insights, it is susceptible to biases. Using environmental performance indicators such as emissions data, energy consumption, and waste reduction metrics, alongside financial and operational performance data, can provide a more accurate and holistic view of a firm's sustainable performance.

Fourthly, exploring additional variables that may influence the relationships studied here would be beneficial. Factors such as technological capabilities, financial resources, firm size, and leadership styles could provide deeper insights into the mechanisms through which green environment orientation impacts competitive advantage and sustainable performance. Additionally, examining the interactions between these variables and green practices could offer a more comprehensive understanding of the factors driving sustainable performance.

Fifthly, integrating emerging theories and perspectives on sustainability and green innovation could enrich the theoretical framework of future studies. For example, the Circular Economy Theory, which emphasizes the importance of designing out waste and keeping products and materials in use, could provide new insights into how firms can achieve sustainable performance through innovative practices.

Lastly, future research should consider the role of digital technologies and Industry 4.0 in enhancing green practices and sustainability. Technologies such as the Internet of Things (IoT), big data analytics, and artificial intelligence have the potential to transform how firms manage their environmental impact and achieve sustainable performance. Investigating how these technologies can be leveraged to support green environment orientation and innovation could provide valuable insights for both academia and practice.

In conclusion, while this study has advanced the understanding of green environment orientation and its effects on sustainable performance, competitive advantage, and innovation, there is substantial scope for further research. Addressing the suggested areas for future research will contribute to a more comprehensive and nuanced understanding of how firms can achieve and sustain competitive advantage through green practices and innovation in an increasingly sustainability-focused global market.

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APPENDIX

APPENDIX A

Questionnaire

APPENDIX A

Questionnaire

RESEARCH INSTRUMENTS

Affidavit of Translation Accuracy

This is to testify that the translated version of the questionnaire used in this research study is a verbatim, true, and faithful translation for all the established questions in the questionnaire are in its complete compliance, rationale, contextual, and in its whole spirit.

Aj.Nuttawut to signature

Questionnaire In English

This questionnaire is a part of the research of the Doctor of Philosophy Program in Industrial Business Administration (International Program), KMITL Business School, at KMITL. The data collected from this questionnaire will be treated with the utmost confidentiality. Kindly answer to the best of your knowledge.

The questionnaire designed for this study will be divided into 2 parts:

Part 1: Questions on the demographic data

Part 2: Question about the level of studied variables

Part 1: Demographic Data of the Respondents

Tick (√) the option applicable for each of the questions listed below.

1) Gender:

( ) Male ( ) Female

2) Age

( ) 20-30 years ( ) 31-40 years

( ) 41-50 years ( ) 51-60 years

( ) Older than 60 years

3）Education

( ) Bachelor Degree or Lower ( ) Master's Degree

( ) Doctoral Degree

4) Year of Experience

( ) Less than 5 years ( ) 5-10 years

( ) 11-15 years ( ) 16-20 years

( ) More than 20 years

5) Type of Manufacturing

( ) Heavy machinery and equipment ( ) Consumer goods

( ) Electronics ( ) Chemicals and Pharmaceuticals

( ) Food and Beverage ( ) Textiles and Apparel

( ) Other

6) Location of Manufacturing

( ) North China ( ) Northeast China

( ) East China ( ) South Central China

( ) Southwest China ( ) Northwest China

( ) South China ( ) Other

Part 2: Level of Studied Variables

Please complete the questionnaire honestly based on your genuine thoughts and opinions. Indicate your level of agreement by marking a check (√) in the corresponding column. Please provide responses for all the questions to ensure completion of the questionnaire. The scale 1 indicating "strongly disagree," 2 indicating "disagree," 3 indicating "neutral," 4 indicating "agree," and 5 indicating "strongly agree."

Variable	Strongly Disagree—Strongly Agree				
	1	2	3	4	5
R&D investment					

Variable	Strongly Disagree—Strongly Agree				
	1	2	3	4	5
Our firm heavily invests in research and development (R&D) to enhance green practices.					
The allocation of resources for green R&D projects is a top priority for our firm.					
Our R&D initiatives have significantly contributed to advancing our green initiatives and environmental practices.					
Top Management Support					
Our top management actively promotes and supports green initiatives within our firm.					
Green projects and initiatives receive visible endorsement and encouragement from our senior leaders.					
The top management's commitment to green practices has positively influenced our environmental performance.					
Firm’s Culture					
Our firm's culture emphasizes the importance of adopting environmentally-friendly practices.					
Employees are encouraged to suggest and contribute to green initiatives.					
A sense of environmental responsibility is deeply ingrained in our organizational values and practices.					
Perceived Policy Effectiveness					
The environmental regulations in place are effective in guiding our firm's sustainability practices.					
Our firm often modifies its practices to align with updated environmental policies.					
Our firm believes that the current environmental policies have significantly impacted our industry.					
Competitor Competition					

Variable	Strongly Disagree—Strongly Agree				
	1	2	3	4	5
Most of our competitors have already adopted green practices in their operations.					
Our firm often benchmarks sustainability practices against industry leaders to remain competitive.					
Our firm believes that green initiatives provide a competitive advantage in our industry.					
Customer Demand					
Our customers frequently demand environmentally-friendly products/services.					
Customer feedback often includes suggestions or requests related to improving our environmental practices.					
Our firm believes that meeting green expectations of customers significantly influences our brand reputation.					
Differentiation Advantage					
Our firm's green initiatives allow us to offer distinct products/services compared to competitors.					
Customers recognize and appreciate the unique environmental features of our products/services.					
Our green practices contribute to a positive brand image and reputation in the market.					
Cost Advantage					
Our sustainable practices have led to significant cost savings in production and operations.					
By adopting green strategies, our firm has been able to reduce waste and improve resource efficiency.					
Our firm believes that, in the long term, green practices will lead to more economical operations.					
Green Product Innovation					

Variable	Strongly Disagree—Strongly Agree				
	1	2	3	4	5
Our firm frequently introduces new products that are environmentally friendly.					
The products that our firm designs and develops prioritize minimizing environmental impact.					
The eco-friendly features of our products differentiate us from competitors.					
Green Process Innovation					
Our firm continuously adopts new processes that reduce waste and environmental pollution.					
Our firm frequently invests in technologies that increase our operational eco-efficiency.					
Our production methods are often updated to ensure minimal resource usage and maximal sustainability.					
Economic Performance					
Our firm's green initiatives have led to increased revenue and market share.					
The adoption of sustainable practices has resulted in significant cost savings for our company.					
Our firm's profitability has improved due to our focus on sustainable and green innovations.					
Our stakeholders, including investors, view our firm favorably because of our commitment to sustainable practices.					
Environmental Performance					
Our firm has significantly reduced its carbon footprint in recent years.					
Our firm has successfully decreased the waste generated from our operations.					
Our company has taken measurable steps to conserve resources like water and energy.					

Variable	Strongly Disagree—Strongly Agree				
	1	2	3	4	5
The use of green technologies has minimized the environmental impact of our operations.					
Social Performance					
Our firm is recognized for its commitment to employee health and safety.					
Our firm actively participates in community development programs and local initiatives.					
Our firm upholds and promotes fair labor practices.					
Our firm prioritizes stakeholder engagement and continuously seeks feedback to improve our societal contributions.					

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