THE IMPACT OF GREEN ENTREPRENEURIAL ORIENTATION ON SUSTAINABLE PERFORMANCE

WENLI HU

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF
PHILOSOPHY PROGRAM IN BUSINESS ADMINISTRATION
FACULTY OF BUSINESS ADMINISTRATION
RAJAMANGALA UNIVERSITY OF TECHNOLOGY THANYABURI
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Name-Surname	Mrs. Wenli Hu
Program	Business Administration (Management)
Dissertation Advisor	Assistant Professor Teetut Tresirichod, D.B.A.
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ABSTRACT

The objective of this research is to examine the impact of green entrepreneurial orientation on sustainable performance in manufacturing firms, focusing on analyzing the mediating role of green intellectual capital and green supply chain management between green entrepreneurial orientation and sustainable performance, as well as the impact of green entrepreneurial orientation on sustainable performance through green intellectual capital and green supply chain management under different conditions of environmental uncertainty.

This research employs a mixed-method approach that combines quantitative and qualitative analyses. In the qualitative phase, in-depth interviews and content analyses were conducted with 15 senior executives and experts from manufacturing companies. In the quantitative phase, data were collected from questionnaires completed by 516 manufacturing business leaders in Sichuan province, China, and analyzed using SmartPLS and SPSS-PROCESS.

The research results indicated the following three findings. First, green entrepreneurial orientation positively impacts sustainable performance. Second, green intellectual capital and green supply chain management play a mediating role in green entrepreneurial orientation and sustainable performance. Third, the higher the environmental uncertainty, the weaker the positive impact of green entrepreneurial orientation on sustainable performance through green intellectual capital or green supply chain management. This research provides important theoretical and practical guidance to manufacturing firms in implementing green strategies and enhancing sustainable performance.

Keywords: green entrepreneurial orientation, green intellectual capital, green supply chain management, sustainable performance, environmental uncertainty

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Table of Contents

Page

Abstract .....…… (3)

Acknowledgements ...…… (4)

Table of Contents ...…… (5)

List of Tables ...…… (7)

List of Figures ...…… (9)

CHAPTER 1 INTRODUCTION ...…… 10

1.1 Background and Statement of the Problems …… 10

1.2 Research Question and Hypothesis …….. 19

1.3 Purpose of the Study ……. 20

1.4 Research Framework …… 21

1.5 Definitions of Terms …… 21

1.6 Research Scope …… 23

1.7 Organization of the Study …… 24

1.8 Contribution of the Study ……..... 25

CHAPTER 2 REVIEW OF THE LITERATURE ……..……..... 28

2.1 Sustainable Performance …….. 28

2.2 Green Entrepreneurial Orientation ……... 46

2.3 Green Intellectual Capital ……. 58

2.4 Concepts and Theories Related to Green Supply Chain Management 65

2.5 Environmental Uncertainty …….. 77

2.6 Green Entrepreneurial Orientation and Sustainable Performance ….... 82

2.7 The Mediating Role of Green Entrepreneurial Orientation ……. 84

2.8 The Mediating Role of Green Supply Chain Management …….. 88

2.9 The Moderating Role of Environmental Uncertainty ……... 94

2.10 Hypothesized Structural Model …….. 99

CHAPTER 3 RESEARCH METHODOLOGY.....…….. 100

3.1 Research Design ……..... 100

3.2 Qualitative Methodology ……. 102

3.3 Quantitative Methodology ……... 104

Table of Contents (Continued)

Page

CHAPTER 4 RESEARCH RESULTS 122

4.1 Qualitative Results 122

4.2 IOC Inspection and Pre-survey 139

4.3 Data Preparation 143

4.5 Assessment of the Measurement Model 157

4.6 Hypothesis Testing 171

4.7 Summary of qualitative and quantitative studies 177

CHAPTER 5 CONCLUSION AND RECOMMENDATIONS 179

5.1 Conclusion 179

5.2 Discussion 181

5.3 Contributions of the Study 190

5.4 Research Limitations and Suggestions for Future Research 198

Bibliography 200

Appendices 227

Appendix A Interview Outline on the Impact of Green Entrepreneurial Orientation on Sustainable Performance 228

Appendix B Questionnaire on Green Entrepreneurial Orientation on Sustainable Performance 230

Appendix C IOC Invitation 247

Biography 251

List of Tables

		Page
Table 1.1	Development Stages of China's Manufacturing Industry ……...	12
Table 2.1	Factors Influencing Sustainable Performance …….....	37
Table 2.2	Measurement of Sustainable Performance across Different Dimensions …….	42
Table 2.3	Measurement Dimensions of Green Entrepreneurial Orientation …..	49
Table 2.4	Measurement Dimensions of Green Intellectual Capital ……	62
Table 2.5	Dimensions of Green Supply Chain Management …….	73
Table 2.6	Dimensions for Measuring Environmental Uncertainty …….	80
Table 3.1	Population and Sampling ……	104
Table 3.2	Summary of Research Variables ……	106
Table 3.3	Scales of Sustainable Performance …….....	107
Table 3.4	Scales of Green Entrepreneurial Orientation ……..	108
Table 3.5	Scales of Green Intellectual Capital ……...	109
Table 3.6	Scales of Green Supply Chain Management ……..	110
Table 3.7	Scales of Environmental Uncertainty …….	111
Table 3.8	Criteria for Reliability Assessment …….	116
Table 3.9	Model Testing Criteria ……	120
Table 4.1	Basic Information of Respondents ……	122
Table 4.2	Results of the In-depth Interview Question 1 …….	123
Table 4.3	Results of the In-depth Interview Question 2 …….	126
Table 4.4	Results of the In-depth Interview Question 3 …….	128
Table 4.5	Results of the In-depth Interview Question 4 …….	130
Table 4.6	Results of the In-depth Interview Question 5 ……..	132
Table 4.7	Results of the In-depth Interview Question 6 …….	134
Table 4.8	Results of the In-depth Interview Question 7 …….	136
Table 4.9	Summary Table of Qualitative Interviews ……..	138
Table 4.10	Abbreviation of Constructs and Observed Variables …….	139
Table 4.11	Reliability Statistics ……	142

List of Tables (Continued)

Page

Table 4.12	Data Analysis Indicator Abbreviations and Meanings ……	142
Table 4.13	Characteristics of the Returned Questionnaire ……	144
Table 4.14	Profile of the Respondents ……..	145
Table 4.15	Summary of the demographic ……	146
Table 4.16	Descriptive Statistics for Sustainable Performance ……	147
Table 4.17	Descriptive Statistics for Green Entrepreneurial Orientation …….	149
Table 4.18	Descriptive Statistics for Green Intellectual Capital ……...	151
Table 4.19	Descriptive Statistics for Green Supply Chain Management ……..	153
Table 4.20	Descriptive Statistics for Environmental Uncertainty …….	155
Table 4.21	Validity and Reliability of Measurement Model …….	158
Table 4.22	Discriminant Validity(Fornell-Larcker Criterion) ……	160
Table 4.23	Cross-Loading Analysis ……..	162
Table 4.24	Heterotrait-Monotrait Ratio (HTMT) ……..	167
Table 4.25	VIF Value ……	168
Table 4.26	Direct Effect Results ……...	171
Table 4.27	Conditional Indirect Effect of GEO on SuP through EU ……	174
Table 4.28	Conditional Indirect Effect of GEO on SuP through EU ……	175
Table 4.29	Summary of Qualitative and Quantitative Studies ……..	177

List of Figures

		Page
Figure 1.1	Research Framework ……...	21
Figure 2.1	Sustainable Value Expression of the Triple Bottom Line Principle …	30
Figure 2.2	Transformation of Corporate Sustainable Development …….	31
Figure 2.3	Sustainable Performance Framework ……..	43
Figure 2.4	Green Entrepreneurial 0rientation Framework ……	50
Figure 2.5	Intellectual Capital Framework ……...	58
Figure 2.6	Green Intellectual Capital Framework ……	63
Figure 2.7	Green Supply Chain Management Framework ……...	74
Figure 2.8	Environmental Uncertainty Framework ……..	81
Figure 2.9	Impact of Green Entrepreneurial Orientation on Sustainable Performance ……	83
Figure 2.10	The Impact of Green Entrepreneurial Orientation on Green Intellectual Capital …….	84
Figure 2.11	The Impact of Green Intellectual Capital on Sustainable Performance …….	85
Figure 2.12	The Mediating Role of Green Intellectual Capital ……..	87
Figure 2.13	Impact of Green Entrepreneurial Orientation on Green Supply Chain Management ……	89
Figure 2.14	Impact of Green Supply Chain Management on Sustainable Performance …….	91
Figure 2.15	The Mediating Role of Green Supply Chain Management …….	93
Figure 2.16	EU moderates the relationship between GIC and SuP …….	94
Figure 2.17	GEO Impacts SuP through GIC Conditionally upon the Effect of EU ...	95
Figure 2.18	EU moderates the relationship between GSCM and SuP ……...	97
Figure 2.19	GEO impacts SuP through GSCM conditionally upon the effect of EU	97
Figure 2.20	Research Framework and Hypotheses ……	97
Figure 4.1	Model Constructed using Reflective Measurement Model (Model 1)	157
Figure 4.2	Estimated Conceptual Framework …….....	172

CHAPTER 1
INTRODUCTION

This chapter provides a brief overview of the entire thesis on the study titled "The Impact of Green Entrepreneurial Orientation on Sustainability Performance." The chapter outlines the background of the study, the research question, the research hypothesis, the purpose of the study, the research framework and definition of terms, the scope of the study, and the contributions.

1.1 Background and Statement of the Problems
1.2 Research Question and Hypothesis
1.3 Purpose of the Study
1.4 Research Framework
1.5 Definitions of Terms
1.6 Research Scope
1.7 Organization of the Study
1.8 Contribution of the Study

1.1 Background and Statement of the Problems

The traditional extensive production model has demonstrated significant short-term economic development results for businesses but has also led to severe environmental issues (Stern, 2004). The negative impact of economic growth on the environment has progressively increased, contributing to the escalating global environmental crisis (Porcelli, 2022), including phenomena such as global warming, marine pollution, air pollution, chemical explosions, resource depletion, and energy consumption (Leonidou et al., 2017; Lin et al., 2013). This trend is observable across various countries globally, including the United States, the United Kingdom, Thailand, China, and others. As the world's largest economy and one of the most significant consumers of resources, the United States has significantly affected water resources, land resources, and biodiversity due to agricultural, industrial, and urbanization processes (Foley et al., 2005). The industrialization history of the United Kingdom has resulted in profound environmental damage, with the Industrial Revolution leading to substantial

carbon emissions, contributing to global temperature rise and far-reaching impacts on climate change (Malm, 2016).

In 2021, there will be 15 extreme heat events in the world, and 9 "climate zero cut-off points" have been activated, increasing the possibility of extreme weather changes and triggering deadly "dominoes." In 2022, there were 891 extreme weather events in the world, and the highest number of deaths was 16,305 heat waves in Europe, of which 95 million people were affected by drought.

As the world's largest developing country, China emits the highest carbon dioxide emissions in the world, and its economic development has a particularly significant impact on the environment(Guan et al., 2012; Li et al., 2019). China's industrialization, urbanization, and population growth have placed substantial pressures on land resources, water resources, and air quality, concurrently intensifying greenhouse gas emissions and biodiversity reduction(Zhang et al., 2010).In summary, economic development has led to severe ecological degradation, drawing global attention to environmental pollution(Wu et al., 2022). The growing contradiction between economic benefits and environmental deterioration has heightened public demand for sustainable development.

As the contradiction between economic growth and the ecological environment becomes increasingly acute, effectively assessing sustainability performance at the enterprise level has become a focal concern across society to address sustainability challenges. The manufacturing industry plays a vital role in China's economic growth and social development, but it also confronts numerous challenges. As the world's largest manufacturing nation, China's manufacturing output accounts for over one-fourth of the total global (Xianjiang, 2018). This provides robust impetus for China's economy, supporting the nation's industrialization and modernization processes (Naughton, 2021). However, China's manufacturing industry also faces various challenges. On the one hand, environmental pollution and excessive resource consumption issues are prominent(Yuan & Xiang, 2018). On the other hand, significant gaps persist in terms of product quality and innovation capability (Liu & Xie, 2020).

According to China's economic policies and global economic development trends, the evolution of China's manufacturing industry has been categorized into four

stages, summarizing the developmental characteristics and challenges faced at each stage, as illustrated in Table 1.1.

Table 1.1 Development Stages of China's Manufacturing Industry

Temporal Phase	Development Characteristics	Challenges Faced
1949-1978 (Planned Economy Era)	Emphasis on heavy industry, neglect of consumer goods manufacturing, and agricultural mechanization	Disconnection between supply and demand, technological lag, low product quality
1978-2001 (Reform and Opening-Up to Pre-WTO Accession)	Economic system transformation, manufacturing transitioning towards globalization, increased focus on technological research and development	Intensified market competition, domestic enterprises facing challenges from foreign investment, insufficient technological innovation
2001-2015 (Post-WTO Accession to "Made in China 2025" Era)	Manufacturing entering the globalization era, increased foreign investment in China, innovation becomes a keyword	Overcapacity, severe environmental pollution, persistent inadequate technological innovation capacity
2015-Present ("Made in China 2025" Era to Present)	The "Made in China 2025" strategy proposed increased investment in green and intelligent manufacturing, the pursuit of high-quality development in manufacturing.	Pressures for green transformation, slow progress in high-tech industry development, heightened trade pressures

The development of China's manufacturing industry has undergone different phases, each characterized by unique developmental features and associated challenges. The industry has evolved from its initial focus on heavy industry and planned economy through phases of globalization and intensified technological research and development to the current era marked by the "Made in China 2025" strategy and emphasis on high-quality development. In the present phase, significant obstacles exist in achieving green transformation, and the progress of high-tech industries is sluggish while trade pressures have intensified. Balancing competitiveness with the pursuit of greener and smarter transformation will be the key focus for the future advancement of China's manufacturing industry.

In this context, the development of the manufacturing industry in Sichuan holds significant importance. Situated in the southwestern part of China, Sichuan Province constitutes a crucial component of China's manufacturing landscape. As an economic engine in the western region of China, the unique nature and significance of its manufacturing industry cannot be underestimated. Firstly, the manufacturing output of Sichuan occupies a substantial share nationally. Its diversified industrial structure spans various sectors such as electronics, food and beverages, machinery and equipment, chemicals, and textiles, among others (Xuechun, 2011).

Moreover, Sichuan's manufacturing sector plays a pivotal role in driving technological innovation, industrial upgrading, and balanced regional economic development in China (Guo & Yang, 2016). For instance, Sichuan boasts the most extensive silicon industry base in the country and serves as a vital hub for the electronic information industry. Its contributions to the national strategy of becoming a manufacturing powerhouse are irreplaceable. More importantly, the green development of Sichuan's manufacturing industry could offer valuable practical experience and insights into the sustainable development trajectory of China's manufacturing sector.

However, the development of Sichuan's manufacturing industry also faces serious environmental challenges. Research indicates that the environmental quality of Sichuan Province has been negatively impacted by manufacturing output, mainly due to extensive resource exploitation and consumption, leading to soil erosion, soil pollution, and air quality deterioration(Tian et al., 2017). In response to these issues, Sichuan Province has formulated a series of environmental policies to promote green manufacturing and low-carbon economic development (He et al., 2019). Against this backdrop, the manufacturing industry in Sichuan is at a critical juncture of transformation. Guided by environmental protection and sustainable development, the shift towards green and environmentally friendly manufacturing not only helps address Sichuan's environmental challenges but also enhances its competitiveness, achieving a win-win situation for the economy and the environment. Furthermore, the experiences and lessons from Sichuan can offer valuable insights into the manufacturing development of other provinces and regions.

Countries around the world are striving to strike a balance between economic development and environmental protection, implementing relevant policies to achieve sustainable development. In April 2021, leaders of major economies convened at a climate summit to address the impact of the environment on climate change, urging and promoting reductions in corporate pollution emissions. The United States signed an executive order to rejoin the Paris Agreement and set goals for reducing greenhouse gas emissions (Bodansky, 2016). The United Kingdom passed the Net Zero by 2050 Act, demonstrating a serious commitment to tackling climate change. More than 138 countries around the world have put forward "zero carbon" or "carbon neutrality" goals and the Chinese government has also issued a series of environmental policies and regulations that put forward higher requirements for the sustainable development of enterprises, requiring enterprises to disclose environmental information (Ahmad et al., 2019). The Chinese government has unveiled the "14th Five-Year Plan" (2021-2025), emphasizing high-quality development and the establishment of a green economy. This plan includes a range of environmental targets, such as reducing energy consumption, lowering carbon emissions, and advancing the research and application of environmental protection technologies. The impact of environmental protection policies on China's manufacturing industry is becoming increasingly evident. Policy-driven environmental pressures have necessitated reform for many manufacturing enterprises. For instance, restrictions on carbon emissions, regulations on wastewater treatment, and oversight on the emission of harmful substances have presented significant challenges to manufacturing companies (Feng & Chen, 2018; He et al., 2018).

Simultaneously, green products are gradually emerging as a consumer advantage and a focal point of choice for consumers(Tully & Winer, 2014). Consumers are willing to purchase environmentally friendly products and are even prepared to pay a premium for such products or services. This trend is evident in the explosive growth of new energy vehicles in Europe, the Americas, and Asia, where "green cars" are gaining consumer recognition(Sun et al., 2020). With the evolution of the market, driven by the combined efforts of governments and market forces, businesses are required to achieve economic benefits within the framework of ecological sustainability.

Faced with the pressures of environmental pollution, policy constraints, and societal demands, a segment of scholars in academia believe that addressing environmental issues can be achieved through entrepreneurial activities(Coase, 1974). Entrepreneurship's impact on the environment is multifaceted: On one hand, it may lead to pollution, ecological degradation, and the depletion of non-renewable resources; on the other hand, it can play a pivotal role in addressing environmental issues(Criscuolo & Menon, 2015). Among these perspectives, green entrepreneurship places a significant emphasis on the sustainable development of businesses. While considering short-term profits, it also focuses on value creation and achieving the triple bottom line (economic development, social prosperity, and environmental friendliness). Green entrepreneurship contributes to tackling global environmental issues and climate change, thereby shaping a sustainable future. Similar to traditional entrepreneurship, green entrepreneurship shares common elements such as risk, innovation, and profit. However, green entrepreneurship emphasizes the need for business operators to balance environmental impact and commercial benefits, thereby reducing adverse effects on the environment (Gevrenova, 2015). It is regarded as a form of entrepreneurship that is intrinsically sustainable and a crucial component of sustainable development. The greening of manufacturing activities has become an imperative strategic move for enhancing competitiveness and performance in China's manufacturing sector (Horbach et al., 2012). Nevertheless, many Chinese manufacturing enterprises need a strategic orientation toward green entrepreneurship. Prevailing mindsets are still traditionally profit-oriented, prioritizing economic gains over environmental considerations, and often fail to grasp the significance of green entrepreneurship for sustainable business development.

Green entrepreneurship shares commonalities with traditional entrepreneurship, such as risk, innovation, and profit. However, green entrepreneurship necessitates business operators to strike a balance between environmental impact and commercial benefit, aiming to mitigate adverse effects on the environment (Gevrenova, 2015). It constitutes a sustainable form of entrepreneurship and stands as a pivotal component of sustainable development. The emergence of Green entrepreneurial orientation as a novel topic in the field underscores its capacity to enable enterprises to safeguard the environment while simultaneously attaining economic gains. This orientation garners

sustained attention from academia and business managers (Gast et al., 2017). Forward-thinking enterprises adopting green entrepreneurship as a strategic orientation seek to reduce environmental pollution, thereby enhancing ecological conditions, fostering positive corporate images and reputations, bolstering competitive advantages, improving performance, and promoting sustainable business development (Moyan & Xuejiao, 2022). Many companies are attributing "green," "low-carbon," or "environmentally friendly" labels to their products, leveraging these labels to achieve a dual-win outcome of environmental and economic benefits.

Existing research predominantly focuses on the relationship between Green entrepreneurial orientation and performance, suggesting that it is linked to environmental performance and growth performance (Golicic & Smith, 2013; Orlitzky et al., 2003). Furthermore, the positive impact of green entrepreneurial orientation on a company's financial performance has been well-established (Jiang et al., 2018). However, some studies argue that the direct conversion of green entrepreneurial orientation into firm performance needs to be more evident, with no significant connection between the two (Parrish, 2010). Implementing green entrepreneurial orientation might also lead to additional costs for companies (Hillman & Keim, 2001). Green entrepreneurial orientation enhances innovation advantages for businesses through the improvement of environmentally friendly attributes in products, services, and operational processes (Chen et al., 2006). This innovation advantage can bolster competitiveness, increase market share, and subsequently improve financial performance (Cohen & Winn, 2007; Rennings, 2000). Green entrepreneurial orientation contributes to enhancing a company's reputation and brand image (Miles & Covin, 2000).

Nevertheless, it could lead to increased initial investments for companies. Shifting towards environmentally friendly operational practices, acquiring green equipment, updating technologies, and developing new eco-friendly products may require substantial capital expenditure (Porter & Linde, 1995; Schaltegger, 2002). Within the constraints of limited financial resources, such investments could have short-term adverse effects on a company's competitiveness. These studies collectively underscore that the mechanism through which green entrepreneurial orientation influences performance remains to be seen (Hughes et al., 2018), and there is no unified consensus on whether it

is advantageous for firm performance. A gap exists in the literature regarding potential mediating variables that could impact the relationship between green entrepreneurial orientation and firm performance (Alegre & Chiva, 2013).

Furthermore, enterprises may lack the requisite knowledge and experience to implement the necessary green entrepreneurial orientation, wherein external heterogeneity of knowledge plays a pivotal role (Zhang et al., 2020). Through green supply chain management (GSCM), companies can acquire information about new technologies and practices from suppliers and other business partners, thereby enhancing their environmental performance. GSCM assists businesses in achieving a balance between environmental preservation, economic viability, and social sustainability (Zhu et al., 2013). Concurrently, contemporary market competition is shifting from traditional price and quantity competition to quality and differentiation competition (Beal & Lockamy III, 1999; Makadok & Ross, 2013), as well as supply chain competition. With the escalating demands for environmental responsibility, enterprises need to employ advanced technologies and efficient processes to mitigate their environmental impact (Theyel, 2000).

In comparison to more developed economies, the level of green supply chain management (GSCM) in China's manufacturing industry remains relatively lower. The effectiveness of GSCM implementation is closely tied to an enterprise's strategic orientation. Despite historical conflicts between environmental initiatives and profitability, GSCM offers a win-win solution for resolving the tension between environmental management and business performance (Chen & Chang, 2011). Some scholars argue that green entrepreneurial orientation significantly influences supply chain management. Amid increasing environmental challenges and social responsibility demands, a green entrepreneurial orientation can aid enterprises in gaining a competitive advantage in the market (Schaltegger, 2002; York & Venkataraman, 2010). As a result, whether a positive impact on corporate performance can be achieved through green entrepreneurial orientation via green supply chain management remains to be determined. Hence, the role of green supply chain management should be considered in studying the effects of green entrepreneurial orientation on sustainable performance within the manufacturing industry.

With the rise of the knowledge economy, knowledge has become an indispensable strategic resource for businesses. It plays a pivotal role in enhancing corporate performance, not only by improving performance metrics but also by preventing market obsolescence. Drawing from the resource-based view, some researchers have examined mechanisms for enhancing corporate performance from the perspective of intellectual capital. They contend that intellectual capital contributes to optimizing resource utilization and operational efficiency, reducing negative environmental impacts, and minimizing resource wastage. As a result, it significantly elevates the overall performance of enterprises (Huang & Kung, 2011; Inayat et al., 2022). However, the impact of green intellectual capital on sustainable performance is frequently overlooked.

Furthermore, the significance of contingency theory in entrepreneurship management research is increasingly prominent, especially in topics related to corporate sustainable development, garnering widespread attention from scholars. China is currently undergoing economic and societal transformations (Steele & Lynch, 2013), and businesses often need to navigate paths of survival and growth in an ever-changing and complex environment (Sarasvathy, 2001). Therefore, the greening of China's manufacturing industry faces a dynamic external environment where enterprises require different environmental strategies and decision-making approaches to thrive amid such turbulence. In this context, contingency theory provides entrepreneurial enterprises with a framework to identify and exploit opportunities, shape and select the most fitting strategies, and achieve their sustainable development goals when confronted with environmental challenges (York & Venkataraman, 2010). Contingency theory emphasizes the process of learning and adaptation in organizations. In environmental uncertainty, organizations gradually accumulate experience and knowledge through continuous trial and error and revision, which has an impact on the formation of green intellectual capital. Therefore, combining the power change theory deepens the understanding of the mechanism of the impact of environmental uncertainty on green entrepreneurial orientation and sustainable performance and emphasizes the need for firms to flexibly adjust their strategies to changes in power relations in dynamic and uncertain environments and to continuously optimize the achievement of their sustainable

performance through the accumulation of green capital. The study focuses on the moderating effect of environmental uncertainty, an external uncertainty factor, in the impact of green entrepreneurial orientation on firm performance, which is of more theoretical and practical significance.

This paper, grounded in entrepreneurship theory, systematically reviews relevant literature on green entrepreneurial orientation, sustainable performance, green intellectual capital, green supply chain management, and other related topics. By studying the manufacturing industry, it investigates the mechanism through which green entrepreneurial orientation influences sustainable performance, explores whether green competitive advantage and green supply chain learning act as mediators and examines the potential moderating effect of environmental uncertainty.

1.2 Research Question and Hypothesis

1.2.1 Research Questions

The above studies raise a research question in this section: Whether green intellectual capital and green supply chain management conditionally transmit the effects of green entrepreneurial orientation to sustainable performance on values of environmental uncertainty.

1.2.2 Research Hypothesis

The manufacturing industry holds significant importance for both the national economic development and the enhancement of citizens' quality of life. To foster sustainable enterprise development, elevate the green competitive advantage of businesses, and effectively respond to external environmental changes, the integration of green entrepreneurial orientation must be established as a pivotal corporate developmental strategy. This orientation serves not only to facilitate economic benefits for businesses but also to concurrently yield societal and environmental benefits.

Furthermore, green intellectual capital represents a critical driver for enterprises to promote green supply chain management, consequently enhancing sustainable performance. Within the framework of the hypotheses, it is postulated whether green entrepreneurial orientation will influence corporate sustainable performance through its

impact on both green intellectual capital and green supply chain management, all while being subjected to the effects of environmental uncertainty.

Through the research process involving the exploration of green intellectual capital and green supply chain management, the study aims to investigate the influence of green entrepreneurial orientation on sustainable performance. The following hypotheses can be put forth:

H1: Green entrepreneurial orientation positively affects Sustainable Performance.

H2: Green intellectual capital mediates the relationship between green entrepreneurial orientation and sustainable performance.

H3: Green supply chain management mediates the relationship between green entrepreneurship orientation and sustainable performance.

H4: Green entrepreneurial orientation impacts sustainable performance through green intellectual capital conditionally upon the effect of environmental uncertainty.

H5: Green entrepreneurial orientation impacts sustainable performance through green supply chain management conditionally upon the effect of environmental uncertainty.

1.3 Purpose of the Study

The purpose of this research is to reveal the relationship between green entrepreneurial orientation and sustainable performance and the mediating role of green intellectual capital and green supply chain managements in this relationship. In the face of social, economic, and environmental pressures, business managers must capitalize on development opportunities in order to facilitate the formation of new competitive advantages. This research provides new theoretical ideas and practical guidance for the sustainable development of China's manufacturing industry. Therefore, the specific objectives of this research are as follows:

(1) To investigate the impact of green entrepreneurial orientation on sustainable performance in manufacturing firms.

(2) To investigate the mediating roles of green intellectual capital and green supply chain management between green entrepreneurial orientation and sustainable

performance.

(3) To investigate the impact of green entrepreneurial orientation on sustainable performance through green intellectual capital and green supply chain management with the varying conditions of environmental uncertainty.

1.4 Research Framework

From the hypotheses, the conceptual framework of this dissertation is depicted in Figure 1.1 below:

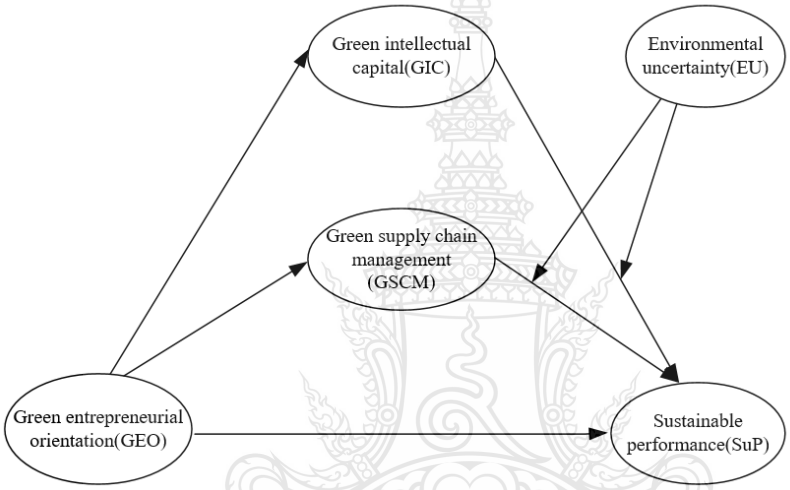


Figure 1.1 Research Framework

1.5 Definitions of Terms

1.5.1 Green Entrepreneurial Orientation

Green entrepreneurial orientation is a strategic approach for businesses that emphasizes the organic integration of environmental sustainability with commercial activities, aiming to achieve the dual objectives of economic growth and ecological equilibrium. This orientation entails the infusion of environmental consciousness into an organization's culture, operational strategies, and dynamic capabilities, leading to reduced resource consumption, minimized environmental pollution, and competitive advantage in the market. Green entrepreneurial orientation goes beyond mere financial profit-seeking; it also places significance on societal and environmental impacts, striving to attain comprehensive sustainable development objectives through innovation, research and development, and collaboration.

1.5.2 Sustainable Performance

Sustainable performance refers to the coordinated, balanced, and integrated efforts of businesses across economic, environmental, and social dimensions aimed at achieving long-term success and prosperity. While pursuing economic objectives, sustainable performance takes into account environmental preservation and social responsibility, ensuring that present-day development does not compromise resources and opportunities for future generations.

1.5.3 Green Intellectual Capital

Green intellectual capital is defined as the cumulative stock of intangible assets, knowledge, experiences, professional skills, and innovative capabilities possessed by organizations or enterprises in the realms of environmental sustainability and eco-friendliness. This concept underscores the value of knowledge and intellectual resources within the context of environmental protection and sustainable development.

1.5.4 Green Supply Chain Management

This paper posits that green supply chain management, as a strategic approach, involves the integration of environmental management strategies and environmental consciousness into various facets of supply chain management. Through collaboration with upstream and downstream suppliers and internal cooperation within the organization, the aim is to minimize the adverse environmental impacts of the entire supply chain across the entire product lifecycle. Simultaneously, this approach seeks to enhance both the environmental and economic performance of the enterprise. Ultimately, the overarching objective is to achieve sustainable development for both the enterprise and its associated supply chain.

1.5.5 Environmental Uncertainty

Environmental uncertainty may be categorized into two primary classifications: technological uncertainty and demand uncertainty. Technical insecurity refers to the need for defined technical standards or a clear understanding of the use of new technologies, which can lead to uncertainty for businesses when selecting and implementing technology. Demand uncertainty pertains to the instability and unpredictability of market demand. The combination of these two types of uncertainties presents problems for

organizations operating in a dynamic environment, necessitating the implementation of flexible response techniques and a high level of flexibility.

1.6 Research Scope

The scope of this research focuses on manufacturing firms. It aims to explore how green entrepreneurial orientation affect firms' sustainable performance through green intellectual capital and green supply chain management under environmental uncertainty. Specifically, this research focuses on manufacturing firms in Sichuan Province, China, which was chosen because of its unique geographical location, rich natural resources, and strong industrial base, which make it play a key role in China's economic development and industrial structure transformation. As the industrial center of Southwest China, the manufacturing industry of Sichuan Province has distinctive regional characteristics and development potential, which can provide a unique research background and practical experience for green development.

This research adopts a combination of qualitative and quantitative analyses with a view to comprehensively understanding the impact of green entrepreneurial orientation on corporate sustainable performance from a multidimensional perspective. Firstly, the qualitative analysis part was conducted through in-depth interviews with 15 senior leaders and industry experts from the manufacturing industry in Sichuan Province to discuss in depth the application and challenges of green entrepreneurial orientation, green intellectual capital, green supply chain management, and environmental uncertainty in corporate strategies and daily operations. This part of the study provides essential theoretical support and practical reference for quantitative analysis. Secondly, the quantitative analysis part collects data through questionnaires in order to further validate and extend the conclusions drawn in the qualitative analysis. The design of the questionnaire is based on the results of relevant literature and in-depth interviews covering the core variables of green entrepreneurial orientation, green intellectual capital, green supply chain management, environmental uncertainty, and sustainable performance. The study adopted a stratified sampling method based on official data from the China Bureau of Statistics to classify the manufacturing industry in Sichuan Province into three main categories: Light textile industry, Resource processing industry, and

Machinery and electronic manufacturing, to ensure the sample's The survey respondents are medium-sized enterprises of various types of manufacturing enterprises. The survey respondents were middle and senior leaders of various manufacturing enterprises, and these respondents were able to provide valuable insights into the strategic decisions, operational management, and concrete implementation of green development in their enterprises.

Through such research design and methodology, this research aims to reveal the role of green entrepreneurial orientation in the sustainable development of the manufacturing industry, and to provide theoretical basis and empirical support for enterprises to formulate more scientific and reasonable green development strategies.

1.7 Organization of the Study

This research is divided into five chapters, primarily investigating how green entrepreneurial orientation influences sustainable performance in enterprises. The research also analyzes the mediating roles of green intellectual capital and green supply chain management in this process, as well as the moderating effects of environmental uncertainty on the relationship between green intellectual capital and sustainable performance and between green supply chain management and enterprise sustainable performance. The research content is structured as follows:

Chapter 1: Introduction

This chapter provides a detailed overview of the research background within the context of green entrepreneurial orientation in the manufacturing industry. It outlines the research questions, objectives, and scope of the study. The Research Framework diagram is presented, and the study's limitations and contributions are discussed.

Chapter 2: Literature Review

The second chapter comprehensively reviews and synthesizes relevant research literature on sustainable performance, green entrepreneurial orientation, green intellectual capital, green supply chain management, and environmental uncertainty. This review serves as the theoretical foundation for the study's hypotheses.

Chapter 3: Methodology

Building on the research questions, hypotheses, and literature reviewed in Chapters 1 and 2, this chapter details the research methodology. Topics covered include research design, survey methods, sampling strategy, measurement properties of chosen scales, data analysis plan, quantitative measurement, and a qualitative study to validate the quantitative findings.

Chapter 4: Empirical Analysis and Results Discussion

Based on the formulated hypotheses, a survey questionnaire is designed, and data is collected from manufacturing enterprises. Utilizing SPSS-PROCESS and SmartPLS 4, the chapter employs analysis to examine the relationship between green entrepreneurial orientation and sustainable performance. Further, it verifies the mediating roles of green intellectual capital and green supply chain management. The chapter also explores the moderating effect of environmental uncertainty, presenting model examination results.

Chapter 5: Conclusion and Future Outlook

By combining the findings of empirical research with existing studies, this chapter concludes the relationships between variables. It highlights the contributions and limitations of the research and offers rational suggestions for the future direction and methods of studies related to green entrepreneurial orientation.

1.8 Contribution of the Study

The manufacturing industry, as a tangible sector, plays an irreplaceable role in societal development and a nation's overall economic progress. However, it is also a significant consumer of energy and a primary source of pollution, leading to an intensifying conflict between economic development and ecological preservation. Addressing this complexity involves strategic orientations that consider both environmental and social factors, integrating enterprise competitive advantages, promoting green supply chain management, and achieving sustainable development. These challenges require in-depth academic research to provide theoretical support and guidance.

Currently, green entrepreneurial orientation in China is in its nascent stage, and relevant management theories still need to be fully developed. Aspects such as

environmental concerns, social impacts, and policy pressures are increasingly pressuring enterprises in their developmental endeavors. This research focuses on data analysis within the manufacturing sector of Sichuan Province, constructing a process model for green entrepreneurial orientation within manufacturing. It elucidates the characteristics of various elements and their interrelationships, thus offering guidance for the sustainable development of the manufacturing industry.

1.8.1 Theoretical Contribution

The research on green entrepreneurial orientation is still in its preliminary stage, with ambiguities in related concepts and disagreements in dimensions and measurement methods. This research constructs a theoretical framework based on the natural resource base view and the theory of weights and measures through both qualitative and quantitative methods to explore in depth the relationship between green entrepreneurial orientation and sustainable performance. The study reveals the role of green intellectual capital and green supply chain management in this relationship and explains the mechanisms through the moderating effect of environmental uncertainty. This research expands the sustainable performance literature, provides theoretical support for the scientific understanding of green entrepreneurial orientation, enriches the theory of green entrepreneurial management and the theory of innovation management, and provides theoretical references for manufacturing enterprises to improve sustainable performance.

In addition, by verifying the positive impact of green intellectual capital and green supply chain management on firms' sustainable performance, this research highlights the criticality of these two factors in the implementation of green entrepreneurial orientation strategies in the manufacturing industry. The findings provide empirical support for further understanding the development of sustainable performance in the manufacturing industry.

1.8.2 Managerial Contribution

This research examines the determinants of sustainable performance of manufacturing industries in Sichuan Province from the perspective of natural resource management. It provides empirical evidence to promote the sustainable development of enterprises. The study examines the impact of green entrepreneurial orientation on firms' sustainable performance, the mediating role of green intellectual capital and green supply

chain management between green entrepreneurial orientation and sustainable performance, and the moderating role of environmental uncertainty. This finding highlights the importance of implementing green entrepreneurship strategies, focusing on environmental uncertainty, strengthening green supply chain management, and enhancing green intellectual capital, which provides strategic guidance for sustainable performance in manufacturing. First, green entrepreneurial orientation provides a practical path for firms to synergize economic growth with environmental protection, and by developing green products and cleaner production technologies, firms can increase profitability and reduce environmental burdens. In addition, green entrepreneurship orientation gives companies innovative and adaptive strategic advantages, enabling them to achieve green transformation and promote sustainable development in the face of environmental uncertainty. Second, the practical application of green intellectual capital and green supply chain management is of great value. Enterprises should pay attention to the cultivation of green intellectual capital, promote green technological innovation through specialized R&D teams, and implement green supply chain management to enhance the environmental standards of their production processes. Finally, the study provides policy references for the government to promote green practices among enterprises, suggesting that measures such as economic incentives, tax breaks, and financial support should be taken to stimulate enterprises' willingness to invest in green investments and to enhance their green entrepreneurial capabilities through publicity and education. These comprehensive measures will not only promote the green transformation of China's manufacturing industry but also enhance the global contribution to environmental protection and sustainable development, creating a win-win situation for both economic benefits and environmental responsibility.

CHAPTER 2
REVIEW OF THE LITERATURE

The article "The Impact of Green Entrepreneurial Orientation on Sustainable Performance", this chapter provides an overview of the literature review, including the concepts and theories of Green Entrepreneurial Orientation, Green Intellectual Capital, Green Supply Chain Management, Sustainable Performance, Environmental Uncertainty, and the theoretical underpinnings of this research. The chapter is organized as follows:

2.1 Sustainable Performance

2.2 Green Entrepreneurial Orientation

2.3 Green Intellectual Capital

2.4 Concepts and Theories Related to Green Supply Chain Management

2.5 Environmental Uncertainty

2.6 Green Entrepreneurial Orientation and Sustainable Performance

2.7 Green Entrepreneurial Orientation, Green Intellectual Capital, and Sustainable Performance

2.8 Green Entrepreneurial Orientation, Green Supply Chain Management, Environmental Uncertainty, and Sustainable Performance

2.9 The Moderating Role of Environmental Uncertainty

2.10 Hypothesized Structural Model

2.1 Sustainable Performance

2.1.1 Sustainability

In the backdrop of economic development, environmental resource degradation, and accelerated urbanization during the 1880s, the concept of sustainable development gradually emerged. In 1987, the World Commission on Environment and Development (WCED) presented the "Our Common Future" report to the United Nations General Assembly, formally introducing the concept and framework of "sustainable development." The report provided the following definition for sustainability: "Development that meets the needs of the present without compromising the ability of

future generations to meet their own needs." This definition garnered widespread international recognition.

In the literature, the definition of sustainability is generally agreed upon as WCED, which encompasses three issues: economic, social, and environmental. Elkingtón (1998) proposed the concept of the Triple Bottom Line for sustainability, which requires equal attention to the three dimensions of economic, social, and environmental sustainability.

2.1.2 Definition of Sustainable Performance

Sustainable development initiatives demand particular attention to ecological rationality within economic activities, and the concept of sustainable performance (SuP) has been implicated in various research domains. As highlighted by Brundtland (1987), sustainable development aims to simultaneously address current societal and economic needs while safeguarding the capacity of future generations to fulfill their requirements. Drumwright (1994) first proposed that enterprises should have a sense of social responsibility and focus on social benefits while pursuing economic benefits.

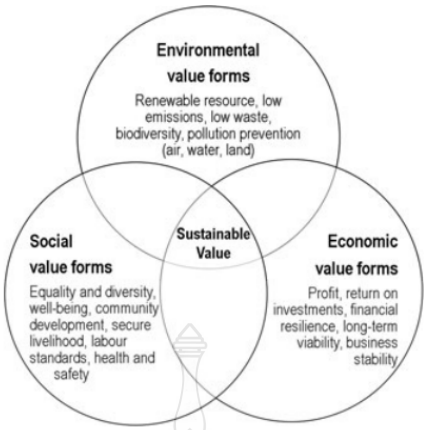
Within the discourse of sustainable development, the concept of sustainable performance (SP) has emerged as a focal point. Sustainable Performance, often referred to as SP, is commonly defined as an enterprise's comprehensive performance across economic, environmental, and social dimensions. It serves as a gauge to assess whether a business has achieved the objectives of sustainable development (Elkington & Rowlands, 1999). Historically, economic indicators held prominence in assessing business development, and research on entrepreneurial orientation predominantly focused on economic metrics (Combs et al., 2005; Ketchen Jr & Bergh, 2006). However, as enterprises progress, a sole reliance on financial indicators becomes inadequate for long-term growth. In response, scholars have advocated the division of performance metrics into financial and non-financial categories (Rauch et al., 2009). Research by Delmas and Toffel (2008) demonstrates that businesses can achieve a dual win of economic and environmental benefits by adopting environmentally friendly practices, which reduce resource consumption and waste emissions. Simultaneously, corporate social responsibility (CSR) constitutes a significant source of sustainable performance. Carroll (1979) introduced the three-dimensional model of social responsibility, emphasizing

economic, legal, ethical, and philanthropic responsibilities. Through proactive fulfillment of social responsibilities, enterprises can enhance employee loyalty, productivity, and performance. Liang and Wang (2019), adopting a stakeholder perspective, investigated the sustainable development performance of Public-Private Partnership (PPP) projects. Baggio and Valeri (2022) explored sustainable performance in tourism family businesses from a network structure viewpoint, noting the challenges faced by smaller family-owned enterprises in terms of scale, innovation, and collaboration.

In summary, this paper contends that sustainable performance denotes the harmonious, balanced, and integrated performance of businesses across economic, environmental, and social dimensions, aiming to achieve long-term success and prosperity. While pursuing economic objectives, it takes into account environmental preservation and social responsibility, ensuring that present-day development does not compromise resources and opportunities for future generations.

2.1.3 Importance of Sustainable Performance

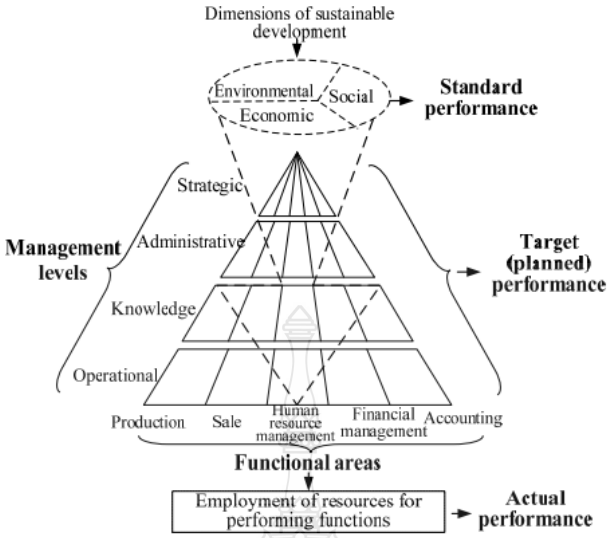
Considering the tripartite bottom line, sustainable performance not only pursues economic benefits but also emphasizes social responsibility and environmental protection. Enterprises need to address employee and societal concerns alongside economic growth while also striving to minimize adverse impacts on the environment. By harmonizing these three bottom lines, sustainable performance endeavors to achieve mutual growth in economic, environmental, and social value, thereby fulfilling the objectives of sustainable development. In this context, the bottom lines refer to the minimum return on investment for capital investors or the minimum level of performance (Evans et al., 2017), as illustrated in Figure 2.1.



Source: Evans et al. (2017)

Figure 2.1 Sustainable Value Expression of the Triple Bottom Line Principle

The Triple Bottom Line emphasizes an enterprise's performance across three dimensions: the profit bottom line, the people bottom line, also referred to as the social bottom line, and the planet bottom line, commonly known as the environmental bottom line. As global environmental issues become increasingly urgent, businesses must enhance their awareness of environmental responsibilities and actively implement measures to mitigate adverse impacts on the environment. Maintaining a solid environmental performance not only contributes to elevating a company's competitiveness and market image but also garners recognition from governments, clients, and investors, consequently fostering additional business opportunities and resources for the enterprise. According to the perspective of Ciemleja and Lace (2011), companies undergoing transformation driven by sustainable development are closely tied to the process of achievement and its evaluation. This is chiefly reflected in the following aspects: 1) at the corporate management level, particularly in the realms of strategy and knowledge management, and 2) across various functional areas, with a pronounced emphasis on the role of individuals as constituents of social capital. Their approach for measuring corporate performance in the context of sustainable development is presented, and this methodology is applied across different tiers of corporate management and various functional spheres, as elaborated in Figure 2.2.



Source: Ciemleja and Lace (2011)

Figure 2.2 Transformation of Corporate Sustainable Development

Ciemleja and Lace (2011) proposed a measurement system for sustainable performance and emphasized that there are variations among industries and enterprises (such as leadership style, company size, and strategic orientation). They assert that companies should consider these three dimensions and tailor a performance measurement framework that aligns with their unique circumstances and supports sustainable development goals. Additionally, scholars have extensively researched factors influencing environmental performance. Environmental management and resource utilization are two critical aspects in this regard. Several studies have found that companies implementing ISO 14001 environmental management system certification tend to exhibit superior environmental performance (Arocena et al., 2021). Moreover, optimizing resource utilization efficiency is an effective means of enhancing environmental performance. Through measures like energy conservation, emissions reduction, and recycling, enterprises can curtail energy and resource consumption, reduce waste emissions, and consequently minimize adverse environmental impacts.

2.1.4 Factors Affecting Sustainable Performance

Habib et al. (2020) conducted research that demonstrates the positive impact of green supply chain management on corporate performance. Their findings also suggest the presence of a mediating effect of market orientation between Green entrepreneurial orientation and green supply chain management.

Fatoki (2019) comprehensively defined corporate sustainable performance across the dimensions of finance, social engagement, and environmental impact. The study substantiated a constructive influence of Green entrepreneurial orientation on a firm's financial performance. This orientation facilitates the exploration of novel avenues within the realm of environmental opportunities, accentuating the indispensable role of innovation in the trajectory of business development. Conscientious recognition of the paramount significance of green innovation in the context of sustainable corporate progression remains pivotal for achieving triumphant outcomes.

Afum et al. (2023), focusing their inquiry on small and medium-sized enterprises (SMEs), contended that resource scarcity amplified the challenges faced by SMEs in cultivating competitive advantages. The authors posit that an orientation toward sustainable entrepreneurship proved advantageous for the establishment of environmental and social performance dimensions among SMEs. They further advocated for governmental enactment of incentive policies to safeguard the interests of environmentally salient SMEs, concurrently serving as exemplary for industry-wide best practices.

Muangmee et al. (2021) conducted an empirical analysis of Thai enterprises' components and, in conjunction with the resource-based view theory, formulated a theoretical model. Their study substantiates the pivotal role of green innovation as a constituent of both economic and environmental performance. Furthermore, the research unveils the positive impact of green entrepreneurial orientation on green innovation. The authors assert that corporate performance should not be solely centered on economic aspects; instead, social and environmental performance hold considerable significance.

Ameer and Khan (2022) primarily delved into the impact of green entrepreneurial orientation on corporate environmental performance. They contended that the relationship between these two variables lacked mediating effects, further expounded upon the involvement of organizational factors.

Yadegaridehkordi et al. (2023) contend that corporate sustainable performance is characterized by complexity and multidimensionality, rendering linear expressions inadequate. In light of this, they employ the SEM-ANN method for in-depth exploration. Their study reveals that green innovation exerts a positive influence on environmental and social performance. Green innovation achieves this by operationalizing novel technologies and creating environmentally friendly products to mitigate adverse environmental impacts. However, its discernible impact on sustainable financial performance remains unclear. Further analysis uncovers that a majority of businesses in Malaysia still perceive a rise in operational costs due to the implementation of green entrepreneurial orientation.

Ameer and Khan (2020) analyzed the manufacturing sector and revealed a previously overlooked aspect in the realm of corporate performance, the influence of managerial age. Their study posits that younger managers exhibit heightened acumen in recognizing sustainable opportunities, directing their attention toward strategies related to green entrepreneurial orientation. Additionally, these younger managers demonstrate a proclivity for risk-taking and venturesome actions, embracing cleaner technologies. This tendency contributes to the maintenance of customer loyalty. Employing younger managers and decision-makers emerges as one of the methods to address the conflict between pursuing corporate sustainable performance and mitigating environmental pollution within the manufacturing industry.

Chen et al. (2023) delved into the context of corporate sustainable development amid evolving lifestyles, where the burgeoning demand for green alternatives extended across various domains, including consumption, attire, habitation, and transportation. Their analysis underscored the pivotal role of green entrepreneurial orientation in enterprise advancement. They argued that through the development of diverse, innovative technologies, businesses could enhance both economic and environmental benefits, thereby exerting a positive influence on financial performance.

Alfandi and Bataineh (2023) contend that the tourism and hospitality sectors pose environmental risks and require novel operational models to foster industry sustainability. They posit that entrepreneurial orientation constitutes an intangible resource aiding enterprises in identifying and capitalizing on opportunities. However, they note that enhancing green products could impact material performance. Operational managers can

bolster their competitive edge by augmenting knowledge management related to green practices.

Fang (2022) asserted that sustainable corporate performance was influenced by a multitude of factors, given the complexity of enterprise resources. Organizational dynamic capabilities were recognized as intangible assets, vital for navigating external environmental changes and fostering sustainable operations. These dynamic capabilities were instrumental in maintaining competitive advantages through the effective utilization of diverse resources. Additionally, the study demonstrated the mediating role of boundary-spanning research in the relationship between Chief Executive Officers (CEO) and Sustainable Performance (SP), emphasized that enterprises were inclined to opt for boundary-spanning search (BSS) to enhance their operational efficacy and overall management.

Abbade et al. (2014) contended that while social performance had a substantial and immediate impact on economic performance in the short term, the influence of environmental performance on economic performance became more pronounced over the long term. Therefore, enterprises should have recognized the significance of non-economic aspects such as social and environmental performance and formulated appropriate strategies to attain sustainable economic benefits.

Latan et al. (2018) suggested that environmental uncertainty affected every company, primarily manifested through ecological uncertainty and market unpredictability. Environmental Management Accounting (EMA) can furnish environmentally relevant information to business managers confronting environmental uncertainty, facilitating effective decision-making and subsequently influencing environmental performance.

Chin et al. (2014) proposed that small and medium-sized enterprises. confronted intensified external competition, necessitating close collaboration with upstream and downstream entities within the supply chain to acquire the latest concepts, technologies, and materials. This strategic approach served to mitigate the impact of environmental uncertainty. The study further demonstrated the moderating role of environmental uncertainty in the relationship between External Integration and firm performance.

Aman et al. (2023) examined performance measurement indicators and recommended supply chain risk management, filling a gap in this research area. They proposed that relevant risk management practices assisted in risk mitigation and offered fresh

insights for measuring firm performance. They developed a framework for the dimensions of firm performance.

Yan and Yan (2017) contend that small enterprises require collective creativity to find novel approaches in response to environmental uncertainty and market changes, facilitating effective avenues for performance enhancement. Their study verified that collective entrepreneurial capability has a more significant impact on firm performance in dynamically changing environments. However, this research omitted the influence of other variables such as company age, size, and managerial characteristics.

Saputra et al. (2023) employed structural equation modeling to investigate the impact of green competitive advantage on sustainable performance, with environmental management accounting serving as a mediator. However, the sample size was relatively small, and further substantiation of their relationship is possible.

Yusliza et al. (2020) underscored the significance of green intellectual capital in addressing environmental concerns, a facet often overlooked in its influence on sustainable performance. Their study focused on the Malaysian manufacturing industry, establishing a new path for achieving sustainable development.

Martínez-Falcó et al. (2023) conducted an in-depth analysis of the Spanish wine industry, emphasizing the importance of intangible assets in sustainable development. They demonstrated the enhancing role of green intellectual capital in sustainable performance (triple bottom line), with green supply chain management acting as a mediator. Furthermore, they introduced a novel moderating variable, green agriculture, in the relationship between green supply chain management and sustainable performance.

Mahmood and Nasir (2023) emphasized the crucial role of green human resource management practices in fostering environmentally responsible behavior among employees and enhancing organizational outcomes. Implementing green policies necessitated effective management and training of personnel, underscoring the significance of green human resource management for organizational leaders. Simultaneously, the development of green intellectual capital to address environmental and social challenges became imperative for improving environmental and economic performance.

Inayat et al. (2022) studied the influence of green intellectual capital on sustainable performance in small and medium-sized enterprises. They align with the World Commission

on Environment and Development's (WCED, 1987) perspective on sustainable development, emphasizing the need to consider the impact of current economic and social development on future generations, especially concerning the environment. This approach advocates a comprehensive assessment of economic, social, and environmental performance.

Chin et al. (2015) regard green supply chain management as an environmental innovation that integrates environmental protection, pollution reduction, and energy conservation into supply chain management. They highlight the pivotal role of green supply chains in influencing a company's environmental impact.

Zaid et al. (2018) explored the linkage between bundled green human resource management practices and green supply chain management (both external and internal practices) and their impact on sustainability performance. The study utilized a quantitative approach and conducted a tailored survey among 121 companies in the most environmentally challenged food, chemical, and pharmaceutical manufacturing industries in Palestine. After data collection, the researchers applied partial least squares structural equation modeling for data analysis.

Hassan et al. (2016) assert that a green supply chain encompasses various activities within a company, such as cooperation and coordination with different suppliers and customers to mitigate the impacts related to green logistics or product information. They proposed a conceptual framework suggesting a positive relationship between green supply chain management and sustainable performance.

Radu (2012) engaged in an in-depth consideration of sustainable development, suggesting that integrating the core principles of the balanced scorecard could enhance a company's sustainable development efforts. This integration involves contemplating environmental and social management and applying them to corporate management, thereby guiding strategic organizational transformation.

The summarized research findings are presented in Table 2.1.

Table 2.1 Factors Influencing Sustainable Performance

	Habib et al. (2020)	Fatoki (2019)	Afum et al. (2023)	Muangmee et al. (2021)	Ameer and Khan (2022)	Yadegaridehkordi et al. (2023)	Ameer and Khan (2020)	Chen et al. (2023)	Alfandi and Bataineh (2023)	Fang (2022)	Abbade et al. (2014)	Latan et al. (2018)	Chin et al. (2014)	Aman et al. (2023)	Yan and Yan (2017)	Saputra et al. (2023)	Yusliza et al. (2020)	Martínez-Falcó et al. (2023)	Mahmood and Nasir (2023)	Inayat et al. (2022)	Chin et al. (2015)	Zaid et al. (2018)	Hassan et al. (2016)	Radu (2012)	Total
Green entrepreneurial orientation	/	/		/	/	/		/	/	/															8
Market orientation	/					/																			2
Sustainable Firm Performance	/																								1
Green radical product innovation			/																						1
Sustainable entrepreneurship orientation			/				/																		2
Sustainable supply chain management			/																						1
Green innovation				/		/																			2
Leadership commitment						/																			1
Stakeholder pressure						/																			1
Manager's Age							/																		1
Entrepreneurs' characteristics								/																	1
Knowledge management									/																1
Environmental dynamism										/															1
Boundary-spanning Search										/															1
Entrepreneurial orientation											/														1
Environmental Uncertainty												/	/		/										3
Effects of Environmental Strategy												/													1
Top Management's Commitment												/													1

Table 2.1 Factors Influencing Sustainable Performance (Cont.)

	Habib et al. (2020)	Fatoki (2019)	Afum et al. (2023)	Muangmee et al. (2021)	Ameer and Khan (2022)	Yadegaridehkordi et al. (2023)	Ameer and Khan (2020)	Chen et al. (2023)	Alfandi and Bataineh (2023)	Fang (2022)	Abbade et al. (2014)	Latan et al. (2018)	Chin et al. (2014)	Aman et al. (2023)	Yan and Yan (2017)	Saputra et al. (2023)	Yusliza et al. (2020)	Martínez-Falcó et al. (2023)	Mahmood and Nasir (2023)	Inayat et al. (2022)	Chin et al. (2015)	Zaid et al. (2018)	Hassan et al. (2016)	Radu (2012)	Total
Environmental Management Accounting												/													1
External Integration													/												1
Supply Chain Uncertainty Management														/											1
Supply Chain Risk Management														/											1
Collective Entrepreneurship															/										1
Green Intellectual Capital																	/	/	/	/					4
Green Supply Chain Management	/																	/			/	/	/		5
Green Agriculture																		/							1
Green Behaviour																			/						1
Green Human Resource Management Practises																			/						1
Green Absorptive Capacity																				/					1
Green Dynamic Capabilities																				/					1
Environmental Collaboration																					/				1
Green Human Resource Management																						/			1
Supply Chain Integration																							/		1

Table2.1 Factors Influencing Sustainable Performance (Cont.)

	Habib et al. (2020)	Fatoki (2019)	Afum et al. (2023)	Muangmee et al. (2021)	Ameer and Khan (2022)	Yadegaridehkordi et al. (2023)	Ameer and Khan (2020)	Chen et al. (2023)	Alfandi and Bataineh (2023)	Fang (2022)	Abbade et al. (2014)	Latan et al. (2018)	Chin et al. (2014)	Aman et al. (2023)	Yan and Yan (2017)	Saputra et al. (2023)	Yusliza et al. (2020)	Martínez-Falcó et al. (2023)	Mahmood and Nasir (2023)	Inayat et al. (2022)	Chin et al. (2015)	Zaid et al. (2018)	Hassan et al. (2016)	Radu (2012)	Total
Sustainability Balanced Scorecard																								/	1
Organizational Change																								/	1

Based on the table, it can be observed that scholars have investigated sustainable performance from various angles and variables. Among the 24 scholars, including Habib et al. (2020), Fatoki (2019), Afum et al. (2023), Muangmee et al. (2021), Ameer and Khan (2022), Yadegaridehkordi et al. (2023), Ameer and Khan (2020), Chen et al. (2023), Alfandi and Bataineh (2023), Fang (2022), Abbade et al. (2014), Latan et al. (2018), Chin et al. (2014), Aman et al. (2023), Yan and Yan (2017), Saputra et al. (2023), Yusliza et al. (2020), Martínez-Falcó et al. (2023), Mahmood and Nasir (2023), Inayat et al. (2022), Chin et al. (2015), Zaid et al. (2018), Hassan et al. (2016), Radu (2012), the focus of research has predominantly centered around the impacts of Green entrepreneurial Orientation, Environmental Uncertainty, Green Intellectual Capital, and Green Supply Chain Management on sustainable performance. Thus, this research will delve into the influence pathways of these variables on sustainability.

2.1.5 Study of Relevant Indicators for Sustainable Performance

Radu (2012) asserted that organizations aspiring to sustainable development needed to emphasize their interaction with other entities and collectively analyzed interpretations of responsibility and performance. Prioritizing the interplay of environmental, economic, and social factors while enhancing energy utilization efficiency could bring long-term or short-term value to business operations. He underscored the need for knowledge-based economic development to achieve the goal of sustainability.

Alfandi and Bataineh (2023) analyzed the tourism industry, emphasizing the consideration of short-term benefits from a financial perspective while also contemplating the long-term development of enterprises from the same viewpoint. As environmental concerns gain prominence, the evaluation of corporate performance has undergone a shift, applying a sustainable perspective to performance assessment and considering the interplay of environmental, economic, and social factors, which is the essence of sustainable performance.

Caiado et al. (2019) highlight the influence of economic, environmental, and social aspects on the green supply chain and stress the importance of considering all three dimensions for enhancing performance. They emphasize that choosing suppliers should

encompass a comprehensive assessment of internal and external social standards and other related factors.

Govindan et al. (2013) emphasized the impact of economic, environmental, and social dimensions on the green supply chain and highlighted the necessity of considering all three aspects to enhance performance. They also stressed that the selection of suppliers should encompass various factors, including internal and external social standards.

Habidin et al. (2015) conducted a study on the sustainable performance of the Malaysian automotive industry across three dimensions. Their research delved into the measurement methods for these dimensions, aiding scholars in gaining a deeper understanding of sustainable performance and expanding its applicability.

Ciemleja and Lace (2011) proposed a comprehensive measurement of performance that incorporates the entire lifecycle of a company. They advocated for a systematic approach to measurement and management. Focusing on small and medium-sized enterprises (SMEs), they argued that integrating social, economic, and ecological aspects into business activities is crucial for achieving sustainable development goals.

Zaid et al. (2018) analyzed the sustainable performance of the most heavily polluted manufacturing industries in Palestine. Their research explored the influence of green human resource management and green supply chain management on sustainable performance. They suggested that future research could investigate different types of supply chains while acknowledging the limitations of measurement methods. They also proposed using in-depth interviews for exploratory technical research.

Li (2014) discussed the impact of green innovation on sustainable development performance and analyzed sustainable development performance from three dimensions: economic performance, environmental performance, and social performance. This research compiled the various dimensions of sustainable performance from different literature sources (see Table 2.2).

Table 2.2 Measurement of Sustainable Performance across Different Dimensions

	Radu (2012)	**Alfandi and Bataineh (2023)**	**Caiado et al. (2019)**	**Govindan et al. (2013)**	**Habidin et al. (2015)**	**Ciemleja and Lace (2011)**	**Zaid et al. (2018)**	**Li(2014)**	**Total**
Economic performance	/	/		/	/	/	/	/	7
Environmental performance		/		/	/		/	/	5
Social performance	/	/		/		/	/	/	6
Ecological performance	/					/			2
CSR performance					/				1
Environmental protection			/						1
Cost performance			/						1
Supplier relations			/						1
Corporate reputation			/						1
Quality management			/						1

Based on the table, different scholars have categorized the sustainable performance of businesses into various dimensions based on their research characteristics. Among the seven scholars, including Radu (2012), Alfandi and Bataineh (2023), Caiado et al. (2019), Govindan et al. (2013), Habidin et al. (2015), Ciemleja and Lace (2011), Zaid et al. (2018), and Li (2014), a common theme is the application of the Triple Bottom Line theory to study sustainable performance. The top-ranked dimensions are typically economic performance, environmental performance, and social performance, emphasizing the importance of comprehensive benefits, environmental innovation, social responsibility, and shared value in the process of sustainable development for businesses. Therefore, this research will focus on investigating green

entrepreneurial orientation from these three dimensions. Therefore, the structure of SuP is shown in Figure 2.3 shown.

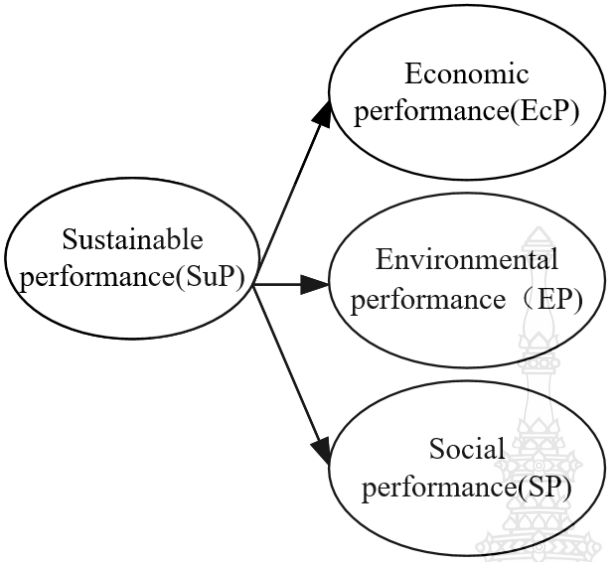


Figure 2.3 Sustainable Performance Framework

(1) Economic Performance

The economic performance of a business encompasses all components of its economic transactions, including both the traditional indicators used in financial management and accounting, as well as intangible aspects that are not typically measured in financial terms. Economic performance forms the foundation for a business's robust development and emphasizes the maintenance of a healthy economic state. It comprises both financial performance and contributions to the economic system. This type of performance is reflected in the ability to generate profits and growth, focusing on financial condition, profitability, market position, and asset efficiency. Economic performance stands as a core indicator of a business' competitiveness and profitability, requiring continuous enhancement to navigate competition. In an intensely competitive environment, economic solid performance bolsters competitive positioning, providing the financial support needed for expansion and investment.

(2) Environmental Performance

Environmental performance not only concerns a business's operations and development but is also closely tied to the increasing societal focus on environmental

responsibility. Environmental performance refers to a business's ability to impact the environment and assume responsibility for its actions during its operations. Enhancing environmental performance has become one of the critical elements of sustainable business development (Arocena et al., 2021). It is a measure of a company's performance and achievements in environmental conservation. This encompasses a company's efficiency in resource utilization, waste emissions, and carbon footprint, as well as its compliance with environmental regulations (Russo & Fouts, 1997). In summary, environmental performance plays a pivotal role in a company's sustainable development. By adopting effective environmental management measures, optimizing resource efficiency, and addressing the environmental impacts of the supply chain, businesses can enhance their environmental performance, fulfill their environmental responsibilities, and gain a competitive edge in the increasingly competitive market.

(3) Social Performance

Social performance encompasses a business's efforts to enhance employee welfare, engage in community activities, support charitable causes, and comply with social responsibilities and ethical standards (Waddock & Graves, 1997). It refers to a business's ability to create positive impacts and contributions to society during its operations. Contemporary businesses increasingly emphasize social performance, defining it as the capacity to generate positive impacts and contributions to society throughout their operations (Porter & Kramer, 2006). It is a measure of a company's performance and achievements in fulfilling social responsibilities and creating social value, covering contributions to employee welfare, community support, charitable donations, environmental stewardship, and more. Social performance not only concerns a business's operations and development but is also closely tied to the sustainable development of society.

Enhancing social performance has become one of the critical elements of sustainable business development. A growing body of research suggests that having strong social performance not only enhances a company's public image and reputation but also earns recognition from governments, customers, and investors, leading to more business opportunities and resources (McWilliams & Siegel, 2001). With increasing societal focus on corporate social responsibility, businesses must strengthen their

understanding of societal needs and actively take measures to enhance their social performance. Scholars have extensively investigated the factors that influence social performance. Among them, corporate governance and leadership decisions are considered vital factors affecting social performance. Some studies find that effective corporate governance and leadership decisions facilitate proactive social responsibility and value creation (Bansal & Song, 2017).

Furthermore, employee involvement and engagement have been proven practical way to enhance social performance. Employee participation in social welfare and charitable activities contributes to establishing a positive image and reputation in society (Maignan & Ferrell, 2000). Additionally, community support is a critical component of social performance. Active engagement in community affairs and supporting local education, culture, and environmental preservation activities allows businesses to establish strong ties with the community, increasing social identity and trust (Clarkson, 1995).

In summary, social performance plays a pivotal role in a company's sustainable development. Social solid performance not only enhances a company's public image and reputation but also earns recognition from governments, customers, and investors, leading to more business opportunities and resources.

2.2 Green Entrepreneurial Orientation

2.2.1 Entrepreneurial Orientation Concept

Green entrepreneurial orientation (GEO) emerges from the amalgamation of entrepreneurial orientation theory and green entrepreneurial. The study of entrepreneurial orientation originated in the 1970s, with pivotal scholars underscoring the determination and capabilities for corporate innovation. Entrepreneurial orientation denotes the competitive advantage gained by firms within intricate market environments, wherein managerial leaders orchestrate organizational resources to explore or craft novel developmental prospects (Covin & Miles, 1999). Entrepreneurial orientation encapsulates a strategic approach adopted by business proprietors; a concept first introduced by Miller (1983). He postulated that innovation-driven enterprises must embrace calculated risks and proactively innovate to outmaneuver rivals. Companies

exhibiting heightened entrepreneurial orientation have an incline toward delivering innovative products in pioneering and audacious ways or furnishing services to enhance competitiveness and expand market share.

2.2.2 The Concept and Definition of Green Entrepreneurial

Green entrepreneurial endeavors stem from entrepreneurial theory, and with the evolution of the economy, they represent a fresh entrepreneurial model geared towards addressing environmental pollution and energy consumption through the application of green processes (Criado-Gomis et al., 2018). Green entrepreneurial pursuits underscore concepts of environmental sustainability and social responsibility, aiming to seamlessly blend economic growth with ecological equilibrium through innovation and sustainable operational practices. Green entrepreneurs uphold the values of environmental conservation, sustainable development, and societal welfare, dedicating themselves to resource efficiency, pollution reduction, and the advancement of the green industry via innovative, technologically applied, and responsible operational practices (ME Porter & C van der Linde, 1995). Within the ambit of Green entrepreneurial undertakings, businesses no longer single-mindedly pursue economic profits but rather integrate environmental and social responsibility as fundamental tenets of their operations. This entrepreneurial orientation emphasizes efficient resource utilization and environmental preservation, aligning with the contemporary societal clamor for sustainable development (Spani, 2020).

As a novel entrepreneurial approach, Green entrepreneurial ventures diverge from conventional methods, and Green Enterprises diverge from their traditional counterparts. Green Enterprises are not exclusively preoccupied with short-term profits. Green entrepreneurs aspire to strike a balance between ecological, economic, and societal aspects (Garcés-Ayerbe et al., 2022). However, the ecological emphasis is the crux of competitiveness. Scholars have undertaken profound analyses of the pivotal components and motivations driving Green entrepreneurial endeavors (Gast et al., 2017; Kirkwood & Walton, 2014). Grounded in resource theory, this research scrutinizes the influence of Green entrepreneurial orientation on green innovation within the manufacturing sector of Sichuan Province. Moreover, it predominantly examines the impact of Green entrepreneurial orientation on a company's social, economic, and environmental benefits.

In summation, green entrepreneurial endeavors exhibit a dual impact on both the ecological environment and market dynamics, thereby carrying substantive significance in the realms of environmental conservation and business pursuits. From a societal perspective, green entrepreneurial assumes the role of an innovative archetype, emblematic of broader societal commitment towards reshaping conventional commercial paradigms, refining economic frameworks, and catalyzing the surge of the green ecological revolution.

2.2.5 Indicators of Green Entrepreneurial Orientation

Green entrepreneurial orientation holds significant importance in achieving global sustainable development goals, making it a valuable application for entrepreneurs and businesses in their operational decisions.

Golsefid-Alavi et al. (2021) suggest that entrepreneurship as a distinct field of study has needed more integration with the environment. The introduction of green entrepreneurial orientation has notably spurred the development of the intersection between entrepreneurship and environmental studies. However, there remains a dearth of research within the academic sphere concerning the interplay among entrepreneurship, sustainability, and the environment. The author extensively reviews pertinent literature centered around entrepreneurship themes (such as green entrepreneurship, entrepreneurial orientation, and sustainable entrepreneurship), ultimately presenting a conceptual framework for the internal and external factors influencing green entrepreneurial orientation.

Habib et al. (2020) conducted an in-depth analysis of the pathway between green entrepreneurial orientation and sustainable performance, affirming its impact on economic, environmental, and social performance. The study suggests that firms implementing Green entrepreneurial orientation can leverage dynamic capabilities to identify market opportunities, enhance strategic and decision-making abilities, and engender environmentally friendly activities, thereby furthering sustainable business practices. However, the research only considered the influence of mediating effects while neglecting the...

Jiang et al. (2018) propose that Green entrepreneurial orientation can enhance performance (financial, social, environmental) through three mechanisms -

innovativeness, proactiveness, and risk-taking. It is a dynamic capability that fosters innovation through open-minded thinking, facilitates competitive advantage formation under uncertain conditions, and provides recommendations for knowledge transfer and integration.

Fang (2022) studied small and medium-sized enterprises in the manufacturing sector. The research indicates that successful implementation of Green entrepreneurial orientation for these enterprises requires accurate strategic positioning, balancing economic, social, and environmental factors, enhancing cross-boundary search capabilities, and transcending organizational boundaries to access additional resources, enabling survival and growth within incentivized environments.

Xia (2019) contends that entrepreneurial orientation encompasses both market and environmental orientations, requiring increased resource allocation from enterprises. However, the influence of this strategic position on sustainable performance and competitive advantage remains unclear. To address this gap, the study delves into and demonstrates the significant impact of green entrepreneurial orientation on sustainable performance, introducing the concept of opportunity-resource integration.

Xiang Fenglin (2021) posits that green entrepreneurial orientation involves exploring sustainable entrepreneurial opportunities in the absence of market mechanisms. Entrepreneurs can leverage these opportunities to address environmental issues while attaining economic benefits. The author defines green entrepreneurial orientation based on the dimensions of green innovativeness, proactiveness, risk-taking, and environmental orientation.

Xianjiang (2018) stated that green entrepreneurial orientation was a strategy in which firms engaged in green product market innovation to cater for profitability and environmental protection needs. In this strategy, firms were willing to take risks and make forward-looking innovations to combat competitors and expand into new markets, creating a green eco-revolution.

Consequently, the research further analyzes the dimensions of green entrepreneurial orientation. The measurement dimensions for green entrepreneurial orientation, as depicted in Table 2.3, are derived from the literature above.

Table 2.3 Measurement Dimensions of Green Entrepreneurial Orientation

	Golsefid-Alavi et al. (2021)	Habib et al. (2020)	Jiang et al. (2018)	Fang. (2022)	Xia (2019)	Xiang Fenglin (2021)	Xianjiang (2018)	TOTAL
Green risk taking	/	/	/			/	/	5
Green innovativeness	/	/				/	/	4
Green proactiveness	/						/	2
Green Opportunity Orientation	/							1
Green action plan		/						1
Green vulnerability		/						1
Green innovation			/					1
Market proactiveness			/					1
Green innovation orientation				/				1
Green initiative orientation				/		/		2
Environmental orientation				/	/	/		3
Social Orientation				/				1
Market orientation					/			1

From the table, it is evident that scholars have researched green entrepreneurial orientation from various perspectives and variables. Among the six scholars, including Golsefid-Alavi et al. (2021), Habib et al. (2020), Jiang et al. (2018), Fang (2022), Xia (2019), Xiang Fenglin (2021), and Xianjiang (2018), the dimensions of Green Risk Taking, Green Innovativeness, and Environmental Orientation are notably prominent in terms of their impact on sustainable performance. Based on the current research compilation, these dimensions are at the forefront. As a result, this research will focus on exploring the pathways through which these variables influence sustainability. Therefore, the structure of GEO is shown in Figure 2.4.

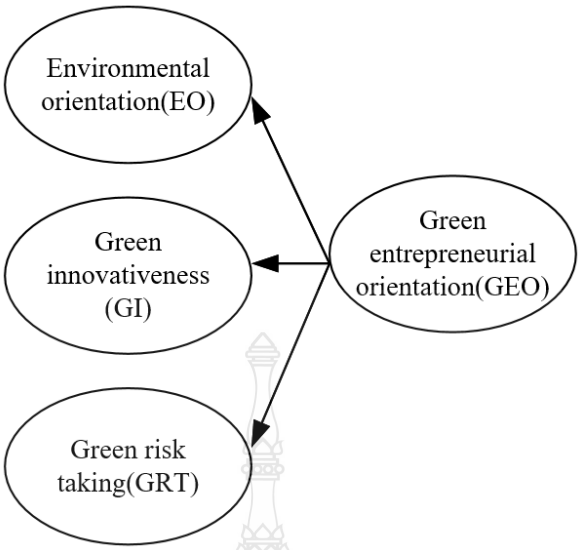


Figure 2.4 Green Entrepreneurial 0rientation Framework

(1) Environmental Orientation

Environmental orientation is a core characteristic of green entrepreneurial orientation, reflecting the heightened attention of green entrepreneurs toward environmental sustainability. Kai (2011) defines environmental orientation as the incorporation of environmental considerations into the strategic institutional process of a business. From an opportunity recognition perspective, this strategic orientation involves the development and marketing of green products to reduce pollution and enhance environmental sustainability. Green entrepreneurial orientation encompasses both economic and ecological benefits in a company's decision-making process. Dean and McMullen (2007) posit that green entrepreneurship involves recognizing and leveraging environmentally related opportunities when market mechanisms fail. Against the backdrop of ecological demands, environmental orientation manifests as positive impacts of entrepreneurial activities on the environment, contributing to the achievement of sustainable development goals.

Environmental orientation is manifested through green entrepreneurs' efforts to reduce environmental impacts, diminish pollutant emissions, and promote the use of clean energy and green technologies in product design, production processes, and resource utilization. Huajing (2015) defines environmental orientation as businesses adopting

environmental management as a goal to enhance environmental quality and promote sustainability, integrating it into their entrepreneurial processes.

In summary, environmental orientation entails businesses actively assuming environmental responsibility while considering shareholder interests in their production and operational activities. This involves adopting green actions to protect the ecological environment.

(2) Green Innovativeness

Under the umbrella of green entrepreneurial orientation, the innovation orientation dimension reflects a business's inclination toward green products, services, and market opportunities. This includes the birth of novel green concepts, enthusiasm for research and development, and the launch of innovative green products. It embodies a company's ability to swiftly and accurately grasp green intentions and anticipate forward-looking opportunities. Pearce and Ensley (2004), in their longitudinal study, found a cross-impact relationship between innovation efficacy and shared vision within innovation teams focusing on product and process innovation. The enhancement of innovation efficacy fosters shared vision, which in turn promotes innovation efficacy. The success of green entrepreneurship significantly hinges on innovativeness. Innovativeness refers to the introduction of new ideas and methods by green entrepreneurs in products, services, and business models to address existing environmental and societal issues. Green entrepreneurs continuously explore new technologies and methods to harmonize economic development with environmental preservation. According to research, green entrepreneurs often adopt innovative financing methods like venture capital and social capital to support their entrepreneurial projects. Innovativeness is regarded as a crucial factor in enhancing a firm's competitive advantage and is deemed intrinsic to entrepreneurial orientation, noted for its non-imitability (Covin & Miles, 1999).

It is worth noting that green innovation differs in emphasis from conventional innovation and is considered more intricate. In summary, green innovativeness refers to the act of utilizing market opportunities related to environmental conservation for innovative actions. This encompasses the development of new green products, the introduction of clean production technologies, and the cultivation of green human capital.

(3) Green Risk Taking

Green entrepreneurs face numerous challenges and risks, and their willingness to undertake these risks is a vital characteristic of green entrepreneurship. These entrepreneurs often need to invest significant amounts of capital, time, and resources, confronting risks like technological immaturity and market uncertainty. However, they believe that through innovation and persistence, they can achieve a win-win scenario for both the economy and the environment. Green entrepreneurs typically encounter pressures from funding shortages and market competition. Even with these risks, they still uphold their environmental principles. They are willing to shoulder these risks and contribute to creating a more sustainable future.

When traditional business models undertake new tasks, companies relying on internal resources inevitably introduce institutional risks. Investment projects are inherently uncertain, and risk-taking reflects the proactive strategies employed when engaging in highly uncertain investments (Jiang et al., 2018). Enterprises participating in green product innovation bear certain risks associated with competitors and market expansion strategies (Xianjiang, 2012).

In summary, green entrepreneurial orientation entails unpredictable and risk-laden entrepreneurial behavior. Entrepreneurs execute the entire process, from opportunity recognition and resource acquisition to the implementation of business plans for company development. Risk-taking reflects the inclination to adopt proactive stances when investing in projects characterized by high levels of uncertainty.

2.2.3 Definition of Green Entrepreneurial Orientation

Business development is solely focused on profit maximization at the expense of other dimensions of growth (Muo & Azeez, 2019). Green Entrepreneurial Orientation (GEO) refers to entrepreneurs considering environmental and social responsibility factors in their business decisions, prioritizing innovation and sustainable development, and implementing measures that strike a balance across the economic, social, and environmental spheres (Elkington & Rowlands, 1999). GEO emphasizes innovation and sustainability, pursuing the alignment of environmental, social responsibility, and economic benefits (Cohen & Winn, 2007).

Makhloufi et al. (2022), grounded in the natural resource-based view theory, conceptualize green entrepreneurial orientation as a strategic resource positioned at the intersection of organizational culture and dynamic capabilities. The authors posit that GEO functions as an embedded strategic resource situated within the core fabric of organizational culture and dynamic capabilities. This configuration facilitates the organization's capacity to capitalize on opportunities and sustain its environmental endeavors. This dual purpose is realized through two primary mechanisms: firstly, by diffusing green practices across core operational activities, and secondly, by leveraging the informational flow along the supply chain's upstream and downstream segments. This sourcing of green supply chain knowledge is coupled with internal organizational insights, thereby augmenting the overall environmental performance. On a distinct note, Zhang (2019) underscores that green entrepreneurial orientation involves the fusion of green entrepreneurial principles into an enterprise's strategic developmental trajectory, thus culminating in a strategic directive. The crux of this orientation lies in the concerted reduction of energy consumption and pollution, concomitant with the continuous enhancement of ecological quality via individual or corporate actions. This trajectory yields a harmonious synergy among financial gains, ecological benefits, and social advantages. Green entrepreneurial orientation embodies a strategic corporate stance that harmonizes environmental and social dimensions. However, it is essential to differentiate this orientation from an outright assumption that business-as-usual operations inherently fulfill social obligations or partake in philanthropic deeds.

Nonetheless, at the firm-level strategic vantage point encapsulated by Green entrepreneurial orientation, enterprises are poised to galvanize green activities. In the face of intricate environmental oscillations, this orientation enables proactive identification and exploitation of developmental prospects, consequently cultivating novel avenues for competitive advantage (Jiang et al., 2018).

The conceptual genesis of Green entrepreneurial orientation stems from the escalating concern over global environmental issues. A multitude of international organizations advocate for a global shift towards green development, where economies transition into green economies (Farinelli et al., 2011). As issues such as climate change, resource depletion, and ecological system collapse intensify, there is an ever-increasing

societal clamor for sustainable development. Within this context, Green entrepreneurial orientation emerges as a pivotal choice for entrepreneurs to address environmental challenges while pursuing economic growth.

In conclusion, this paper contends that Green entrepreneurial orientation represents a corporate strategic orientation that underscores the intrinsic fusion of environmental sustainability with business pursuits, aiming to achieve the harmonization of economic growth and ecological equilibrium. This orientation implies the integration of environmental stewardship into organizational culture, operational strategies, and dynamic capabilities, thereby enabling resource conservation, pollution reduction, and competitive advantage within market landscapes. Green entrepreneurial orientation transcends mere financial gains, encompassing considerations for societal and environmental impacts. It encompasses an amalgamation of innovation, research and development, and collaborative efforts to realize comprehensive sustainable development objectives.

2.2.4 Importance of Green Entrepreneurial Orientation

Natural resources are indispensable for both sustainable economic development and the harmonious functioning of human society. The theory of the natural resource-based view is grounded in the broader concept of the resource-based view (RBV). RBV stands as one of the most influential perspectives within organizational science and entrepreneurial research. It was initially introduced by Wernerfelt in 1984 and has played a crucial role in the evolution of strategic management theory. Wernerfelt highlighted that firms are constituted by their unique capabilities and resources, both of which collectively contribute to their competitiveness. Building on this, Barney (1991) conducted further exploration of RBV, suggesting that valuable, rare, inimitable, and non-substitutable organizational resources (often referred to as VRIN resources) can yield sustainable competitive advantages. Firstly, the creation of valuable, unique, and enduring resources, coupled with successful imitation barriers, aids in fostering competitive firm capabilities. Secondly, strategically essential resources should be scarce or firm-specific, making them difficult for competitors to acquire and imitate.

However, the operating environment of firms is invariably influenced and constrained by the external milieu. To address this, Hart introduced the concept of the

natural resource-based view. This perspective posits that a firm's competitive advantage emanates from how it manages the interplay between strategic development and environmental concerns, closely tied to the feasibility of conducting environmentally friendly sustainable economic activities. The natural resource-based view is instrumental in explaining how organizations can leverage their internal resources and capabilities, adopt the correct strategic orientations, sustain competitive advantages, and generate corporate benefits. It places significant emphasis on environmental considerations, integrating environmental factors into corporate strategies, and further advancing corporate operations (Hart, 1995).

Strategic orientation serves as the guiding course of action for a business and constitutes a vital component of its resource allocation, a concept commonly evidenced in operational activities (Hakala, 2011). It holds a pivotal role in enhancing corporate benefits. As environmental degradation persists, China has also formulated pertinent environmental protection policies, prompting businesses to integrate ecological considerations into their strategic orientations. Consequently, within the backdrop of manufacturing serving as a crucial pillar of China's economy, the amalgamation of environmental factors into corporate strategies and the adoption of a Green entrepreneurial orientation has garnered substantial attention.

Green entrepreneurial orientation is an entrepreneurial concept that underscores environmental sustainability and social responsibility, aiming to organically unite economic growth with ecological balance through innovation and sustainable operational practices. Within this orientation, entrepreneurs regard environmental conservation and social responsibility as core values of business operations, striving to curtail resource consumption, environmental pollution, and ecological degradation. This pursuit ultimately seeks to achieve economic prosperity and social progress (Michael Porter & Claas Van der Linde, 1995; Qin et al., 2021). Green entrepreneurial orientation has gradually garnered global attention and finds widespread application across diverse industries.

The practice of Green entrepreneurial orientation encompasses a wide array of domains. Entrepreneurs can engage in the development and dissemination of environmentally friendly technologies, such as clean energy, sustainable agriculture, and

energy-efficient solutions, with the intent to mitigate adverse environmental impacts (Muo & Azeez, 2019). Additionally, entrepreneurs can incorporate social responsibility into their operational strategies by investing in social welfare projects, thereby fostering societal equity and sustainable development. Entrepreneurs are increasingly prioritizing long-term gains over short-term maximization, recognizing that corporate social responsibility plays a pivotal role in the achievement of corporate success (İyigün, 2015).

McDougall et al. (2019) applied the abstract perspective of natural resources to conduct an in-depth analysis of the UK agricultural and food industry. Their findings not only supported Hart's viewpoint but also revealed new resources, such as local charities, further advancing the theory's development. Scarce resources are closely linked to competitive advantage, which in turn promotes firm performance (Newbert, 2007). Enterprises with innovation capabilities are better equipped to effectively acquire diverse resources and human capital, ultimately gaining a competitive edge in the green domain (Maleki Minbashrazgah & Shabani, 2019). McGahan (2021) asserts that the natural resource-based view in adapting to sustainable development must be distinct from integration with the supply chain. Business development is intricately tied to supply chain management, enabling access to resources beyond organizational boundaries, thereby enhancing competitive prowess. For manufacturing industries, ignoring the scarcity of natural resources and pursuing unsustainable utilization may diminish or even jeopardize the production of such resources. In the context of manufacturing, this connection is indirect and long-term.

Consequently, specific industries must demonstrate more tremendous respect for and comprehension of the natural environment than manufacturing does (Andersen et al., 2018). Furthermore, this orientation not only garners consumer recognition and trust but also cultivates a favorable social image for companies. Most significantly, Green entrepreneurial orientation aids in addressing global environmental challenges and propelling society toward the realization of sustainable development objectives.

In summary, the theory of natural resource-based view regards organizational resources as the underpinning of corporate development, providing a theoretical foundation for exploring the sustainable performance of China's manufacturing industry from a resource perspective. The development of the manufacturing industry confronts

resource-related challenges, necessitating business operators to delve deeply into their internal resources, establish external resource channels, and continuously enhance their competitive advantage. This trajectory is essential to realizing sustainable objectives. Anchored in the natural resource-based view, this research rigorously analyzes the formation pathway of Green entrepreneurial orientation's impact on corporate sustainable performance, positioning Green entrepreneurial orientation as a pivotal resource within the organization.

2.3 Green Intellectual Capital

2.3.1 Concept of Intellectual Capital

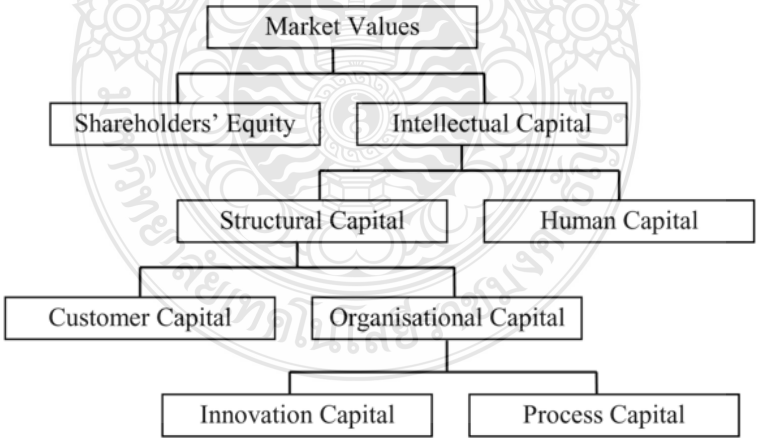
Intellectual capital management is of paramount importance for the long-term and effective development of businesses, leading to their success. Intellectual capital initially found its roots in the field of economics but has since found applications in various domains. According to Masoulas (1998), intellectual capital represents the cumulative total of all intangible assets, knowledge, and skills that businesses can utilize to create value or gain a competitive advantage, ultimately striving for excellence. Stewart (1994) defines intellectual capital as the total accumulation of collective knowledge, information, technology, intellectual property, experience, learning, organizational skills, team communication systems, customer relations, and branding that can generate value for a company. Research on intellectual capital can be categorized into two main types: intellectual capital management and intellectual capital measurement. Intellectual capital management focuses on strategies for effectively managing a company's intangible assets, knowledge base, and the capacity to create value or competitive advantages. Conversely, research in intellectual capital measurement primarily revolves around the collection, organization, analysis, and evaluation of non-financial information used to quantify a company's intangible assets, which typically cannot be adequately represented in financial statements(Roos & Roos, 1997). Consequently, the concept of intellectual capital addresses the shortcomings of traditional accounting methods in accurately measuring intangible assets.

2.3.2 Relevant Research on Intellectual Capital

Amid changing market environments and economic advancements, Secundo et al. (2020) contend that intellectual capital holds significant implications for sustainable development, offering effective organizational methods for enhancing both economic and societal benefits. Intellectual capital underscores knowledge management, considering knowledge to be a pivotal strategic resource for any enterprise. This resource can, through the lens of intellectual capital, propel improvements in financial outcomes and competitive advantages (Wu et al., 2008).

Bontis (2000) retrospectively reviewed the origins and developments of intellectual capital, summarizing measurement methods and dimensions related to its indicators. The study mainly addressed issues faced by corporate leaders in policy formulation, fostering the theory of green capital. Bontis delved into a comprehensive categorization of intellectual capital, with the most common classification being into three types: human capital, structural capital, and relational capital. Secundo et al. (2020) explored the impact of intellectual capital on a company's sustainable development.

In 1993, Edvinsson introduced the Skandia Value Scheme, which gained widespread application and became one of the highly regarded frameworks in the realm of intellectual capital management (Brennan & Connell, 2000), as depicted in Figure 2.5.



Source: Edvinsson (1997)

Figure 2.5 Intellectual Capital Framework

Intellectual capital, as a significant concept, is divided into structural capital and human capital, both of which constitute the essential elements of organizational intelligence. Structural capital encompasses customer capital and organizational capital, representing the organization's capabilities from both internal and external perspectives. Organizational capital is further subdivided into innovation capital and process capital. Process capital signifies the uniqueness of internal organizational processes, including proprietary technologies such as manuals and best practices. On the other hand, innovation capital is regarded as the key to future success, encompassing knowledge assets and intellectual property that lay the foundation for the organization's future development and competitiveness.

In summary, the Skandia Value Scheme provides us with a method to deeply understand intellectual capital and its constituent elements. By decomposing it into structural capital and human capital, this research can better assess the intrinsic value of the organization and more effectively guide the development of innovation and knowledge assets, thus paving the way for future success. This conceptual framework not only aids in theoretical exploration but also offers practical guidance for intellectual capital management, establishing a foundation for the subsequent development of green intellectual capital.

2.3.3 Definition of Green Intellectual Capital

The concept of green intellectual capital was initially introduced by Chen in 2008. It can be understood, from an organizational perspective, as the total stock of intangible assets, knowledge, capabilities, and relationships related to environmental protection or green innovation involving individuals and groups within the enterprise. This definition has gained widespread recognition (Asiaei et al., 2023; Marco-Lajara et al., 2022).

Building upon Chen's (2008) work, Chang and Chen (2012) defined green intellectual capital as the total stock of intangible assets, knowledge, capabilities, and relationships related to environmental protection or green innovation at the individual and organizational levels within the enterprise.

Munawar et al. (2022) interpreted green intellectual capital as a concept that encompassed the knowledge, skills, and abilities contributed by organizational employees

to create and manage sustainable value for the organization. This form of intellectual capital placed emphasis on environmental sustainability and addressing environmental issues, such as reducing carbon emissions, conserving energy, and improving resource utilization.

Khan et al. (2021) described Green Intellectual Capital as intangible assets for enterprises that were closely connected with stakeholders. It was formed through collaboration with partners along the supply chain, customers, enterprise networks, and partners related to environmental management. Its fundamental goal was to enhance competitive advantage and achieve sustainable development.

Paula Benevene et al. (2021) suggested that green intellectual capital could assist enterprises in achieving greener transformations and served as a framework for studying organizational sustainable development. Managing intangible assets (such as knowledge) and coexisting harmoniously with the environment enabled organizations to cultivate more competitive advantages, thereby further impacting business performance.

In line with the viewpoints of Chen (2018) and Chang and Chen (2012), this research primarily defined green intellectual capital as the total stock of various intangible assets, knowledge, experience, professional skills, and innovative capabilities possessed by an organization or enterprise in the realm of environmental sustainability and ecological friendliness. This concept underscored the value of knowledge and intellectual resources within the context of environmental protection and sustainable development.

2.3.4 The Significance of Green Intellectual Capital

Business operations are encountering stringent environmental regulations and increasing consumer demand for "green" products, among other adjustments. In response, enterprises must confront these environmental trends with accuracy. These environmentally conscious trends serve as driving forces for enterprises to engage in green intellectual capital practices, consequently creating a green competitive advantage and enhancing sustainable business performance. Huang and Kung (2011) argue that green intellectual capital plays a promotive role in research about sustainable development. Recognizing environmental issues profoundly does not guarantee an enterprise's ability to develop sustainably. Successful environmental management necessitates the harmonization of diverse knowledge, both implicit and explicit. Green

intellectual capital assists in aligning various aspects, such as external environmental recognition, strategic decision-making, day-to-day operations, organizational culture, and innovation formation within an enterprise (Chen, 2008).

2.3.5 Indicators of Green Intellectual Capital

Paula Benevene et al. (2021) asserted that green intellectual capital could facilitate better green transformation for businesses and posited it as a framework for studying organizational sustainable development. Effective management of intangible assets such as knowledge and harmonious interactions with the environment enables enterprises to cultivate more significant competitive advantages, consequently influencing overall performance.

Chen (2008) contended that enterprises often excessively focused on the costs of environmental investments, which was detrimental to their sustainable development. He introduced a novel concept, green intellectual capital, and explored its impact on competitive advantage.

Malik et al. (2020), employing the perspectives of the natural resource-based view and stakeholder theory, delved into the definitions of green human capital, green structural capital, and green relational capital. Their study considered Pakistan's distinctive environmental challenges and empirically investigated the effects of these three dimensions on sustainable performance. Moreover, they substantiated the positive influence of green human resource management on sustainable performance.

Inayat et al. (2022) recommend that enterprise leaders and grassroots managers should pay attention to green intellectual capital (human, structural, and relational) better to understand consumer, societal, and environmental demands. Amidst heightened competition, small and medium-sized enterprises must actively address ecological concerns and carbon emissions, adjusting their resource allocation to enhance the triple bottom line (economic, environmental, and social) performance.

Yusoff et al. (2019) asserted that the adoption of green intellectual capital to forge new advantages had gained substantial recognition. Their research, conducted on 168 medium- and small-sized Malaysian enterprises, discovered that green human capital was not positively correlated with business sustainability. The increasing demands for

sustainability challenged organizations to confront new market challenges, with structural capital playing a pivotal role.

More businesses are shifting away from a profit-centric mindset to consider social benefits. Huang and Kung (2011) proposed that businesses should have approached environmental issues from a different perspective, considering the interests of multiple stakeholders to formulate more rational environmental strategies and acknowledging the importance of knowledge capital in sustainable environments. They validated that green human capital scored higher than green structural capital, emphasizing the significance of employee development as a focal point of green intellectual capital.

To achieve sustainable development, enterprises should invest more resources and effort into enhancing green intellectual capital. Chang and Chen (2012) present a novel research framework on green intellectual capital, asserting that higher levels of corporate social responsibility facilitate the development of environmental management capabilities in employees. This leads to the creation of green products that cater to stakeholders' needs and exhibit a positive relationship with green intellectual capital, with environmental awareness acting as a mediating variable.

The research dimensions of the scholars above are illustrated in Table 2.4.

Table 2.4 Measurement Dimensions of Green Intellectual Capital

	Chen (2008)	**Malik et al. (2020)**	**Inayat et al. (2022)**	**Yusoff et al. (2019)**	**Huang and Kung (2011)**	**Chang and Chen (2012)**	**Total**
Green human capital	/	/	/	/	/	/	6
Green organizational capital	/						1
Green relational capital	/	/	/	/	/		5
Green structural capital		/	/	/	/	/	5
Green relationship capital						/	1

Based on the table, it is evident that different scholars, driven by their research foci, have examined green intellectual capital from diverse dimensions. Among the six scholars, namely Chen (2008), Malik et al. (2020), Inayat et al. (2022), Yusoff et al. (2019), Huang and Kung (2011), and Chang and Chen (2012), the prominent dimensions

include green human capital (GHC), green relational capital (GRC), and green structural capital. In the context of this research, the measurement of green intellectual capital will be undertaken through these three aforementioned dimensions. Therefore, the structure of the GIC is shown in Figure 2.6.

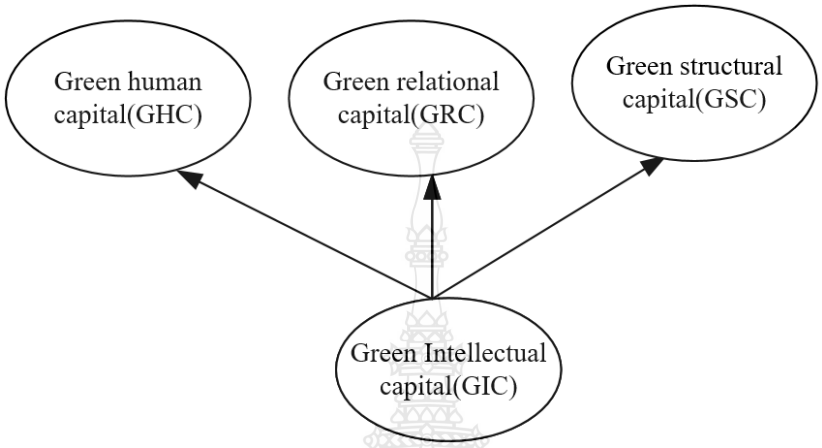


Figure 2.6 Green Intellectual Capital Framework

(1) Green Human Capital

The definition of green human capital is rooted in the resource-based view, incorporating insights from the scholars above. It can be defined as the collective sum of knowledge, skills, abilities, experience, attitudes, wisdom, creativity, and commitment embedded at the employee level towards environmental conservation or green innovation. This amalgamation can aid enterprises in fostering competitive advantages conducive to their developmental progress.

(2) Green Relational Capital

Green relational capital encompasses the array of relationships concerning environmental management and green innovation, explicitly focusing on stakeholders closely linked to the enterprise's operations, such as customers, suppliers, shareholders, employees, and partners. Amidst the dynamic external green landscape, companies must engage and sustain connections with stakeholders, particularly pivotal ones, to address challenges in sustainable development, necessitating increased resource allocation for shared advancement.

(3) Green Structural Capital

In alignment with CHEN's (2008) perspective, this paper defines green structural capital as non-human or intangible organizational assets pertinent to environmental conservation or sustainable development strategies. Examples include organizational capabilities, commitments, knowledge management systems, management philosophies, organizational culture, corporate image, patents, copyrights, trademarks, and more. Notably distinct from human resources, structural capital derives from the overall organization and remains unaffected by the departure of individual employees.

2.4 Concepts and Theories Related to Green Supply Chain Management

2.4.1 Definition of Supply Chain Management

Cox (1997) contended that supply chain management was a focused approach aimed at enhancing the operational effectiveness and efficiency of the entire delivery process. This approach involved the identification of tools and techniques that must be constructed within both internal and external environments to support the provision of a company's existing products and services to customers. The objective of this approach was to continually optimize the delivery channel, ensuring that the company remained competitive throughout the process of delivering value to customers.

Cox (1999) posited that the initial practices of supply chain management were based on emulating the methods pioneered by Toyota in its external resource management, yet these practices had limitations. Subsequently, Cox introduced the lean paradigm. He believed that business success stemmed from elevating performance through various channels and management practices to offer higher value to customers. He suggested establishing amicable and stable relationships with different suppliers within the supply chain, as the future of business competition lay not between two individual companies but among supply chains.

Premkumar (2001) defined supply chain management as the optimization of internal relationships within the supply chain, the coordination of product flow, and transformation processes from raw materials to end consumers along the corresponding information flow, all in pursuit of sustained competitive advantage. This strategic management approach aimed to maximize efficiency, reduce costs, and ensure efficient

resource utilization, thereby enabling organizations to excel in a dynamic market environment consistently.

Shihua et al. (2003) indicated that supply chain management entailed planning, organizing, coordinating, and controlling partial activities within the supply chain. It was a novel management strategy that integrated diverse enterprises to enhance the efficiency of the entire supply chain, emphasizing inter-firm cooperation and bolstering core competitive capabilities.

Power (2005) argued that supply chain integration was fundamentally strategic, transcending the boundaries of traditional organizations and providing a pathway for multiple partners to attain competitive advantages. Among these networks in the upstream or downstream of the supply chain, mutual trust among all partners was an essential prerequisite for effective integration.

Boxiong et al. (2012) viewed supply chain management as a highly prevalent technology in the contemporary management landscape. The term "supply chain" referred to a value-added chain comprising a sequence of enterprises, including raw material suppliers, component suppliers, manufacturers, distributors, retailers, and transporters. Raw materials and components progressively transformed into products through each enterprise in the "chain," reaching the end user. This sequence of activities constituted the entirety of a complete supply chain (from a supplier's supplier to a customer's customer).

Therefore, this paper asserts that a supply chain is a mutually interdependent relationship formed among supply chain members to achieve common interest objectives, and supply chain management involves the management of this very relationship.

2.4.2 Research on Supply Chain Management

Supply chain management can be classified into short-term objectives and long-term objectives. Short-term objectives primarily address the reduction of product inventory levels and the operational cycle of funds. Long-term objectives involve enhancing market share and meeting consumer demands to achieve economic benefits through the management of the upstream and downstream elements of the supply chain (Tan, 2002). Certain scholars explore the application of green supply chain practices to maintain competitive advantages. Some researchers categorize the supply chain into operational supply chains (unique to a company) and entrepreneurial supply chains

(defined by entrepreneurial supply chain thinking) (Cox, 1999). Certain scholars delve deep into the study of Green Supply Chain Learning.

Learning, as a fundamental strategic approach, involves continuous creation and effective utilization of knowledge to attain and sustain competitive advantages (Bäckstrand & Powell, 2021). It plays a significant role in the development of corporate capabilities, spanning from individuals to entire departments, companies, and even the entire supply chain. Mainly for enterprises in developed countries, achieving innovation solely through existing resources becomes challenging. Thus, developing Chinese companies necessitates leveraging inter-organizational learning to enhance business performance (Muangmee et al., 2021), such as in the context of supply chain partners, specifically Green Supply Chain Learning. Green Supply Chain Learning is derived from supply chain learning, which entails the ongoing process of supply chain participants acquiring, integrating, and applying knowledge and experiences to continually enhance and optimize supply chain operations (Mentzer et al., 2001). It emphasizes establishing close collaborative relationships among all organizations within the supply chain, sharing information and resources to enhance overall supply chain performance and adaptability. Initially, supply chain learning primarily focused on information sharing and coordination to address issues of information asymmetry and lag. With globalization and the development of information technology, supply chain learning gradually evolved into a strategic management approach. In the early 21st century, with the rise of sustainable development principles, the focus of supply chain learning shifted toward environmental and social responsibility. Scholars began researching how supply chain learning could mitigate carbon emissions, reduce resource wastage, and promote sustainable development within the supply chain (Seuring & Müller, 2008a). Modern supply chain learning not only concentrates on learning and optimizing within individual companies but also emphasizes learning and coordination across the entire supply chain network (Lee & Rha, 2016). Supply chain learning underscores cooperation and mutual benefit among all participants in the supply chain, striving for overall benefits maximization through shared learning and improvement. In summary, the evolution of supply chain learning has progressed from information sharing and coordination to strategic management and subsequently to sustainable development (Sukati et al., 2012).

Within the academic sphere, there currently needs to be more attention directed towards defining Green Supply Chain Learning. Green Supply Chain Learning entails the dissemination and transfer of knowledge and novel ideas across the entire supply chain, constituting an intriguing research subject (Pham et al., 2022). The foundation of Green Supply Chain Learning rests upon the recognition and comprehension of environmental issues. Various stakeholders within the supply chain require access to knowledge regarding environmental protection, energy conservation, emissions reduction, recycling, and more. They need to understand the impact of environmental issues on businesses and society and recognize the significance of transitioning towards environmentally friendly practices (Seuring & Müller, 2008a). Lisi et al. (2020) merged environmental concerns with supply chain learning, introducing the concept of Green Supply Chain Learning. Aligned with Green Supply Chain Theory, Green Supply Chain Learning becomes a crucial avenue for enterprises to acquire and implement green knowledge. It is posited that Green Supply Chain Learning is an organizational learning capability that aids companies in acquiring, absorbing, and interpreting information and knowledge about customers and suppliers. This learning capability can foster the acquisition of novel green knowledge beyond the confines of organizational boundaries, thus nurturing new competitive advantages (Pereira et al., 2021). The process of Green Supply Chain Learning encompasses knowledge acquisition (such as acquiring new knowledge about green management through interactions with suppliers, customers, environmental agencies, etc.), knowledge transformation (internalizing this new knowledge into a company's experience and common sense), and knowledge application (applying this knowledge to supply chain management and operations to enhance environmental performance) Zhu et al. (2013).

The scope of Green Supply Chain Learning encompasses various dimensions, including green procurement, green manufacturing, green distribution, and green reverse logistics collectively encompassing knowledge and skills relevant to environ mentalizing the supply chain (Srivastava, 2007).

(1) Green Supplier Learning

Enterprises need to absorb and draw from the environmental management capabilities of their suppliers, enhancing internal resource management for efficiency

gains (Wang et al., 2021). Collaborating with suppliers who possess heightened environmental awareness allows companies to learn from their experiences and practices in environmental management, subsequently applying these insights to their production and operations. Through this approach, companies can continually refine their environmental management systems, enhance resource utilization efficiency, and reduce environmental pollution and ecological degradation.

Green supplier learning aids companies in addressing environmental issues (Pagell & Wu, 2009). Environmental challenges, such as waste disposal and energy consumption, can arise within the supply chain. By understanding the green skills and knowledge of suppliers, companies can factor environmental considerations into product design and manufacturing stages (Handfield et al., 2002). Collaborating with green suppliers allows companies to learn effective methods and strategies to address these challenges, thereby better tackling environmental issues within the supply chain (Lawson & Samson, 2001).

Through this mode of learning, enterprises continually enhance their capabilities in sustainable development, optimize resource utilization, and diminish adverse environmental impacts (Kumar et al., 2004). Close collaboration with green suppliers facilitates the selection of environmentally friendly materials and components, the design of energy-efficient products, and the reduction of waste generation during production, leading to reduced resource consumption. In summary, green supplier learning provides several advantages for companies, including accessing environmental information, assimilating environmental management capabilities, addressing environmental concerns, and understanding the green skills and knowledge of suppliers (Dubey et al., 2017).

(2) Green Customer Learning

Green customer learning involves gathering information from customers and jointly solving issues with them (Fang & Zou, 2010; Hernández-Espallardo et al., 2010). This not only promotes mutual understanding and information sharing between businesses and customers but also helps obtain detailed insights into customer preferences for environmentally friendly products. To maintain long-term relationships with customers, companies should demonstrate a steadfast commitment to environmental

partnership and strive to apply green technologies across all business operations. Green customer learning is a crucial approach for enterprises to achieve sustainability and environmental goals. Through close engagement and interaction with customers, companies can better understand customer needs and preferences, subsequently meeting their demand for environmentally friendly products and services (Kim et al., 2018).

In this process, businesses can acquire feedback from customers regarding the characteristics and performance of eco-friendly products. They can also discern customer attitudes and perceptions toward environmentally friendly products (Feng et al., 2019). Such insights are pivotal for developing and promoting eco-friendly products that align with customer expectations. Green customer learning also aids in building strong cooperative relationships between businesses and customers (Chan, 2001). By collaboratively addressing environmental concerns, companies showcase their concern and support for customers, fostering trust and cooperation (Sweeney & Soutar, 2001). This collaborative relationship not only facilitates businesses in gathering more information about customer needs and market dynamics but also aids in better promoting and propagating the concepts and advantages of eco-friendly products (Lam et al., 2004).

During the process of engaging in green learning with customers, companies need to demonstrate a steadfast commitment to environmental partnership (Sharma & Vredenburg, 1998). This encompasses ensuring that companies themselves adhere to eco-friendly principles in product design, production, and operations to reduce adverse environmental impacts and enhance resource utilization efficiency (Zhu & Geng, 2013). Businesses should also proactively drive green transformations up and down the supply chain, collaborating with environmental initiatives, governmental bodies, and other relevant companies to collectively advance environmental objectives (Wu & Pagell, 2011).

In practical implementation, companies should strive to apply green technologies across all their business operations (Angell & Klassen, 1999). This includes enhancing the environmental performance of products through technological innovation, adopting clean production technologies to reduce environmental pollution in manufacturing processes, promoting green logistics and packaging methods to reduce resource consumption, and more (Jabbour & Santos, 2008). By incorporating green

technologies, companies can continually enhance their competitive advantage in environmental aspects and better fulfill customer demands for eco-friendly products and services (Chen & Paulraj, 2004).

In conclusion, green customer learning is a vital avenue for businesses to achieve sustainability and environmental goals. Through establishing close connections and interactions with customers, companies can better comprehend customer needs and meet their demands and expectations for eco-friendly products (Melnyk et al., 2003). They are collaboratively addressing environmental challenges with customers aid in building cooperative solid relationships and enhancing a company's competitive advantage (Sarkis, 2003). To maintain long-term relationships with customers, companies should demonstrate a steadfast commitment to environmental partnership and strive to apply green technologies across all their business operations (Pagell et al., 2010). Only through proactive learning and improvement can businesses sustain growth in the ever-evolving market environment and achieve their sustainability objectives.

2.4.3 Definition of Green Supply Chain Management

Handfield et al. (1997) defined Green Supply Chain Management (GSCM) as an approach that applies environmental management principles to activities throughout the entire customer order cycle. This concept aims to integrate principles of environmental sustainability into all aspects of the supply chain, encompassing design, procurement, production, distribution, usage, recycling, and disposal of products and services.

Zsidisin and Siferd (2001) viewed GSCM as a collection of supply chain management policies that held environmental sustainability values. The implementation actions of these policies and the establishment of relationships were geared towards addressing issues related to the natural environment, aiming to form a comprehensive mechanism for environmental response.

Vachon and Klassen (2008) described GSCM as the process of acquiring, transforming, and applying knowledge related to environmental issues at various stages of the supply chain to achieve environmental and sustainability objectives in supply chain management and operations.

Diabat and Govindan (2011) posited that GSCM emerged from the evolution of supply chain management. With increasing diversification and intensity of competition and growing public awareness and demand for green practices, businesses were compelled to operate in an ethical and socially responsible manner within their supply chains.

De Giovanni (2012) further deepened this concept, stating that GSCM involved considering environmental factors in supply chain management, spanning from product design, raw material procurement and selection, and production processes to final product delivery and the end of product life.

Additionally, Tachizawa et al. (2015) defined GSCM as a strategy rooted in environmental characteristics, aiming to achieve lean supply chain management to minimize or eliminate waste.

In summary, Green Supply Chain Management is seen as a strategic approach that integrates environmental management strategies and environmental awareness into various stages of supply chain management. Through collaboration with upstream and downstream suppliers and customers, as well as internal cooperation within an enterprise, GSCM seeks to minimize the overall negative environmental impact of the entire supply chain across the product lifecycle. Simultaneously, it aims to enhance environmental and economic performance, ultimately achieving sustainable development for both the enterprise and its supply chain.

2.4.4 Importance of Green Supply Chain Management

Green Supply Chain Management (GSCM) can bring numerous benefits to business operations (Chin et al., 2015). Economically, it can reduce supply chain costs, enhance production efficiency, and promote inventory reduction. Notably, improvements in lead time performance are evident (Storey et al., 2006). In the context of intense competition, effective supply chain management lowers operating costs and optimally allocating company resources is crucial for sustained operations. Coordinating relationships from upstream to downstream in the supply chain is a crucial principle, ensuring efficient flow from raw materials to end products, thus meeting customer needs and value expectations. The supplier's ability to produce high-quality products at lower costs while meeting contractual agreements with the company is closely tied to this.

As practices of Green Supply Chain Management mature, governments have introduced policies and encouraged multi-stakeholder collaboration to mitigate environmental pollution and reduce ecological impacts. This contributes to reducing business operational risks (Darnall & Edwards Jr, 2006). Research has indicated a close relationship between environmentally friendly corporate behavior and stock prices, suggesting that companies with significant environmental liabilities may experience stock price declines (Flammer, 2013). Therefore, environmentally sensitive companies are likely to garner favor from stakeholders and attract more investment resources (Chin et al., 2015). Enterprises need to disseminate green knowledge and share it with other employees who require it. They also need to utilize green knowledge to maintain a competitive edge in the realm of environmental sustainability (Lin & Chen, 2017).

2.4.5 Indicators of Green Supply Chain Management

Chin et al. (2015) researched large and medium-sized manufacturing industries in Malaysia using Structural Equation Modeling (Seman et al.) to establish a theoretical model involving Green Supply Chain Management (GSCM) and Sustainable Performance (SP) with environmental collaboration as a moderating variable. They examined GSCM from four dimensions: Green Procurement, Green Manufacturing, Green Distribution, and Green Logistics.

Zhu et al. (2008) delved into supply chain management and sustainable development, constructing a scale for Green Supply Chain Management. This scale assisted companies in understanding the critical points of green supply chain practices and determining the pros and cons of implementing such practices. Chinese organizations faced specific gaps compared to developed countries, having fewer knowledge resources and economic assets than developing nations.

Green et al. (2012) collected data from 159 manufacturing managers, investigating the impact of implementing Green Supply Chain Management on economic performance, environmental performance, operational performance, and operational performance. They emphasized that top management should elevate the environment to a strategic level and make environmental sustainability a critical organizational declaration.

Wu et al. (2012) regarded Green Supply Chain Management as a pillar of the green business model and emphasized that resource-limited companies need to explore multiple avenues for assistance. Their study focused on the textile industry and explored the driving factors of Green Supply Chain Management (green management capabilities, inter-organizational coordination, and government advisory services). They suggested that companies should leverage organizational support, social capital, and government involvement to implement green supply chain practices.

China has heightened requirements for carbon emissions reduction, a demand across various industries. Zhu and Sarkis (2004) suggested that as a developing country, China needs to balance the economy and environment, and Green Supply Chain Management offers new perspectives and significantly impacts improving company performance. They explored the influences of Quality Management (QM) programs and Just-In-Time (JIT) practices.

Hassan et al. (2016) highlighted that environmental sustainability has become an essential choice, and successful business strategies are closely tied to supply chain integration. Combining environmental management with supply chain management provides various methods and channels to propel organizational environmental activities, thereby reducing risks.

The above studies are primarily analyzed from several dimensions, as summarized in Table 2.5.

Table 2.5 Dimensions of Green Supply Chain Management

	Chin et al. (2015)	**Zhu et al. (2008)**	**Green et al. (2012)**	**Wu et al. (2012)**	**Zhu and Sarkis (2004)**	**Hassan et al. (2016)**	**Total**
Green Procurement	/						1
Green Manufacturing	/						1
Green Distribution	/						1
Green logistics	/						1
Internal environmental management		/	/		/		3
Green purchasing		/	/	/		/	4

Table 2.5 Dimensions of Green Supply Chain Management (Cont.)

	Chin et al. (2015)	Zhu et al. (2008)	Green et al. (2012)	Wu et al. (2012)	Zhu and Sarkis (2004)	Hassan et al. (2016)	Total
Cooperation with customers		/	/	/			3
Eco-design		/	/	/	/	/	5
Investment recovery		/	/	/	/		4
Green information systems			/				1
External GSCM					/		1
Reverse logistic						/	1

Based on the table, it is evident that different scholars have conducted research on Green Intellectual Capital from various dimensions, taking into account their research focus. Among the six scholars – Chin et al. (2015), Zhu et al. (2008), Green et al. (2012), Wu et al. (2012), Zhu and Sarkis (2004), and Hassan et al. (2016) – the prominent dimensions are Internal Environmental Management (IEM), Green Purchasing, Cooperation with Customers, Eco-design, and Investment Recovery. In this research, these five dimensions will be investigated in relation to the practice of Green Supply Chain Management. Indeed, here is a breakdown of the five dimensions mentioned in the description. Therefore, the structure of the GSCM is shown in Figure 2.7.

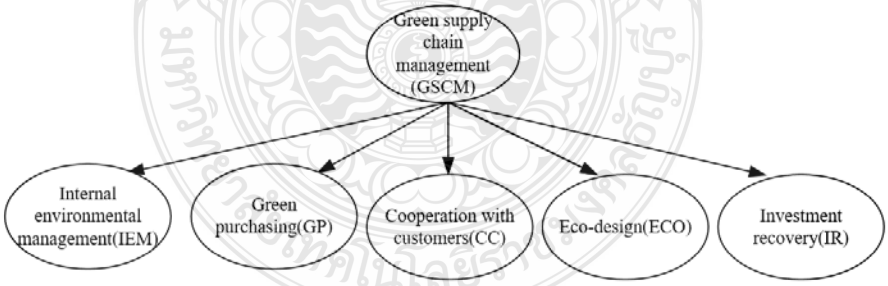


Figure 2.7 Green Supply Chain Management Framework

(1) Internal Environmental Management

This dimension focuses on the measures taken by a company internally to reduce resource waste, lower environmental impact, enhance efficiency, and ensure sustainability. It involves strategies related to resource management, energy efficiency,

waste management, etc. This could include identifying, monitoring, and managing various resources like energy, water, and raw materials. By implementing strategies for energy conservation, promoting recycling, and reducing waste, companies can cut costs, improve efficiency, and reduce reliance on natural resources.

(2) Green Purchasing

Green purchasing is a procurement strategy aimed at selecting products and services that meet environmental standards, with a focus on collaboration with suppliers. Companies consider environmental factors during the procurement process, such as the environmental impact of the production process, material renewability, and recyclability. By choosing green products, companies can collaborate with customers, design cleaner production processes, and reduce their environmental burden.

(3) Cooperation with Customers

In the context of a green supply chain, cooperation with customers refers to building close collaborative relationships between a company and its customers to meet their demands for environmentally friendly products and sustainable solutions. It involves joint development of eco-friendly products, promoting product recycling, providing environmental information, and more to meet customers' needs for sustainability.

(4) Eco-design

Eco-design is an approach that integrates ecological principles into the product and system design process. It considers the entire lifecycle of a product, from raw material extraction to waste disposal. By optimizing designs to reduce resource consumption and environmental impact, companies can create more sustainable products while enhancing efficiency and lowering costs.

(5) Investment Recovery

In the context of sustainability, investment recovery refers to the economic returns generated from investments in environmental and sustainable initiatives. This could include investments in energy-efficient equipment, environmental technology innovations, and sustainable production processes, leading to reduced operating costs, increased efficiency, and a competitive advantage in the market.

2.5 Environmental Uncertainty

2.5.1 Definition of Environmental Uncertainty

The origin of environmental uncertainty can be traced back to the early history of human society. In ancient times, humans led a nomadic or hunting-gathering lifestyle, heavily influenced by natural factors such as weather, climate, and flora and fauna resources. The uncertainty of the environment had profound effects on their survival and reproduction. With the advancement and development of human society, the emergence of industries such as agriculture, craftsmanship, and manufacturing has led to an increasing reliance on and impact on the environment in socio-economic terms. However, the complexity and uncertainty of the environment make it challenging for humans to accurately predict and control its evolution, thereby constraining the prospects of sustainable development. One of the pivotal theoretical frameworks in the study of environmental uncertainty is the "Uncertainty and Complexity Theory," which emphasizes that the uncertainty of environmental systems stems from the inherent complexity of the system and the unpredictability of external disturbances (Gleick, 1991). According to this theory, environmental uncertainty is a product of cognitive and technological limitations inherent to humanity. While it cannot be eliminated, it can be managed and addressed through suitable governance and decision-making strategies (Renn & Walker, 2008). Simultaneously, decision theory plays a significant role under conditions of environmental uncertainty, aiding individuals in making optimal choices within uncertain environmental contexts (Sunstein, 2014).

Duncan (1972) defines environmental uncertainty as the impact of imprecisely predicting environmental changes on the operational efficiency of businesses. Milliken (1987) points out that environmental uncertainty refers to the situation in which businesses face inadequate information or rapidly changing information in their external environment, making it difficult for them to predict and adapt to environmental changes.

Various environmental factors introduce uncertainty for businesses, such as changes in market demand, technological shifts, and innovations (Kreiser & Marino, 2002). To survive and thrive, businesses must engage in communication and interaction with their external environment. López-Gamero et al. (2011) assert that the development of organizations is heavily reliant on scarce resources, and when organizations are unable

to control these resources, environmental uncertainty arises. This is an issue that demands attention; currently, numerous enterprises are seeking innovation and adopting diverse management and operational models (Yusoff et al., 2019). Nevertheless, many of them remain unaware of the demands of contemporary society and lack clarity on how to appropriately address the fluctuations in these demands (Ullah et al., 2021).

Accordingly, this research contends that environmental uncertainty denotes the intricacy and unpredictability inherent in the external environment, thereby impeding organizations' ability to precisely forecast and adapt to environmental fluctuations. Such uncertainty exerts an impact on decision-making processes, allocation of resources, and the operational efficiency of entities. This conceptualization underscores the pivotal role played by enterprise decision-making, resource management, and interaction with the external environment in effectively navigating and mitigating the challenges posed by uncertainties.

2.5.2 Importance of Environmental Uncertainty

In the course of business operations, organizations are subject to the influence of the external environment (Donaldson, 2001). This influence becomes particularly pronounced in fiercely competitive industries, where organizational members break down homogeneous elements within both the internal and external environments as a means of addressing environmental uncertainty. The diverse origins of environmental uncertainty (such as suppliers, customers, and competitors) render the measurement and analysis of environmental uncertainty more intricate (Land et al., 2012). Grounded in the theory of natural resources, businesses can capitalize on developmental opportunities and gain competitive advantages while enhancing environmental performance within uncertain environments. Environmental uncertainty constitutes a pivotal determinant of strategic choices made by businesses, often perceived as a form of instability or dynamism (Dess & Beard, 1984).

Consequently, to attain sustainable performance, enterprises need to identify environmental influencing factors and harmonize the relationship between environment and performance (Donaldson, 2001). Environmental uncertainty may exert either negative or positive impacts on business performance (Simangunsong et al., 2012). However, within the context of green entrepreneurial orientation and research on

corporate sustainable performance, the discussion about the effects of environmental uncertainty remains insufficient. The current green market is still in its growth phase, harboring a multitude of challenges and opportunities. Business benefits are subject to a significant number of uncertain factors, with the market environment reflecting both demand and technological uncertainties. This mandates that enterprises respond to the impacts arising from environmental changes. Presently, the global ecosystem faces significant challenges, with extreme weather events on the rise, affording businesses a more excellent array of opportunities within an uncertain environment.

2.5.3 Indicators of Environmental Uncertainty

Duncan (1972) provided an in-depth analysis of three manufacturing industries, exploring the priorities that organizational members considered when making decisions, and an in-depth analysis of environmental uncertainty. Taking together, two dimensions emerged: a complex dimension and a dynamic one. At the same time, he emphasized the need to understand environmental uncertainty in the context of a number of dimensions, such as individual differences in business members, operations, managers, etc. He demonstrated that the dynamism of the environment was more important than the complexity of the environment in terms of its impact on the organization.

The degree of sustainable growth of an organization was closely intertwined with the environment; hence, understanding the environment was imperative. Dess and Beard (1984) employed statistical methods to empirically analyze 52 randomly selected manufacturing industries out of approximately 460 classified industries in the United States. They proposed a three-dimensional analysis of the environment from the perspectives of richness, complexity, and dynamism to aid organizations in comprehending and measuring the environment, enhancing the understanding of the relationship between the external environment and organizations.

Wu (2013), using the IT industry as a research sample, argued for the influence of supply chain integration and green entrepreneurship, in which environmental uncertainty played a moderating role. Wu categorized environmental uncertainty into two dimensions: technological uncertainty and demand uncertainty. It was posited that business operations were influenced by environmental uncertainty, necessitating a further classification of it, which subsequently impacted the discovery of business supply chains.

Lee et al. (2009) introduced two primary facets of environmental uncertainty, namely technological change and market uncertainty, which led to differentiated impacts on supplier alliances and related structures. Specifically, technological change exhibited positive effects on strategic procurement, specific investments, and supplier alliances. However, market uncertainty had differing implications as it created an unfavorable environment for specific investments and hindered the formation of supplier alliances. This research's findings hold significant academic and practical value, providing profound theoretical insights and practical recommendations for the field of strategic supply management.

Fynes et al. (2004) delved into environmental uncertainty, indicating that both demand and supply uncertainty aspects support this viewpoint. In situations of unstable demand and supply, enterprises need to monitor forecast accuracy from both a temporal and quantitative perspective and accordingly manage their interrelation. Enterprises operating in unstable and tumultuous markets, compared to those in more stable compact markets, must rely more on effective supply chain relationships grounded in interactive communication, collaboration, commitment, and trust. Minimized uncertainty comes from minimal and predictable changes in customer demand, while the supply equation maintains stability, with conditions approximating equilibrium.

Competitive dynamics in enterprises are often embodied in their supply chains. Davis (1993) conducted an in-depth analysis of the impact of environmental uncertainty on supply chains from the perspectives of suppliers, manufacturers, and customers. He introduced the environmental influences of three levels: technological uncertainty, market uncertainty, and supply uncertainty. This research further expanded the understanding of supply chain development.

Certain scholars have explored the dimensions for measuring environmental uncertainty, as illustrated in Table 2.6.

Table 2.6 Dimensions for Measuring Environmental Uncertainty

	Duncan (1972)	Dess and Beard (1984)	Wu (2013)	Lee et al. (2009)	Fynes et al. (2004)	Davis (1993)	Total
Dynamism	/	/					2
Complexity	/	/					2
munificence		/					1
Demand uncertainty			/		/	/	3
Technological uncertainty			/		/	/	3
Market uncertainty				/			1
Technology change uncertainty				/			1
Supply uncertainty					/	/	2

According to the table, it is evident that different scholars, considering the specific nature of their research, have categorized the dimensions of green entrepreneurial orientation differently. They have explored factors influencing entrepreneurial orientation in enterprises. Among the six scholars Duncan (1972), Dess and Beard (1984), Wu (2013), Lee et al. (2009) Fynes et al. (2004), and Davis (1993)—many have conceptualized environmental uncertainty as a multidimensional variable. Notably, the dimensions that have been extensively researched and ranked prominently are "Demand Uncertainty" and "Technological Uncertainty." Therefore, the structure of the EU is shown in Figure 2.8.

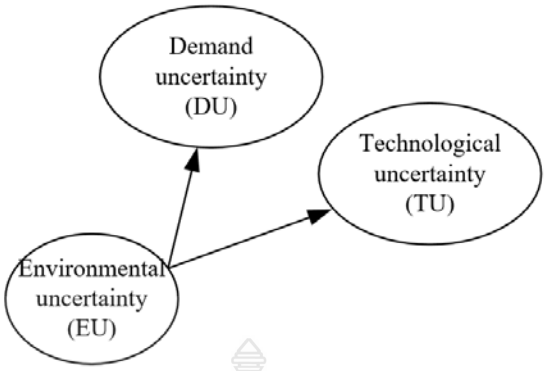


Figure 2.8 Environmental Uncertainty Framework

(1) Demand Uncertainty

Organizations exist within an ongoing process of continuous change over time (Duncan, 1972). Demand uncertainty encompasses challenges related to accurately assessing customer expectations, predicting the evolution of demand, and anticipating shifts in customer preferences. This implies that, across different project stages, there might be a degree of ambiguity regarding the specific scale and nature of demand. This is because multiple factors, including market trends, competitive dynamics, and technological advancements often influence customer demand.

(2) Technological Uncertainty

Technological uncertainty manifests as the unpredictability of the technological environment. This encompasses the rapid evolution of technology, the complexity and challenges it introduces, and the continual emergence of new technologies. The swift pace of technological change can render existing solutions obsolete, necessitating projects to adapt to new technologies to remain competitive continuously.

2.6 Green Entrepreneurial Orientation and Sustainable Performance

The impact of green entrepreneurial orientation on a company's sustainable performance is a highly explored research domain. Traditional enterprises primarily focus on profit levels and emphasize financial performance, while green entrepreneurial orientation considers the triple bottom line principles of economic, environmental, and social performance. It entails integrating environmental sustainability as a core value and aligning it with organizational strategies and daily operational decisions. Numerous

studies indicate that green entrepreneurial orientation has a positive influence on a company's sustainable performance.

For instance, Smith et al. (2001) suggested from a stakeholder perspective that the alignment between a company's values and organizational and societal orientations might impact customer loyalty, subsequently affecting economic benefits indirectly. Delmas and Blass (2010) found that companies with a green entrepreneurial orientation exhibited higher levels of environmental performance, including reduced energy consumption and waste emissions. Hart and Milstein (2003) demonstrated that businesses could enhance resource utilization efficiency, lower production costs, and achieve dual benefits of economic and environmental gains through environmental innovation and technology application. Jiang et al. (2018) conducted an in-depth study of 264 Chinese firms and found positive impacts of green entrepreneurial orientation on both environmental and financial performance. Ameer and Khan (2022) emphasized the influence of green entrepreneurship on a company's environmental performance. They systematically analyzed its macro, meso, and micro-level factors, further substantiating the positive impact of green entrepreneurial orientation on environmental performance. These improvements in environmental performance not only aid in reducing environmental risks but also elevate a company's reputation and brand value. Furthermore, green entrepreneurial orientation is closely connected to a company's economic performance. It positively affects environmental performance (Makhloufi et al., 2022).

Viewed from the perspective of organizational evolution, a company's sustainable development is a unified pursuit of economic, environmental, and social benefits. Balancing these three aspects is often challenging. Green entrepreneurial orientation allows companies to uncover new opportunities, extracting new value and benefits, thereby serving as a pivotal factor in a company's sustainable development. Green innovation orientation can enhance a company's sustainable performance in three distinct ways. Firstly, it can drive product innovation through market research, thus reducing costs (Chuang & Yang, 2014). Secondly, the pursuit of green innovation can lead to unique competitive advantages (Pacheco et al., 2010). Thirdly, entrepreneurs can play diverse roles in green projects or products (Pacheco et al., 2010).

In summary, green entrepreneurial orientation promotes economic, social, and environmental benefits, exerting a crucial influence on sustainable performance. It results in superior performance across various dimensions, such as environmental performance, economic performance, and employee performance. Hence, this research proposes the following hypotheses (see Figure 2.9).

H1: Green entrepreneurial orientation positively affects sustainable performance.

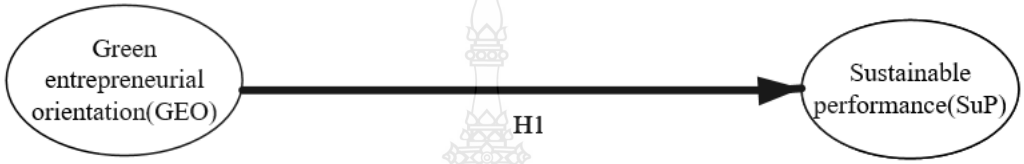


Figure 2.9 Impact of Green Entrepreneurial Orientation on Sustainable Performance

2.7 The Mediating Role of Green Entrepreneurial Orientation

2.7.1 Green Entrepreneurial Orientation and Green Intellectual Capital

The natural resource-based view posits that ecosystems will influence future business competition, and wise companies will integrate business development with the environment to foster growth (Hart, 1995). These prudent enterprises regard contrasting factors as sources of competitive advantage, with some focusing on innovation (Christensen, 2001). The strategic approach of green entrepreneurial orientation holds a significant influence on a company's accumulation of green intellectual capital (Yong et al., 2019). This strategy guides companies to shift their focus from primarily environmental management to sustainable development through knowledge innovation, green innovation, environmentally conscious managerial practices, and collaborative endeavors based on environmental innovation. In this transition, green entrepreneurial orientation plays a pivotal role. Its core function lies in enhancing environmental performance while continuously seeking ecological opportunities.

Green entrepreneurial orientation enhances resource utilization efficiency within companies. During product manufacturing, emphasis is placed on green technologies, thereby reducing the consumption of water, electricity, and non-renewable

resources such as coal and oil (Triguero et al., 2013). This approach aids in raising organizational members' awareness of environmental issues and accumulating knowledge, experience, and skills related to environmental preservation (Chen, 2008), thus forming green intellectual capital. Specifically, green human capital encompasses employees' integrated knowledge, abilities, and attitudes concerning environmental safety and management. Green structural capital comprises organizational culture, corporate image, and management capabilities, all critical for environmental management and sustainable development.

Additionally, green relational capital underscores collaborative partnerships with external stakeholders in environmental strategies, which holds paramount significance for organizational environmental management (Yusoff et al., 2019). Thus, green entrepreneurial orientation is not solely manifested in a company's strategic orientation; it is an intangible resource. Companies driven by green entrepreneurial orientation exhibit superior performance in product development, technological innovation, brand image, etc., thus forging a distinct form of intellectual resource in the market competition. In light of this, this research proposes the following path derivation: green entrepreneurial orientation positively affects green intellectual capital. (see Figure 2.10).

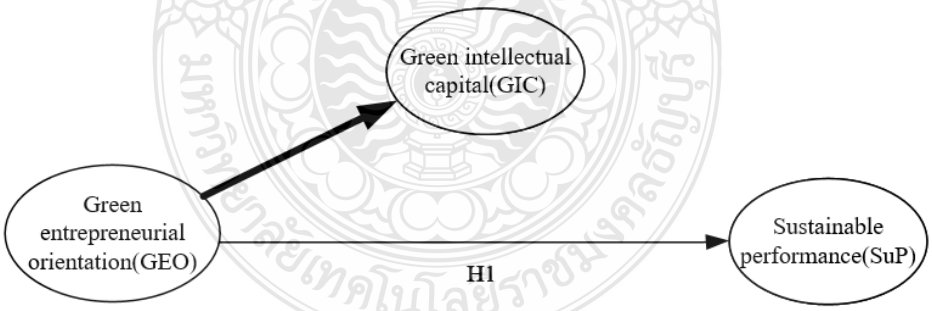


Figure 2.10 The Impact of Green Entrepreneurial Orientation on Green Intellectual Capital

2.7.2 Green Intellectual Capital and Sustainable Performance

Organizational involvement in green management and environmental initiatives can reduce resource waste and contribute to productivity enhancement. Pressure from

stakeholders and consumers has prompted manufacturing industries to implement green transformations earlier and faster than other sectors. Companies with higher environmental awareness are more willing to use Green Intellectual Capital (GIC) methods, creating new competitive advantages and paving the way for sustainable development (P Benevene et al., 2021). Effective management of intangible assets, such as knowledge, in harmony with environmental considerations, enables companies to cultivate more competitive advantages, further influencing organizational performance. GIC is defined as the collection of all knowledge within a company, and a heightened focus on GIC could become pivotal in achieving ongoing development and fostering unique competitive advantages (Malik et al., 2020). Intellectual and intangible resources hold significance in business operations. Appropriate management approaches for such resources can enhance resource management capabilities, further promoting sustainable performance (Zhang et al., 2020).

Based on this, this research infers from the literature that green intellectual capital positively influences sustainable performance (see Figure 2.11).

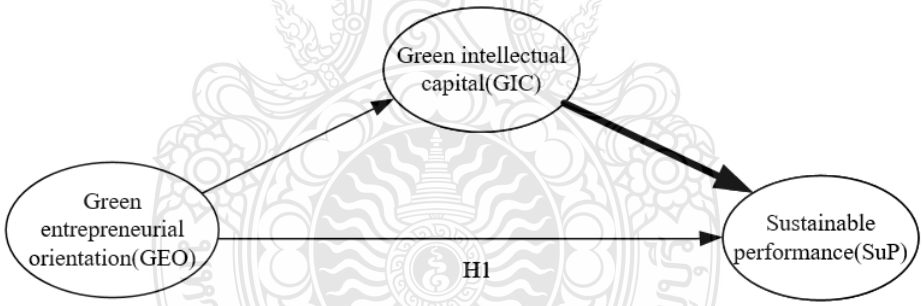


Figure 2.11 The Impact of Green Intellectual Capital on Sustainable Performance

2.7.3 Green Entrepreneurial Orientation, Green Intellectual Capital, and Sustainable Performance

Environmental Orientation of green entrepreneurial orientation can form green intellectual capital and enhance green knowledge-sharing capacity by establishing a knowledge network system, and green intellectual capital can help enterprises to balance between environmental performance, economic performance, and environmental performance in order to achieve sustainable performance of enterprises (Fernando et al.,

2019). Green entrepreneurial orientation plays a crucial role in shaping green intellectual capital. Environmental Orientation, which enables companies to focus on green development, through green entrepreneurial orientation continuously, companies build green relational capital with external partners and strengthen cooperation on environmental strategies. This contributes to the broader promotion of sustainable development.

The application of green innovation in companies promotes the process of continuous learning of new technologies and knowledge, which stimulates green innovative thinking among employees and enhances environmental commitment. This further motivates companies to establish green knowledge management systems to reduce energy consumption and contribute to the formation of green intellectual capital. Green risk taking on the other hand, drives firms to focus on risky and high-return green projects that may help to build new relationship networks such as customers, suppliers, and strategic partners, resulting in the formation of green solid relational capital (Jiang et al., 2018).

Green human capital is expected to enable members of organizations to acquire environmentally relevant knowledge, skills, and abilities, helping enterprises implement green strategies and achieve sustainable performance in a dynamic competitive environment. Green structural capital helps enterprises reduce environmental pollution through green product design, clean production processes, and raw material recycling and reuse, enabling them to comply with environmental regulations and customers' green needs and promoting them to realize sustainable performance. Therefore, green intellectual capital constitutes an element for enterprises to realize green sustainable performance under green entrepreneurial orientation. The resource-based perspective clarifies the importance of human capital for firms to gain an edge in competition (Yong et al., 2019). As an essential intangible asset, green human capital improves employee satisfaction and positively affects business performance (Zaid et al., 2018). Green human capital is expected to motivate organizational members to acquire environmentally relevant knowledge, skills, and competencies, which help firms implement green strategies and achieve sustainable performance in a dynamic competitive environment. Green structural capital helps enterprises reduce environmental pollution through green

product design, clean production processes, and raw material recycling and reuse, enabling them to comply with environmental regulations and customers' green needs and driving them to achieve sustainable performance. Therefore, green intellectual capital constitutes an element for enterprises to realize green sustainable performance under green entrepreneurial orientation.

In summary, this research proposes the following hypotheses (see Figure 2.12).

H2: Green intellectual capital mediates the relationship between green entrepreneurial orientation and sustainable performance.

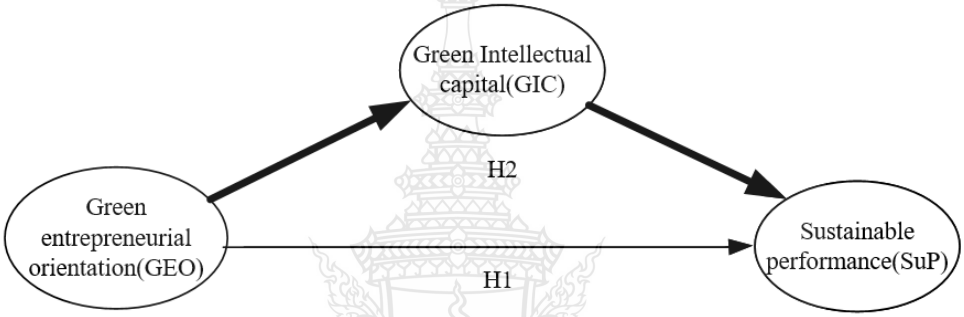


Figure 2.12 The Mediating Role of Green Intellectual Capital

2.8 The Mediating Role of Green Supply Chain Management

2.8.1 Green Entrepreneurial Orientation and Green Supply Chain Management

To achieve organizational sustainability, businesses need to prioritize supply chain practices. An increasing number of companies are incorporating environmental considerations into their corporate strategies. Green entrepreneurial orientation drives collaborative environmental efforts among supply chain partners. Linton et al. (2007) noted that companies with a green entrepreneurial orientation tend to share environmental information and experiences with supply chain partners, resulting in a collective green supply chain strategy. This collaboration contributes to raising the overall level of environmental sustainability within the supply chain, promoting efficient resource utilization and sustainable environmental preservation.

Seuring and Müller (2008b) revealed that companies with a green entrepreneurial orientation consistently seek innovation and improvements in supply chain management to achieve higher environmental standards. This persistent attitude of improvement leads companies to continuously optimize green practices within the supply chain, creating a virtuous cycle that further propels supply chain management and development. Sarkis et al. (2011) highlighted that green supply chain management enhances companies' understanding of and attention to the importance of environmentally friendly practices, thereby integrating more environmental factors into their entrepreneurial orientation. By learning from advanced practices and successful cases in green supply chains, companies can better define their role in sustainable development.

Green entrepreneurial orientation also fosters continuous improvement in green supply chain management (Sarkis et al., 2011). Companies with a green entrepreneurial orientation are more likely to choose green suppliers and procure environmentally friendly materials, thereby reducing environmental risks and the ecological impact of the supply chain. This construction of a green supply chain contributes to enhancing resource utilization efficiency and establishing a competitive advantage in the realm of green supply chains (Yildiz Çankaya & Sezen, 2019).

In summary, companies engaged in green supply chain management practices upstream and downstream can absorb, process, and transform existing green knowledge and skills, thereby reducing supply chain costs and enhancing competitive advantages. Hence, the stronger a company's alignment with a green entrepreneurial orientation, the more it can foster green supply chain management practices. Based on this, this research infers from the literature that green entrepreneurial orientation positively affects green supply chain management (see Figure 2.13).

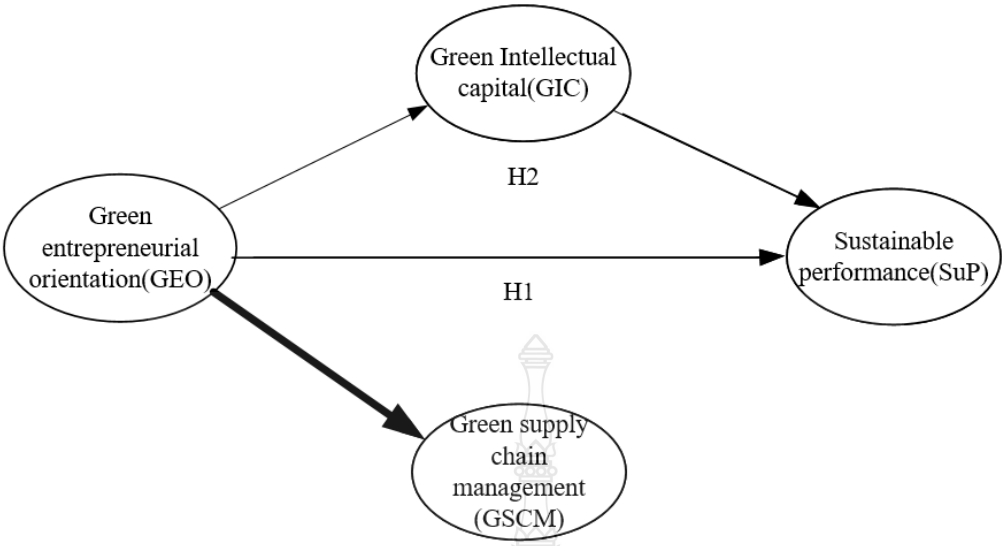


Figure 2.13 Impact of Green Entrepreneurial Orientation on Green Supply Chain Management

2.8.2 Green Supply Chain Management and Sustainable Performance

Scholars have proposed that for organizations to achieve sustained development, the implementation of green supply chain management practices is essential (Markley & Davis, 2007). In the context of scarcity in resources, operational emphasis is placed on acquiring supply chain resources that are difficult to replicate, thereby creating market entry barriers and enabling sustainable benefits (Cox, 1999). Interest in green supply chain management among business operation experts is growing due to heightened awareness of the adverse environmental impacts of manufacturing organizations. Therefore, Green Supply Chain Management (GSCM) is considered an effective strategic management tool that, in addition to enhancing other sustainability performance objectives, can boost a manufacturing company's environmental performance (Hassan et al., 2016).

Against the backdrop of global sustainable development trends, businesses are increasingly focusing on supply chain management that integrates environmentally friendly operations and social responsibility (Linton et al., 2007). As the foundation of supply chain management, green supply chain management allows businesses to learn and introduce concepts and practices of sustainable development into supply chain

operations (Walker et al., 2008). Green supply chain management has a positive impact on a company's economic performance. By learning and implementing advanced supply chain management techniques, companies can optimize supply chain processes, reduce logistics costs, and enhance resource efficiency (Chen & Paulraj, 2004). However, green supply chain management also faces challenges, such as a lack of supply chain transparency and increased costs.

Zhu et al. (2005) used data from Chinese companies to show that GSCM practices significantly enhance environmental and operational performance but do not have a significant effect on economic performance. Laari et al. (2018), using data from logistics service providers, found that GSCM practices among such companies do not significantly affect economic performance. However, they suggested that economic performance has a lag effect and is a long-term outcome achieved through sustained green practices. The unified impact of green supply chain management on sustainable performance remains to be determined. GSCM emphasizes reducing environmental impacts in supply chain management (Pagell & Wu, 2009). Companies introduce measures such as green design, green procurement, and green production through advanced environmental technologies and experiences to enhance resource utilization and waste reduction. For instance, optimizing material procurement, production, and transportation processes helps lower carbon emissions and waste generation, reducing negative environmental impacts. By learning from sustainable procurement and supplier management experiences, companies can drive a green upgrade across the entire supply chain, enabling resource recycling and reuse. These measures aid in reducing resource consumption and dependency on natural resources.

At a societal level, green supply chain management enhances a company's social reputation and builds consumer trust (Renn & Walker, 2008) (Renn & Walker, 2008). By learning advanced social responsibility management practices, companies can focus on employee welfare, community engagement, charitable activities, and fulfilling social responsibilities. Consumers increasingly favor environmentally friendly and socially responsible products and services. By promoting a green supply chain, companies can gain consumer recognition and support.

Green supply chain management allows companies to reduce resource consumption, minimize environmental impact, and enhance social responsibility, achieving a triple-win in terms of economy, environment, and society. As consumers place greater importance on eco-friendly and socially responsible products, companies can enhance brand image, increase product competitiveness, and expand market share through green supply chain management. Measures such as optimizing transportation routes, using eco-friendly packaging, and encouraging suppliers to adopt low-carbon production technologies contribute to cost reduction and increased economic benefits. Moreover, green supply chain management promotes the development and marketing of green products and services, leading to increased profits and market share (Zhu & Sarkis, 2007). Therefore, this research infers from the literature that green supply chain management positively influences sustainable performance (see Figure 2.14).

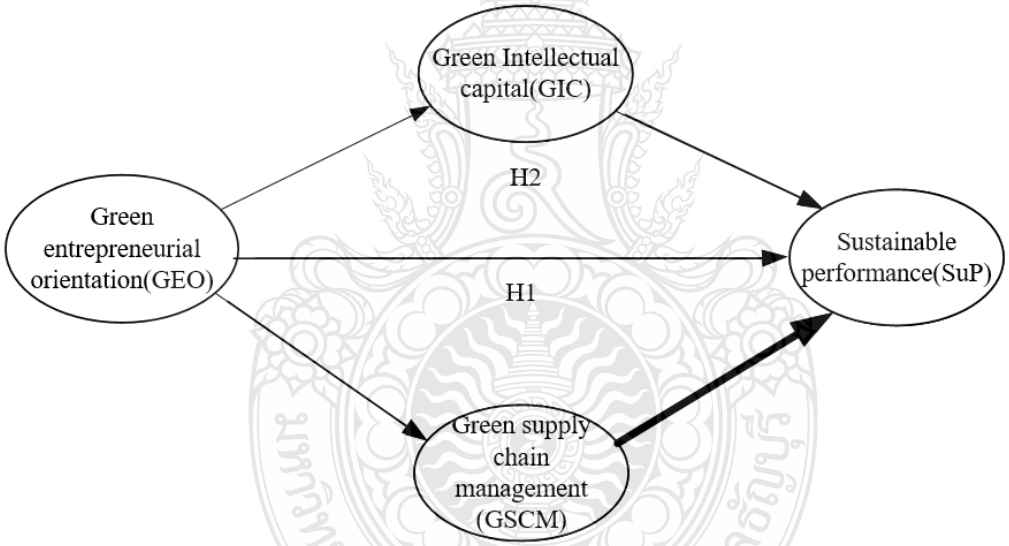


Figure 2.14 Impact of Green Supply Chain Management on Sustainable Performance

2.8.3 Green Entrepreneurial Orientation, Green Supply Chain Management, and Sustainable Performance

Green supply chain management (GSCM), as a comprehensive management concept, plays a crucial role in corporate sustainability. It not only focuses on environmental innovation within the enterprise but also transforms green entrepreneurial

orientation into tangible results of sustainable performance through close cooperation with supply chain partners.

The green entrepreneurial orientation focuses on enterprises' concern for Environmental Orientation and encourages them to consider environmental factors in their business strategies. This orientation promotes more active participation in green supply chain management and translates environmental concepts into practical operations, thereby achieving sustainable performance. Green entrepreneurial orientation emphasizes the adoption of green innovations in products, services, and production processes. Such innovations not only help to meet the market demand for environmentally friendly products but also promote the implementation of green supply chain management in the supply chain, thus facilitating enterprises to realize more sustainable operations. Green entrepreneurial orientation makes enterprises more willing to take environment-related risks and pursue long-term environmentally sustainable performance. This spirit of Green risk taking is reflected in green supply chains, which promote firms to work together with their partners to address environmental challenges and achieve a win-win situation in terms of sustainable performance (Jiang et al., 2018). Some mediating linkages between GEO and performance are missing (Alegre & Chiva, 2013), and Habib et al. (2020)explored the role of sustainable supply chain management and green radical product innovation mediating effects between sustainable entrepreneurial orientation and sustainable performance, identifying a positive mediating relationship between green entrepreneurial orientation in GSCM and Environmental Orientation. Thoo et al. (2014) identified the positive mediating relationship of GSCM practices between market orientation and firm performance. Therefore, this research proposes the following hypotheses (see Figure 2.15).

H3: Green supply chain management mediates the relationship between green entrepreneurship orientation and sustainable performance.

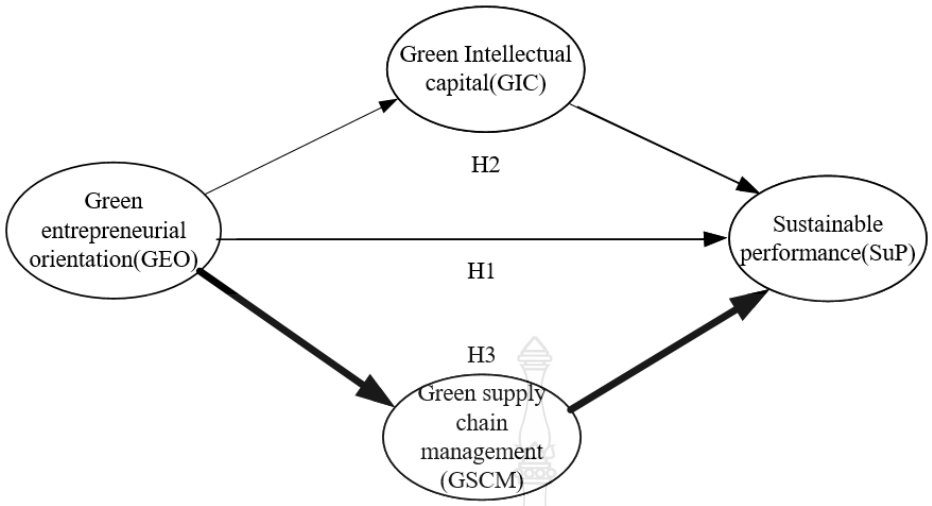


Figure 2.15 The Mediating Role of Green Supply Chain Management

2.9 The Moderating Role of Environmental Uncertainty

2.9.1 The Moderating Role of Environmental Uncertainty Between Green Intellectual Capital and Sustainable Performance

Some scholars argue that performance cannot be solely determined by the fitness between the organization and its environment (Koberg & Ungson, 1987). In uncertain environments, organizations face higher risks. Therefore, some scholars suggest that entrepreneurship in stable environments can better capitalize on opportunities, leading to improved organizational performance (Wiklund & Shepherd, 2005).

The constant changes in the business environment represent a critical external factor that introduces complexity and challenges to the accumulation of green intellectual capital within organizations. These changes may impact the effectiveness of knowledge sharing, technology transfer, and collaboration among organizational members (Helfat & Peteraf, 2015). Uncertainty can also influence organizational structure, as increasing task uncertainty requires decision-makers to process more information to achieve a given level of performance (GALERAITH, 1973). Operating in a complex business environment, companies adopting green practices might encounter heightened risks. Environmental uncertainty might reduce organizational performance (McCabe, 1990), but reducing environmental uncertainty could aid in improving performance (Anderson Jr & Kida, 1985).

Research findings indicate that complex environments provide favorable conditions for the accumulation of green intellectual capital. This requires continuous learning of new knowledge and experiences by organizations to develop green products and processes, ensuring sustainable competitive capabilities (Martinez-Conesa et al., 2017). For instance, by engaging in communication with stakeholders such as customers and suppliers, organizations can accumulate green knowledge, enrich their green intellectual capital, and launch more consumer-friendly products and services to enhance performance (Schilke, 2014). Moreover, given the current focus on climate change and green, low-carbon development, companies might concentrate on adapting to the evolving demands of the external environment. They could quickly adjust to market and regulatory changes, identify green opportunities, accumulate green intellectual capital from the external environment, and apply it to internal green practices to better meet the requirements of clean production and achieve sustainable development.

Thus, an uncertain environment could have a positive adaptive influence on the relationship between green intellectual capital and sustainable performance in agricultural enterprises. In summary, this research infers from the literature that environmental uncertainty moderates the relationship between green intellectual capital and sustainable performance (see figure 2.16).

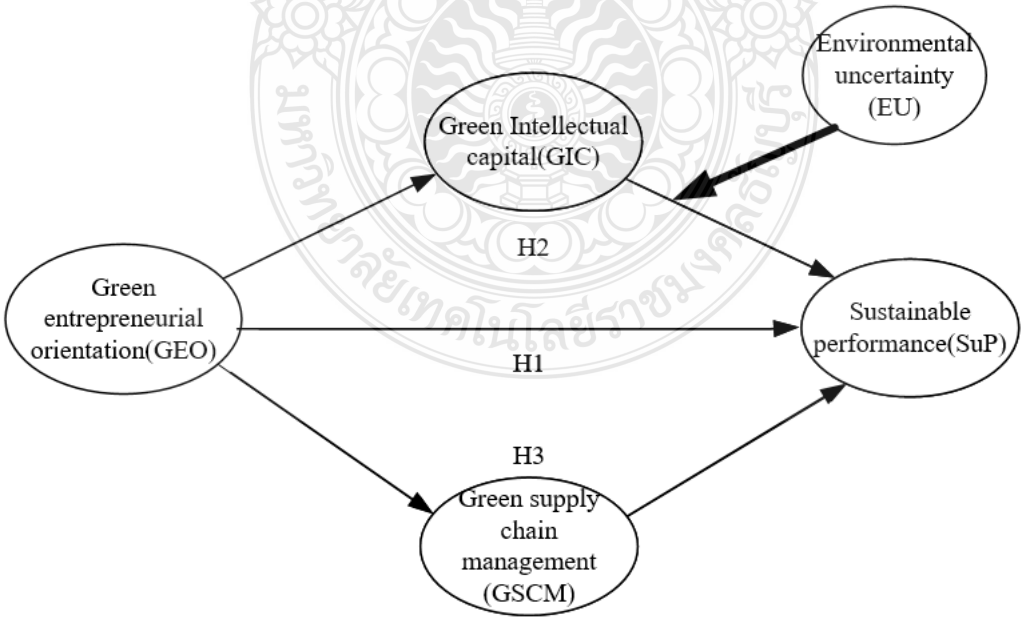


Figure 2.16 EU Moderates the Relationship between GIC and SuP

Based on the above literature review on Green Entrepreneurial Orientation, Green Intellectual Capital, Sustainable Performance, and Environmental Uncertainty, this research formulates the following hypothesis 4 (see Figure 2.17).

H4: Green entrepreneurial orientation impacts sustainable performance through green intellectual capital conditionally upon the effect of environmental uncertainty

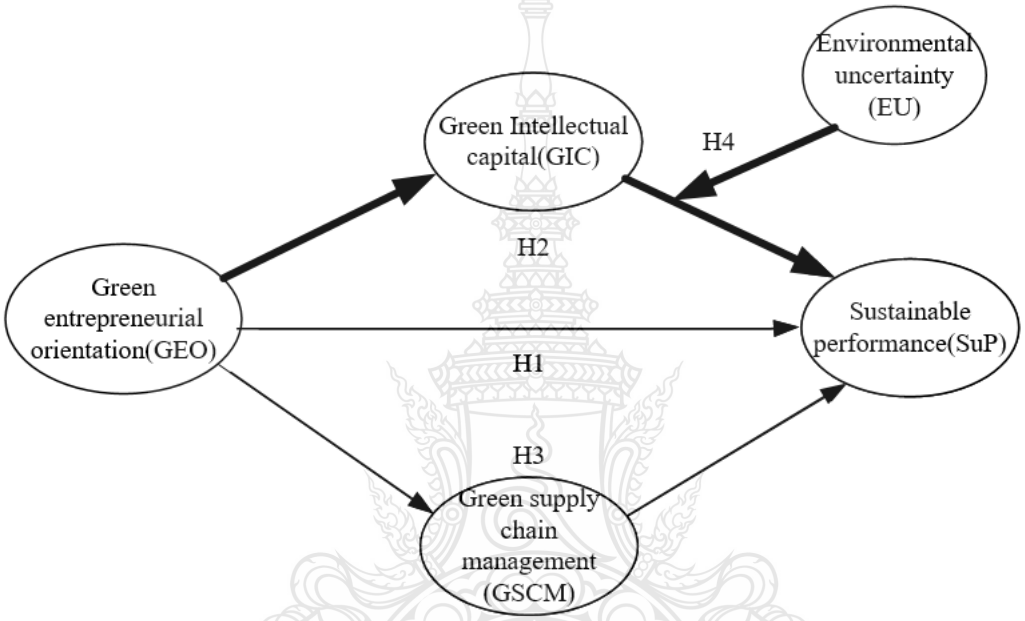


Figure 2.17 GEO Impacts SuP through GIC Conditionally upon the Effect of EU

2.9.2 The Moderating Role of Environmental Uncertainty between Green Supply Chain Management and Sustainable Performance

The contingency theory suggests that organizations often need to adjust their strategies and structures based on different circumstances. The core idea of contingency theory is that there is no "one-size-fits-all" solution that guarantees success in all situations. Each organization is unique, and its success depends on the specific environment and context it operates. The fit between an organization's structure and the specific uncertain environment will determine its performance. In other words, environmental uncertainty prompts organizations to reshape their business models, such as enhancing supply chain management to pursue optimal operational practices.

Operating in a constantly changing environment, supply chains are susceptible to external disruptions and various risks (Ben-Daya et al., 2019).

Customer demands for product value have been increasing, particularly concerning product quality, pricing, and service levels (Christopher, 2016). With the development of the digital age, technological turnover accelerates, and the continuous influx of new products and brands raises the complexity of managing products for businesses (Larson, 2001). Interconnectedness among organizations generates an environment of uncertainty and instability, where suppliers, distributors, customers, competitors, and technological innovations contribute to environmental uncertainty (Paulraj & Chen, 2007). Environmental uncertainty results in rapidly changing critical factors and poses higher demands for environmental management and decision-making. Uncertainty affects organizational structure; as business operations expand, the increase in tasks leads to more significant uncertainty, requiring enterprises to incorporate forces outside their boundaries to achieve a given level of performance (GALERAITH, 1973).

For green supply chain management (GSCM), environmental uncertainty inhibits the precise estimation of customer preferences for green products. When market uncertainty is high, companies must increase their market efforts to reduce forecasting errors. They need to modify GSCM practices to swiftly respond to market demands (Wu, 2013), thereby promoting further integration of supply chain partners and internal departments and enhancing sustainable performance. Within the supply chain context, environmental uncertainty necessitates more robust external communication and internal collaboration among employees to mitigate the risks posed by such uncertainty (Land et al., 2012), ultimately enhancing performance.

In summary, environmental uncertainty plays a specific role in green supply chain management and sustainable performance. Thus, this research infers from the literature that environmental uncertainty moderates the relationship between green supply chain management and sustainable performance (see Figure 2.18).

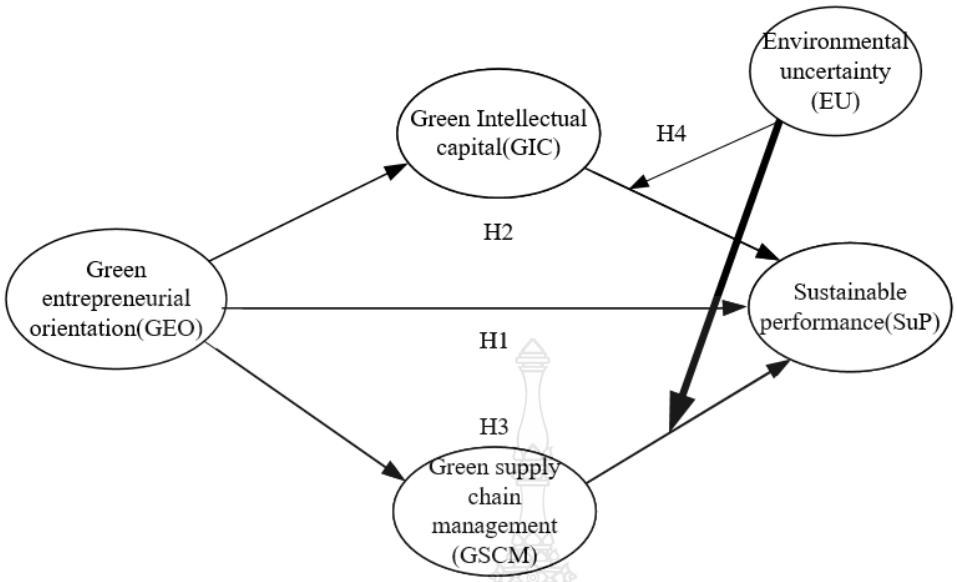


Figure 2.18 EU Moderates the Relationship between GSCM and SuP

Based on the above literature review on Green Entrepreneurial Orientation, Green Supply Chain Management, Sustainable Performance, and Environmental Uncertainty, this research proposes the following hypothesis 5 (see Figure 2.19).

H5: Green entrepreneurial orientation impacts sustainable performance through green supply chain management conditionally upon the effect of environmental uncertainty.

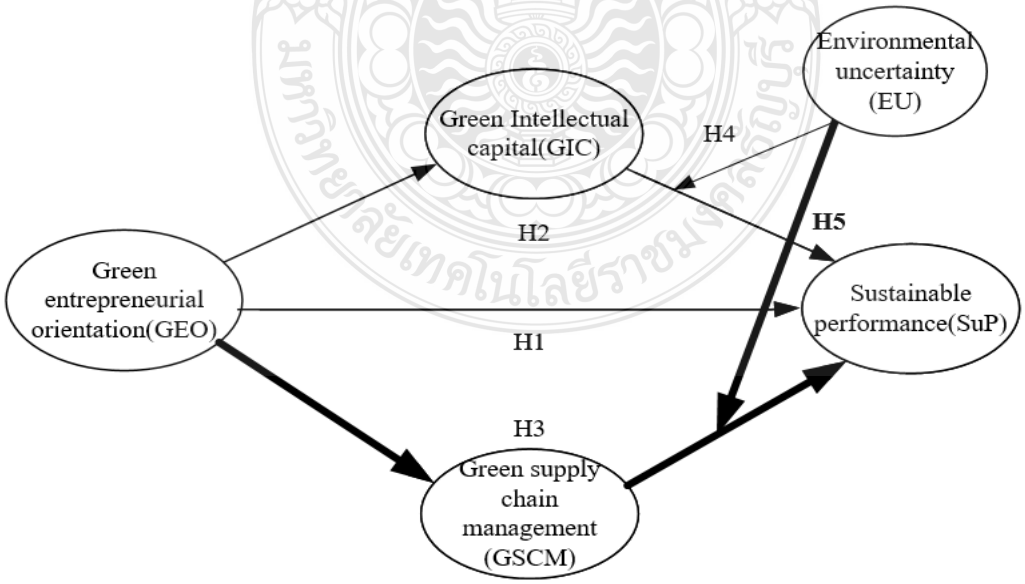


Figure 2.19 GEO Impacts SuP through GSCM Conditionally upon the Effect of EU

2.10 Hypothesized Structural Model

Based on the literature review and a review of the variables mentioned above, this research proposes the following research framework and hypotheses, as depicted in Figure 2.20.

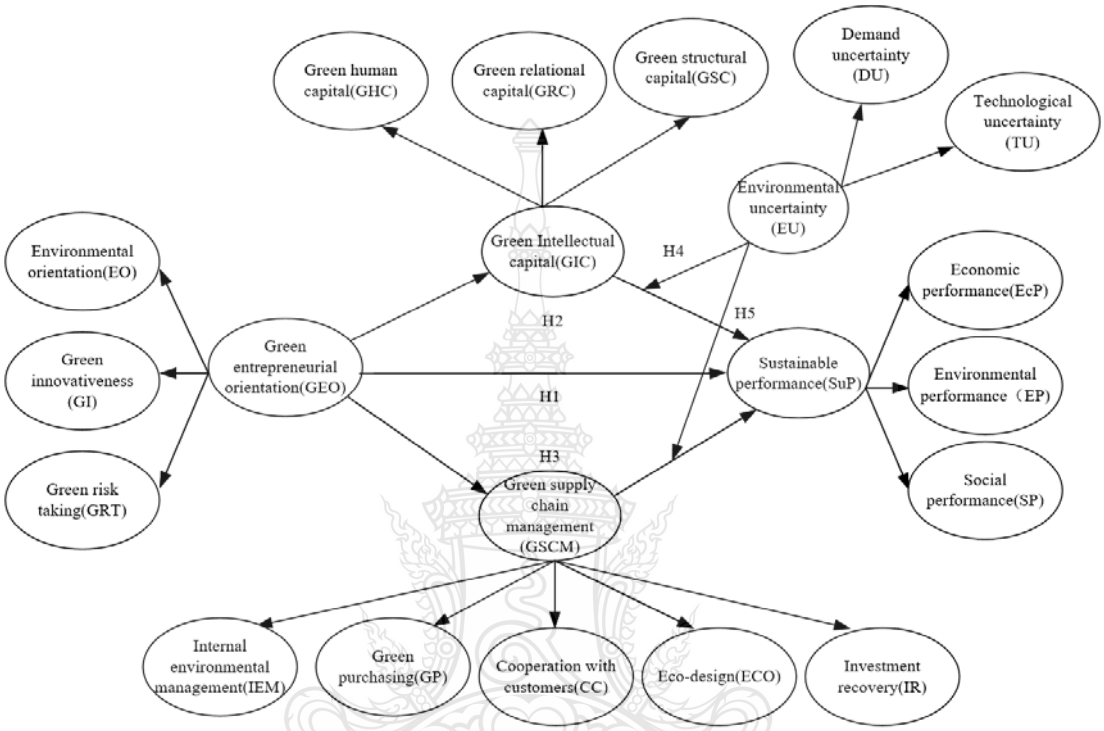


Figure 2.20 Research Framework and Hypotheses

CHAPTER 3
RESEARCH METHODOLOGY

The study entitled "The impact of green entrepreneurial orientation on sustainable performance," this section outlines the details of the research design and methodology. Firstly, the qualitative part of the analysis was conducted using interviews to gain insights into the perspectives and experiences of the research participants, and an outline of the interviews was developed. Next, the quantitative analysis section was conducted through questionnaires to collect data, specifying the measurement scales for the research variables, sample selection, data collection, and analysis. The chapter is structured as follows:

3.1 Research Design

3.2 Qualitative Methodology

3.3 Quantitative Methodology

3.1 Research Design

(1) Determine the relationship between green entrepreneurial orientation (GEO) and sustainable performance (SuP).

(2) Determine the parallel mediation roles of green intellectual capital (GIC), and green supply chain management (GSCM) in transmitting effects of green entrepreneurial orientation (GEO) to sustainable performance (SuP) and compare their intermediary role.

(3) Explore the role of environmental uncertainty (EU) on the relations among green entrepreneurial orientation, green intellectual capital, green supply chain management, and sustainable performance.

(4) Based on the research conclusions, provide suggestions for the sustainable development of the Sichuan manufacturing industry.

To achieve these objectives, this research adopts a mixed-methods approach, combining both quantitative and qualitative methods. Empirical analysis plays a crucial role in this research, aiming to validate the reliability and applicability of the research model proposed earlier. However, obtaining the necessary data for empirical analysis is

not straightforward. This data cannot be directly sourced from publicly available objective data sets; instead, they require collection through the design and implementation of survey questionnaires. Careful consideration is essential when designing these questionnaires. The questionnaire design must thoroughly address the critical points of the research topic and research objectives to ensure that the collected data accurately reflects the core of the research questions. Additionally, special attention must be paid to the following aspects:

Firstly, the clarity of the topic is paramount. The content of the questionnaire must closely align with the research subject, enabling respondents to understand the meaning and purpose of the questions clearly as they answer.

Secondly, the use of concise and clear language in the questionnaire is crucial. Avoiding excessive use of technical terminology is essential to prevent confusion or misunderstandings among respondents, ensuring that the questions are understandable to a broad audience.

Thirdly, the organization of questionnaire items needs to be well-structured. The design of items should follow the logical flow of the survey, allowing respondents to think smoothly as they answer the questions. The level of difficulty of the items should also be considered, ranging from easy to more challenging to help survey participants progressively adapt and engage in the survey.

Fourthly, privacy protection is a crucial consideration during the questionnaire design process. Questions in the questionnaire should minimize the involvement of personal sensitive information, ensuring that the privacy of survey participants is fully respected and safeguarded.

Lastly, the number of measurement items included in the questionnaire should be moderate. Too many questions may decrease respondents' enthusiasm for answering and could impact the quality of the data. Taking into account the time constraints of the respondents, aiming for an optimal completion time of around 10 minutes can effectively balance the quantity and quality of data collection.

3.2 Qualitative Methodology

3.2.1 Purpose of Interviews

The purpose of this research interview is to explore the specific effects of green entrepreneurial orientation on firms' sustainable performance, green intellectual capital, and green supply chain management through in-depth interviews with manufacturing professionals. At the same time, the mediating role of green intellectual capital in the relationship between green entrepreneurial orientation and sustainable performance, as well as the mediating effect of green supply chain management in this relationship, will be investigated. In addition, the study will further explore the moderating role of environmental uncertainty in the relationship between green intellectual capital and sustainable performance, as well as the moderating effect of environmental uncertainty in the relationship between green supply chain management and sustainable performance. In addition, this research wanted to support quantitative research with qualitative findings. Through in-depth analyses of these critical variables and relationships, this research expects to provide theoretical support and practical guidance for manufacturing enterprises and to promote the achievement of sustainable development goals under conditions of environmental uncertainty.

3.2.2 Population and Sample

The semi-structured interview method utilizes direct conversation to collect relevant information and possesses excellent adaptability and flexibility. It is widely used in the fields of management, psychology, and sociology to develop individualized and personalized research. To gain a deeper understanding of the relationship between the different variables in the framework of this research, as well as to obtain first-hand information from the respondents for an in-depth analysis of the entrepreneurs' perceptions, a semi-structured interview methodology was chosen for this research. In this method, an interview outline is used to have a direct conversation with the respondents, followed by a detailed analysis of the interviews to explore the impact of green entrepreneurial orientation on sustainable performance. Interview subjects In this research, 15 middle and senior managers of manufacturing enterprises in Sichuan Province were selected for in-depth interviews, with a relatively large age span between 28 and 60 years old.

3.2.3 Research Tools

This research adopts semi-structured interviews, based on the interview outline, talking to each respondent face to face and recording the contents of the interview process, analyzing the relevant contents after completing the interview, revising the semantic ambiguities in the adopted questionnaire, making logical judgments on the hypothetical causality, and conducting a qualitative analysis of the relationship between green entrepreneurial orientation, green intellectual capital, green supply chain management and sustainable performance of manufacturing industry. Qualitative analysis.

The main questions of the interview outline are listed below:

1) How do you evaluate the current state of green entrepreneurial orientation, green intellectual capital, green supply chain management and sustainable performance in the context of manufacturing?

2) Do you think green entrepreneurial orientation has an impact on green intellectual capital, green supply chain management and sustainable performance?

3) What role do you think green intellectual capital plays in the impact of green entrepreneurial orientation on sustainable performance?

4) In your opinion, what is the role of green supply chain management in the impact of green entrepreneurial orientation on sustainable performance?

5) In your opinion, what is environmental uncertainty and what is its impact on sustainable performance?

6) What role do you think environmental uncertainty plays in green intellectual capital and sustainable performance?

7) What role do you think environmental uncertainty plays in green supply chain management and sustainable performance?

3.2.4 Data Collection

During the collection phase of the interview data, numerous strategies were adopted to ensure the reliability of the data and the richness of the information. Audio recordings, with the consent of the interviewees, were used as a collection tool to help maintain data consistency (Slavich & Irwin, 2014). During the actual interviews, the voices of the interviewees were captured through face-to-face, telephone, or online communication. These voices include not only their views on the research topic but also

their experiences and feelings. At the same time, through audio recording and note-taking, the researcher was able to retain key details and perspectives for subsequent data analysis effectively. If there is insufficient information, the researcher will have to communicate further with the interviewee to obtain additional information.

3.2.5 Content analysis

Data analysis aims to extract valuable information from large amounts of data to make generalizations that support further inferences and conclusions (Braun & Clarke, 2006). During the interview data analysis phase, the researcher needs to transform the collected data into meaningful insights through a systematic process. First, the audio recordings were transcribed verbatim to ensure accuracy for subsequent analysis. Validation of the data is an indispensable step before the actual analysis. The analysis will be based on discourse analysis theory, focusing not only on speech but also on covering elements in a context, such as gestures and body language. Subsequently, the text will be individually tagged using open coding to identify key themes and ideas to prompt the organization and analysis of the data. These open codes formed the basic building blocks of the data. This systematic process of analyzing the interview data helped to reveal the perspectives, experiences, and emotions of the interviewees, thereby providing insight into the research questions.

3.3 Quantitative Methodology

Quantitative analysis is an approach that involves collecting numerical data and applying statistical techniques to gain a deeper understanding of relationships and trends among research subjects. This method unveils patterns, trends, and correlations among variables, providing researchers with quantifiable and replicable outcomes. It aids in discovering patterns and explaining phenomena within complex scenarios. In the realm of modern management science research, the most extensively employed method is the questionnaire survey. This approach ensures data validity by directly acquiring firsthand information, primarily through the distribution of electronic surveys online. This minimizes interference from survey participants and facilitates the identification and testing of relationships between variables (Moshman, 1978).

3.3.1 Population and Sampling

The primary aim of this research is to examine the relationships between green entrepreneurial orientation, green intellectual capital, green supply chain management, and sustainable performance. Drawing from the research background and issues addressed in this paper, coupled with the interconnections between variables, a survey questionnaire tailored to this research was developed. Concurrently, the relationship between the fit of the structural equation model and the sample size is closely associated (Anderson & Gerbing, 1988). Typically, a sample size of N = 100-150 is considered the minimum requirement for conducting a structural equation model (Ding et al., 1995), while some researchers argue that SEM demands a larger sample size, such as N = 200(Hoogland & Boomsma, 1998). It has been suggested that the adequate number of questionnaires should exceed 10 times the number of items in the largest subscale, with a sample size surpassing 500, meeting the requirements for factor analysis (Gorsuch, 1983). Based on the research above findings and referring to the outcomes of Gorsuch (1983), Based on the above findings and with reference to Gorsuch (1983), there are 58 observed variables on the impact of green entrepreneurial orientation on sustainable performance; according to the 20-fold principle, then 1,160 copies should be distributed, considering the questionnaire recycling problem, this paper distributed 1200 questionnaires to the manufacturing industry in Sichuan.

Table 3.1 Population and Sampling

Profession	Profession(N)	Sample (n)
Light textile industry (including food, beverages, tobacco processing, clothing, textiles, leather, wood processing, furniture, papermaking and printing, culture, education, industry, beauty, sports and entertainment supplies, etc.)	2505	247
Resource processing industry (including petrochemicals, chemical fibers, pharmaceutical manufacturing, rubber, plastics, metal products, non-metallic mineral products, etc.)	5577	550

Table 3.1 Population and Sampling (Cont.)

Profession	Profession(N)	Sample (n)
Machinery and electronic manufacturing (including machinery and other equipment manufacturing, transportation, electronic communication equipment, instrumentation, equipment and metal product maintenance, waste resource utilization, other manufacturing industries, etc.)	4080	403
Total	12162	1200

3.4.2 Research Instruments

A questionnaire survey is the primary research method and tool in this paper; this research is designed by combining related literature and questionnaires based on existing studies, the data of green entrepreneurial orientation, sustainable performance, green intellectual capital, and green supply chain management involved in this paper need to be obtained by questionnaire survey method. Focusing on the manufacturing industry in Sichuan Province, China, the survey targets entrepreneurs and middle to senior-level management personnel. After refining the questionnaire based on pre-survey results, the formal survey questionnaire is established. Following the stages of distribution, collection, elimination, and selection, the final research data is acquired.

The questionnaire for this research was designed to address the research hypotheses developed for the development of the conceptual framework. The questionnaire was divided into six sections: Section 1: Demographic and Background Characteristics of Respondents; Section 2: Sustainable Performance; section 3: Green Entrepreneurial Orientation; section 4: Green Intellectual Capital; section 5: Green Supply Chain Management; and Section 6: Environmental Uncertainty.

Likert 5-point scales are utilized in this research to quantify attitudes in the survey questionnaire. The Likert 5-point scale serves as a proxy for interval scales. It is used to indicate the extent of emphasis placed by enterprises on green entrepreneurial orientation, green intellectual capital, green supply chain management, environmental uncertainty, and sustainable performance. An overview of the research variables in this research is presented in Table 3.2.

Table 3.2 Summary of Research Variables

Variable	Dimension	Abbreviation
Sustainable performance	Economic performance	EcP
	Environmental performance	EP
	Social performance	SP
Green entrepreneurial orientation	Environmental orientation	EO
	Green innovativeness	GI
	Green risk-taking	GRT
Green intellectual capital	Green human capital	GHC
	Green relational capital	GRC
	Green structural capital	GSC
	Internal environmental management	IEM
Green supply chain management	Green purchasing	GP
	Cooperation with customers	CC
	Eco-design	ECO
	Investment recovery	IR
Environmental uncertainty	Demand uncertainty	DU
	Technological uncertainty	TU

(1) Dependent Variable

The dependent variable in this research is sustainable performance. The attributes of sustainable performance are primarily assessed from three dimensions: economic performance, environmental performance, and social performance. The first 4 items pertain to financial performance, the middle 5 items measure environmental performance, and the last 4 items evaluate social performance. The elements for each variable are outlined in Table 3.3.

Table 3.3 Scales of Sustainable Performance

Variable	Dimension	Constructs	Source
Sustainable performance	Economic performance	EcP1: Our company reduces the cost of energy consumption EcP2: Our company has improved the capacity utilization rate EcP3: Our company has decreased the fee for waste treatment EcP4: Our company's sales of green products have increased significantly	Li (2014); Zhu et al. (2008)
	Environmental performance	EP1: Our company has achieved important environment-related certifications EP2: On average, the overall environmental performance of our company has improved over the past 3 years EP3: The resource consumption of our company (e.g. water, electricity, and gas) has decreased during the last 3 years EP4: Our company has improved on environmental compliance EP5: Our company is complying with environmental regulations (i.e., carbon dioxide emissions, waste disposal)	Asadi et al. (2020); Wang (2019) ;
	Social performance	SP1: Our company has seen an increase in customer satisfaction over the past 3 years SP2: Our company has improved customer motivation in the last 3 years. SP3: Our company serves more beneficiaries (disadvantaged people) or solving environmental issues SP4: Our company actively participates in public welfare activities and pays attention to social issues	Asadi et al. (2020) ; Cheah et al. (2019)

(2) Independent Variable

Green entrepreneurial orientation is measured through three dimensions: Environmental Orientation, Green Innovativeness, and Green Risk Taking. The elements for each variable are provided in Table 3.4.

Table 3.4 Scales of Green Entrepreneurial Orientation

Variable	Dimension	Constructs	Source
Green entrepreneurial orientation	Environmental orientation	EO1: Our company is committed to improving its overall environmental awareness EO2: Our company is very concerned about the impact of its business activities on the environment EO3: Our company has invested in controlling the environmental impact of its operations EO4: Our company believes that mankind and nature should coexist harmoniously	Covin and Slevin (1991); Xianjiang (2018)
	Green innovativeness	GI1: Our company has developed new green product (service) line to a greater extent GI2: Our company's green transformation of existing product (service) lines to a greater extent GI3: Our company emphasizes green product innovation, technological leadership, and research and development to a greater extent	
	Green risk taking	GRT1: The extent to which Our company participates in the development of green projects with high risks and high returns GRT2: The extent to which Our company tends to take bold and swift action to meet corporate objectives GRT3: The extent to which Our company tends to take a bolder and more proactive approach to capitalizing on potential green opportunities	

(3) Mediating Variable

Green intellectual capital

Green intellectual capital is measured through three dimensions: Green Human Capital, Green Relational Capital, and Green Structural Capital. The elements for each variable are detailed in Table 3.5.

Table 3.5 Scales of Green Intellectual Capital

Variable	Dimension	Constructs	Source
Green intellectual capital	Green human capital	GHC1: Our company's employees are actively involved in production and contribute to ecological protection GHC2: Our company's employees have adequate ecological protection skills GHC3: Our company has a high level of teamwork in ecological protection GHC4: Our company's managers can fully support their employees in ecological conservation work	Yusoff et al. (2019); Huang and Kung (2011)
	Green relational capital	GRC1: Our company designs products or services by environmental requirements GRC2: Our company's relationship with strategic partners in ecological and environmental protection is stable GRC3: Our company's relationship with its supply chain in terms of eco-environmental protection is stable GRC4: Our company's cooperative relationship with customers in terms of ecological and environmental protection is stable	
	Green structural capital	GSC1: Our company has a perfect ecological environmental protection management system GSC2: Our company has invested sufficient funds in ecological environmental protection facilities GSC3: Our company's overall operation process for ecological environmental protection is effective GSC4: Our company's knowledge management system is conducive to accumulating and sharing environmental knowledge	

Green Supply Chain Management

Green supply chain management is assessed through five aspects: Internal Environmental Management, Green Purchasing, Cooperation with Suppliers, Cooperation with Customers, Eco-design, and Investment Recovery. The elements for each variable are outlined in Table 3.6.

Table 3.6 Scales of Green Supply Chain Management

Variable	Dimension	Constructs	Source
Green supply chain management	Internal environmental management	IEM1: Commitment of our company's senior management to GSCM	Zhu et al. (2008);Green et al. (2012)
		IEM2: Middle management's support for GSCM in our company	
		IEM3: Our company's cross-functional collaboration promotes environmental improvement	
		IEM4: Our company's use of total quality environmental management	
	Green purchasing	GP1: Eco-labeling of Products	
		GP2: Our company cooperates with our suppliers to achieve environmental goals	
		GP3: Our company conducts environmental audits of suppliers' internal management	
		GP4: Assessment of environmental practices of second-tier suppliers	
	Cooperation with customers	CC1: Our company cooperates with customers for eco-design	
		CC2: Our company cooperates with customers to realize clean production	
		CC3: Our company cooperates with customers for eco-design	
	Eco-design	ECO1: Our company designs products that reduce material/energy consumption	
		ECO2: Our company designs products that reuse, recycle, and recover materials and components	
		ECO3: Our company designs products to avoid or minimize the use of hazardous products and/or their manufacturing processes	

Table 3.6 Scales of Green Supply Chain Management (Cont.)

Variable	Dimension	Constructs	Source
	Investment recovery	IR1: Investment recovery (sale) of excess inventory/materials of our company IR2: Sale of scrap and used materials by our company IR3: Sale of surplus capital equipment by our company	

(4) Moderator Variable

Environmental uncertainty is measured through two dimensions: Demand Uncertainty and Environmental Uncertainty. The elements for each variable are provided in Table 3.7.

Table 3.7 Scales of Environmental Uncertainty

Variable	Dimension	Constructs	Source
Environmental uncertainty	Demand uncertainty	DU1:Our company has difficulty accurately assessing customer demand for environmental products DU2:Our company's forecasts of demand for environmental products are often inaccurate DU3:It is difficult for Our company to predict customers' future preferences for environmental products	Fynes et al. (2004)；Wu (2013)
	Technological uncertainty	TU1:Technology in our industry is changing rapidly TU2:It is difficult to predict the level of our technology in 3-5 years TU3:Technological changes provide great opportunities for Our company	

Before this questionnaire was distributed, IOC suggestions were conducted in this research. Most of our measurement items for the 16 potential variables were contextually adapted based on well-established scales from previous studies. At the same time, some of them were also self-designed after full validation by a panel of experts in questionnaire development. The questionnaire was distributed to three professors, who evaluated it according to the IOC (Index of Item-Objective Congruence) method. The results of the evaluation were used to adjust and improve the accuracy and validity of the questionnaire.

Index of item congruence: IOC as viewed by three experts, followed by alterations and amendments as suggested by the experts before the study. In this research, the questions listed within the questionnaires contain the IOC general threshold 0.50-1.00. The evaluation assessments are as follows:

If the expert is sure that the item is congruent to objective = +1

If the expert is unsure that the item congruent to objective = 0

If the expert is sure that the item is not congruent to objective = 1

Using the formula below

$$IOC=(\sum R)/N$$

R = the sum of experts' opinion

Three experts evaluated the IOC for this research; the IOC score of all items was 0.67 – 1.00, which was considered acceptable by Turner and Carlson (2003). The suggestion for the wording was to adjust it following the experts' advice to improve the validity of the questionnaires.

3.4.3 Data Collection

The data collection of the questionnaire in this paper is all in the online form, with the help of questionnaire stars to produce questionnaires through WeChat, QQ, email, and other ways to entrust friends and relatives working in manufacturing enterprises to answer the questionnaire and to take the form of a snowball to further expand the sample size and scope. The survey was divided into two stages: pre-survey and formal survey. In the pre-survey stage, the questionnaires were distributed to a small number of experienced middle and senior managers, and 50 questionnaires were expected to be returned in this stage. Based on the feedback results, ambiguous scale questions in

the questionnaire were eliminated and integrated. In the formal research stage, the scope of distribution is expanded to the manufacturing industry in Sichuan Province. The questionnaire is distributed and recovered through the author's direct visits, as well as commissioned enterprise research institutions, questionnaire stars, and individual friends in order to improve the reliability and representativeness of the data in terms of channel selection. The response rate for mail questionnaires must be at least 20% to be accepted.

3.4.4 Data Analysis

In this research, based on the conceptual model of the mechanism of green entrepreneurial orientation on sustainable performance presented in Chapter 2, the structural equation modelling method will be applied to test the fit of the structural model to the sample data, analyse to identify the poorly fitted parts of the model and correct them to produce an optimal model.

Structural equation modelling is a statistical data analysis tool that combines multiple regression analysis, path analysis, and confirmatory factor analysis to explain the relationship between one or more independent variables and one or more dependent variables. It has the following advantages: Handling multiple dependent variables simultaneously, allowing independent and dependent variables to contain measurement error, Simultaneous estimation of the factor structure and factor relationships, and Allowing a more flexible measurement model to estimate the entire model fit (Bollen & Long, 1993). As the variables involved in the conceptual model of green entrepreneurial orientation on sustainable performance mechanism of green entrepreneurial orientation, green intellectual capital, green supply chain management, environmental uncertainty, and sustainable performance are highly subjective, difficult to measure directly, with significant measurement errors and complex causal relationships, they are very suitable for structural equation modelling.

Structural equation modelling (Seman et al.) is a widely used statistical method in the social sciences, with two main mainstream techniques: CB-SEM (covariance form structural equation modelling) and PLS-SEM (variance form structural equation modelling). CB-SEM analyses the covariance structure of the variables through the covariance structure of the variables and defines the factor structure to explain the covariance relationship. PLS-SEM, on the other hand, defines the variance structure

through linear integration and uses regression principles to explain the predictive and explanatory relationships between variables. Although the results are similar in the general causality scenario, they differ in terms of the purpose of the analysis, the distribution of normality, covariance, sample size, and mode of measurement.

Partial Least Squares (PLS-SEM), first proposed by Wold (1975), combines principal component analysis, path analysis, and formative modelling techniques. For complex models where the theory is not yet complete, PLS-SEM provides appropriate estimates and is particularly suitable for predictive modelling. As a new multivariate statistical data analysis method, PLS focuses on explaining variation for checking the significance of causal relationships and is suitable for building theoretical models (exploratory), as well as for validating inferential causal relationships. In applying PLS, it is able to simultaneously perform regression modelling, data structure simplification, and correlation analysis between two sets of variables. In addition, the PLS algorithm does not require a large sample size, which makes it particularly suitable for statistical analyses of small or medium sample data, as well as for regression analyses to obtain the desired estimation solution when the data does not conform to the normative distribution, and the analysis software used is SmartPLS 4.

In this research, Partial Least Squares (PLS-SEM) was used for data analysis and empirical study. Firstly, the main objective of the study is to analyse the relationship between exogenous variables and internal latent variables through empirical data, and PLS-SEM can precisely meet this research need. Secondly, the theoretical model established in this research still needs to be improved, and the related theoretical research currently needs to be further enriched. Therefore, the application of PLS-SEM technology in this research is very appropriate, as it can be used to construct the theoretical model and conduct causality analysis.

In this research, data collected through questionnaires, and statistical analyses such as descriptive statistics, reliability and validity tests, and structural equations will be conducted for the recovered questionnaire data. The analysis software used in this research is SPSS and SmartPLS 4. In this research, descriptive statistical analysis is performed using SPSS software, and measurement model analysis is performed using SmartPLS 4 to explore in depth the direct and indirect relationships between variables

and to reveal the complex interactions in the research model. In addition, the resilience and adaptability of SmartPLS 4 allow it to effectively handle small sample situations and provide more robust results for the study. By utilizing these advanced statistical tools, this research aims to synthesize the collected data, assess the relationships between the variables and draw meaningful conclusions on the impact of green entrepreneurship orientation on the sustainable performance of manufacturing industries in Sichuan Province.

The PLS-SEM model analysis focuses on reliability and validity. In order to deeply analyze the impact of moderating variables on green entrepreneurship orientation on sustainable performance, this paper also applies SPSS-PROCESS for hypothesis testing.

3.4.4.1 Descriptive Statistical Analysis

Descriptive statistical analysis is a scientific means of describing different aspects of data characteristics graphically and computationally, using tabulation and classification methods. It mainly involves analysing the frequency, concentration trends, and dispersion of data and generating the appropriate descriptive statistics. When using SPSS statistical software, this researchusually generate descriptive statistics such as mean, variance, standard deviation, etc., to describe the data in question. These statistics help us to understand the individual and organizational characteristics of the evaluation indicator variables and reveal the correlation between the data.

Firstly, gender, age, education, the industry of work, the size of the organization, and years of working experience were studied. Descriptive statistics were analyzed using the statistical analysis tool SPSS 23.0 to understand the categories and characteristics of the study participants.

Secondly, the maximum, minimum, median, and Standard Deviation of the observed question items of Green Entrepreneurial Orientation, Green Intellectual Capital, Green Supply Chain Management, Sustainable Performance, and Environmental Uncertainty were analyzed.

The items of the questionnaires are rated on a 5-point Likert scale ranging from “5-Strongly Agree- to 1-Strongly Disagree” (Likert, 1932).

The scores are: 5=Strongly Agree, 4=Agree, 3=Uncertain, 2=Disagree, 1=strongly Disagree. The interpretations of the mean score applied during the data analysis are shown below (MacKain et al., 1981).

4.51-5.00 means strongly agree

3.51-4.50 means Agree

2.51 -3.50 means Neutral

1.51 -2.50 means Disagree

1.00-1.50 means least agree

3.4.5 Measurement Model Evaluation

(1) Reliability Test

This article uses SmartPLS 4 statistical analysis software to conduct a reliability test on the collected sample data. This research mainly tests the internal consistency of the sample data and uses explicitly the Cronbach'α value to measure it. The Cronbach's α value will be calculated for the questionnaire items corresponding to each variable. 'α value is used to evaluate reliability, and the reliability judgment is shown in Table 3.8.

Table 3.8 Criteria for Reliability Assessment

Cronbach'α	**Reference standard**
Cronbach'α>0.9	Very high reliability
0.8<Cronbach'α<0.9	Reliability is high
0.7<Cronbach'α<0.8	Fair reliability, scale is acceptable
Cronbach'α<0.7	Low reliability and scale need to be redesigned

(2) Convergent Validity

In terms of convergent validity, Hair et al. (1998) proposed that individual indicator reliability, latent variable composition reliability (CR), and average variation extraction (AVE) must be considered. If these three indicators meet the requirements at the same time, this research can be verified. Has convergent validity.

Individual indicator reliability, considering the reliability of each indicator, Hair et al. (2011) believe that the standard loading value of all factors (ie, individual indicator reliability) should be above 0.7.

The combined reliability (CR) of each measured variable refers to the consistency of the internal variables and measures the correlation between the internal measurement items of the construct. Suppose the CR of a latent variable is higher. In that case, its measured variables are highly correlated, which means they are all measuring the same latent variable, and the latent variable can be measured better. Generally speaking, CR must be greater than 0.7 (Hair et al. 1998).

Average variance extracted (AVE) reflects the extent to which latent factors explain the variance of observed variables and is an essential indicator for measuring the convergent validity of the model. Fornell and Larcker (1981) believe that the average variance extraction value should be greater than 0.5 to indicate that the latent factors can fully explain the observed variables and ensure the convergent validity of the model.

(3) Discriminant Validity

Factor loading values average variance extracted (AVE) and are critical factors in assessing the fitness and reliability of measurement models(Bagozzi & Yi, 1988; Fornell & Larcker, 1981a; Hair, 2009).In addition, Henseler et al. (2015) demonstrated through a simulation study that an alternative method based on a multi-trait-multi-method matrix was proposed to assess discriminant validity: the Heterotrait-Monotrait Ratio of Correlations (HTMT). If the HTMT value is below 0.90, discriminant validity is established between the two reflectometry structures. Therefore, the study simultaneously applied AVE, factor loading values, and Heterotrait-Monotrait Ratio of Correlations for the measure of discriminant validity.

Fornell-Larcker criterion

The Fornell-Larcker criterion is a criterion for assessing the discriminant validity of latent variables in structural equation modeling (Seman et al.). The rationale involves comparing the within-concept variance of each latent variable to its cross-loading with other latent variables. The discriminatory criterion of the Fornell-Larcker criterion is that a latent variable's AVE (within-concept variance) should be significantly

greater than its cross-loading with other latent variables. This indicates that a latent variable has more significant explainable variance within its construct, thus ensuring good discriminant validity between latent variables.

Cross Loadings

Cross Loadings is an essential concept in measurement modelling in Structural Equation Modelling (Seman et al.). It involves loading between an observed variable and the latent variable to which it belongs, as well as loading between the observed variable and other latent variables. Reasonable Cross-loadings should show that the loading value of the observed variable on the latent variable to which it belongs is significantly higher than the loading value on other latent variables for the measurement model to have good discriminant validity.

Heterotrait-Monotrait Ratio of Correlations (HTMT)

HTMT is a measure of the relationship between two latent variables, and discriminant validity is measured by calculating the ratio of the correlation coefficients between the different latent variables; if the HTMT value is below 0.90, discriminant validity is established between the two reflectometry constructs (Henseler et al., 2015).

(4) Collinearity issue

Multicollinearity is generally tested using the variance inflation factor VIF. When the tolerance value is greater than or equal to 0.2, and the VIF value is less than or equal to 5, it means that there is no covariance issue between the indicators (Hair, Ringle, and Sarstedt, 2011).

3.4.6 Hypothesis Testing

(1) P-value

Suppose the calculated P-value is less than 0.05. In that case, it is usually considered significant, which means that there is enough evidence to reject the null hypothesis at a given level of significance.

(2) T-value

T-value is the result of dividing the path coefficients by their standard errors; the larger the absolute value, the more significant the path coefficients are relative to their standard errors. Usually, the absolute value of the T-value is more significant than 1.96

(corresponding to a 95% confidence level) and can be considered a significant path coefficient.

(3) Confidence Interval

Confidence intervals provide an estimate of the range of the path coefficients. If the confidence interval does not contain zero, then the path coefficients are significant at a given confidence level. A 95% confidence interval is usually used, and if the 95% confidence interval does not contain zero, the path coefficient can be considered significant.

(4) Direction

The positive and negative signs of the path coefficients indicate the directional relationship between the variables. A positive coefficient indicates a positive correlation between the variables, and a negative coefficient indicates a negative correlation between the variables. The direction of the path coefficients should be consistent with the theoretical assumptions, and their magnitude should be substantially explanatory.

(5) Coefficient of determination (R2)

Research by Hair Jr et al. (2010) and others showed that the existence of R2 has three critical values of 0.25, 0.5, and 0.75, which reflect the strength of the explanation, representing weak, medium, and strong, respectively.

3.4.7 Testing Criteria

The study employed the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach using the pre-built software SmartPLS and SPSS-PROCESS. The relationships between latent variables and observed variables were modeled as reflective (See Table 3.9).

Table 3.9 Model Testing Criteria

Measurement	Measurement index	Criterion
Construct Reliability	Cronbach Alpha(α)	> 0.7 Hair, et al., (2010)
	Composite Reliability	> 0.7 Hair, et al., (2011)
	Indicator Reliability	>0.7 Hulland, (1999) Chin (1998)
Convergent Validity	Average Variance Extracted (AVE)	> 0.5 Fornell & Larcker (1981) Hair et al., (2009)
Discriminant Validity	Fornell-Larcker criterion	The within-concept variance of this latent variable should be significantly more significant than the cross-loading with other latent variables.
	Cross Loadings	The factor loading of the indicator on the construct to which it belongs should be greater than the loading between the indicator and the other constructs in the model (chin, 2010, Hair et al., 2014)
	Heterotrait-Monotrait Ratio of Correlations (HTMT)	HTMT <0.9 (Henseler et al., 2015)
Collinearity Test	VIF	Probable (i.e. critical) collinearity issues when VIF≥5, Possible collinearity issues when VIF≥3-5, Ideally show that VIF<3
Hypothesis Test	P-value,T-value, confidence interval	P<0.05, T-value>1.96, 95 percent confidence interval does not contain zero.
Coefficient of Determination R^2	The ability to explain variance	Hair et al.,(2010) defines 0.25 as small, 0.50 as medium, and 0.75 as large.

CHAPTER 4
RESEARCH RESULTS

This chapter presents the results of the qualitative and quantitative analyses. For the qualitative analysis, the results of semi-structured interviews with 15 senior and middle-level leaders of Sichuan manufacturing companies and industry experts are presented. This was followed by a quantitative analysis, in which extensive questionnaire distribution was conducted after passing the IOC and pre-survey tests before the questionnaires were formally distributed. The study was analyzed using SmartPLS 4 and SPSS-PROCESS. The study was conducted in two main ways. Firstly, each latent variable and its measurement items were assessed using SmartPLS to ensure that the indicators of reliability, consistency, convergent validity, and discriminant validity were met. The second step was to test the hypotheses of the model using SPSS-PROCESS Model14. The main structure is as follows

4.1 Qualitative Results

4.2 IOC Inspection and Pre-survey

4.3 Data Preparation

4.4 Descriptive Statistics

4.5 Assessment of the Measurement Model

4.6 Regression Analysis and Hypothesis Testing

4.7 Summary of qualitative and quantitative studies

4.1 Qualitative Results

This part is a qualitative study. This research conducted in-depth interviews with managers of manufacturing enterprises, school scholars, and people engaged in government departments in Sichuan, China. This part summarizes the results of the interviews and provides support for the theoretical model through in-depth interviews.

4.1.1 Research Tools

In this section of the study, this research chose the semi-structured interview as the primary research tool. This interview method sets the central questions in advance and acts as a guide for the interview, but it also retains a certain degree of flexibility to

allow for moderate question additions, subtractions, or adjustments during the actual interview process. The nine in-depth interview questions are explained in Chapter Three.

4.1.2 In-depth Interview Results

This interview includes 15 Chinese manufacturing company executives and experts in related fields. Their specific work is described below.

Table 4.1 Basic Information of Respondents

Number	Gender	Age	Years of service	Position or title
Interviewee 1	Male	38	14	Corporate Project Director
Interviewee 2	Female	42	18	Enterprise Project Manager
Interviewee 3	Male	45	23	General Manager
Interviewee 4	Male	37	15	Production Manager
Interviewee 5	Male	50	28	Director of Hydraulics
Interviewee 6	Male	42	27	Sales Director
Interviewee 7	Male	47	23	Director of Research and Development
Interviewee 8	Male	51	28	Professor of Management
Interviewee 9	Male	51	26	Director of Enterprise Supply Chain
Interviewee 10	Male	36	12	Deputy Section Chief of Economy and Informatization Department
Interviewee 11	Male	44	20	Enterprise Sales Director
Interviewee 12	Male	49	26	Enterprise R&D Director
Interviewee 13	Male	39	15	Production Director
Interviewee 14	Male	47	26	Director of Industrial Economics Research Center
Interviewee 15	Female	45	14	Professor of Economics

“How do you evaluate the current state of green entrepreneurial orientation, green intellectual capital, green supply chain management and sustainable performance in the context of manufacturing?”

Table 4.2 Results of the In-depth Interview Question 1

Interviewee	Answer to the question
Interviewee 1	GEO in the manufacturing industry has become an essential strategy for companies to enhance competitiveness. The development of GIC requires the incorporation of more environmental innovations in project management. GSCM should implement green concepts from the beginning to the end of a project to realize the overall environmental benefits. For SuP, the industry is actively adapting to the policy requirements, with significant results, but it still needs to continue to be optimized.
Interviewee 2	GEO in the manufacturing sector has driven the creation and implementation of many new projects. GIC needs to be enhanced through collaboration and knowledge sharing among project teams.GSCM is particularly important in the procurement and implementation phases of a project to ensure that every step of the process is compliant with the green standards.SuPs are visible in the evaluation of the project after its completion, and more data support and analysis are needed.
Interviewee 3	GEO has become an essential part of corporate strategy. The development of GIC relies on the support of corporate culture and staff training. GSCM must be integrated into every aspect of the company's operations, from raw material purchasing to production to logistics and distribution, all of which need to consider environmental protection. suP needs to be realized through the company's all-around green practices and be recognized by the market and society.
Interviewee 4	In production management, GEO needs to reduce pollution and resource consumption at source. GIC needs to train technicians on the production line to enhance their environmental awareness and skills.GSCM should ensure environmental compliance at every step of the production process. SuP needs to achieve this through continuous optimization of the production process and technological innovation to ensure that the goal of green production is achieved.
Interviewee 5	In the production of hydraulic systems, GEO means the use of environmentally friendly materials and technologies. The development of GIC needs to focus on training the R&D team in environmentally friendly skills. The GSCM should ensure that each component supplier complies with environmental standards. The performance of SuP on the production line is critical and needs to be maintained through regular evaluation and improvement.

Table 4.2 Results of the In-depth Interview Question 1 (Cont.)

Interviewee	Answer to the question
Interviewee 6	GEO can bring more market opportunities but will increase the cost of the organization.GIC enhancement requires the sales team to understand and promote the advantages of green products.GSCM should ensure that the products are environmentally friendly at every stage, from production to distribution. SuP needs to be evaluated and adjusted through market feedback and sales data.
Interviewee 7	As R&D Director, GEO drives the development of new technologies and products.GIC's development relies on the innovation and environmental awareness of its R&D staff.GSCM's role in new product development is crucial to ensure that the materials and processes developed are environmentally friendly. SuP needs to be achieved through the application of new technologies and the optimization of R&D processes.
Interviewee 8	From an academic point of view, GEO in manufacturing is not only the choice of enterprises but also a hotspot for research. The development of GIC needs the support of academia to enhance the overall level of the industry through theoretical research and talent training.GSCM should be promoted through interdisciplinary research and enterprise cooperation. The enhancement of SuP needs to comprehensively consider the economic, environmental, and social benefits and provide theoretical support through scientific research.
Interviewee 9	As a Supply Chain Director, I see the growing importance of GEO in Supply Chain Management. The development of GIC requires the environmental knowledge and skills of technicians at all stages of the supply chain. The key to GSCM is compliance with green standards at every stage, from raw materials to finished products. SuP needs to be achieved through holistic optimization of the supply chain and green innovation.
Interviewee10	From the Government's perspective, GEO is an important strategy to promote the transformation and upgrading of the manufacturing industry. The development of GIC requires policy guidance and active participation of enterprises. GSCM needs to be realized through the development of industry standards, policies, and regulations. suP needs to be promoted through policy support and market incentives for the continuous improvement of enterprises.
Interviewee11	In the sales area, GEO can enhance corporate brand value and market competitiveness.GIC enhancement requires the sales team to be familiar with the characteristics of green products and market demand.GSCM should ensure that the entire life cycle of the product complies with environmental standards. SuP needs to be evaluated and improved through customer feedback and market data.

Table 4.2 Results of the In-depth Interview Question 1 (Cont.)

Interviewee	Answer to the question
Interviewee12	GEO promotes the development of new materials and technologies in the chemical industry.GIC's development needs to focus on environmental awareness and innovation by researchers.GSCM plays an essential role in the development of new materials and needs to ensure that the R&D process is environmentally friendly. SuP does this through the application of new materials and the improvement of production processes.
Interviewee13	In production management, GEO means the use of environmentally friendly materials and processes. The development of GIC requires the training of technicians on the production line to upgrade their environmental skills. GSCM should ensure environmental compliance at every stage of production. SuP needs to be realized through the optimization of production processes and technological innovation.
Interviewee14	From the research point of view, GEO in the manufacturing industry is not only a hotspot of enterprise practice but also an essential direction for policy research. The development of GIC needs to rely on industrial economic research and theoretical support.GSCM should be promoted through policy research and industry guidance. The enhancement of SuP needs to consider economic, environmental, and social benefits comprehensively and provide theoretical support through scientific research.
Interviewee15	GEO has received attention in both academia and enterprises. The development of GIC needs to rely on the support of universities and research institutes to cultivate more high-quality talents, and GSCM needs the synergistic promotion of the whole industrial chain in order to realize genuinely sustainable development.

For question 1, the interviewers believed that GEO had become an essential part of the strategy to enhance corporate competitiveness and strategy (1, 3, 4, 7) and to promote the transformation and upgrading of the industry under the guidance of policies (10).GIC needs to be developed through employee training, technician's environmental awareness enhancement, and the support of academia (2, 5, 8, 13).GSCM emphasizes the implementation of production and supply chain aspects of Green standards (3, 9, 11, 14) and relies on the development of policies, regulations, and industry standards (10). SuP, on the other hand, relies on a full range of green practices, technological innovations, and process optimization (4, 6, 12, 13) and needs to be evaluated and improved through market feedback and data analysis (2, 8, 15). Overall, interviewees

agreed that GEO, GIC, and GSCM are essential for achieving SuP in manufacturing, but further optimization and refinement are needed.

Table 4.3 Results of the In-depth Interview Question 2

"Do you think green entrepreneurial orientation has an impact on green intellectual capital, green supply chain management and sustainable performance?"

Interviewee	**Answer to the question**
Interviewee 1	In corporate practice, GEO not only improves the efficiency of resource utilization but also enhances the market competitiveness of the company, and this strategy facilitates the accumulation of GICs and optimizes the GSCM, which provides essential support for the realization of SuP.
Interviewee 2	GEO drives GIC in areas such as technology innovation and employee training. However, GSCM can be challenging when it comes to cost and complexity issues. Together, these factors impact the organization's improvement in SuP.
Interviewee 3	Enterprises implementing GEO strategies need to measure technical and financial investments; otherwise, there will be challenges in the enhancement of GIC and the effective implementation of GSCM. There will also be implications for SuP promotion.
Interviewee 4	Companies are able to GIC under the leadership of GEO and reduce their environmental load by optimizing their production processes, which also contributes to GSCM.
Interviewee 5	GEO has had a significant impact on companies, enhancing their market position and environmental impact through the development of environmentally friendly products and the optimization of supply chain management, effectively contributing to the achievement of SuP.
Interviewee 6	In the market competition, GEO brings a new advantage. This advantage favors the importance of green strategy and the accumulation of green capital, which also has a positive impact on the sustainable development of enterprises.
Interviewee 7	GEO promotes the development of technological innovation and partnerships, significantly improves the environmental performance and market competitiveness of products and effectively supports the overall improvement of SuP.
Interviewee 8	GEO has had a significant impact on GIC and GSCM, but to achieve actual SuP, companies need to focus on technological innovation and strategic transformation.
Interviewee 9	GEO facilitates the green transformation of corporate supply chains, optimizes supplier selection and logistics management, directly improves resource efficiency and environmental benefits, and effectively supports SuP enhancement.

Table 4.3 Results of the In-depth Interview Question 2 (Cont.)

Interviewee	Answer to the question
Interviewee10	Within the constraints of the policy, companies must implement GEO, which may lead to increased costs in the short term, but in the long term, it can drive progress in GIC and GSCM and improve SuP.
Interviewee11	GEO promotes the enhancement of product green attributes and market competitiveness and facilitates the accumulation of GICs. Enterprises also need to strengthen their investment in GSCM to achieve lasting SuP improvements.
Interviewee12	The implementation of green orientation by enterprises is conducive to the promotion of innovative practices in terms of GIC and GSCM, which effectively support the overall enhancement of SuP through technological research and development and the establishment of partnerships.
Interviewee13	In corporate practice, GEO may drive the accumulation of GICs and the environmental optimization of production processes. However, challenges in GSCM still need to be overcome to achieve excellent corporate progress in SuP.
Interviewee14	GEO helps companies identify and utilize GICs and optimize supply chain management, with a significant impact on their GICs, GSCM, and SuP. Improved SuP promotes innovation and environmental responsibility.
Interviewee15	Theoretically, through green orientated environmental measures, firms are better able to adapt to market demand, and GEO has a positive impact on firms' GIC and GSCM, enhancing SuP's long-term competitiveness.

For Question 2, it was found that interviewees perceptions of GEO's (GEO) impact on GIC, GSCM, and SuP focused on the following aspects: most respondents agreed that GEO promoted GIC in their organizations (1, 2, 3, 4, 6, 7, 12), enhanced the effectiveness of GSCM (5, 9, 11, 13), and contributed to a SuP enhancement (1, 4,5,6,7,8,9,11,12,13,14,15). GEO's reduction of environmental loads through technological innovations, employee training, and optimization of production processes has a significant positive effect on the overall competitiveness and environmental impact of the company (1, 4, 5, 7, 8, 10). However, some respondents also mentioned that when implementing GEO, companies may face challenges of increased costs and management complexity (2, 3, 10). Overall, GEO contributes significantly to firms' GIC and GSCM, but its specific effects may vary across firms, depending on the effectiveness of technology inputs, policy support, and internal management of the firm.

Table 4.4 Results of the In-depth Interview Question 3

"What role do you think green intellectual capital plays in the impact of green entrepreneurial orientation on sustainable performance?"

Interviewee	Answer to the question
Interviewee 1	GEO stimulates the coverage and application of GICs in manufacturing, facilitates teams to respond more professionally to market and regulatory changes, improves innovation, and lays the foundation for corporate SuP.
Interviewee 2	The accumulation of GICs is a manifestation of the implementation of GEO. This process raises operating costs in the short term but contributes to corporate SuP in the long term.
Interviewee 3	GEO promotes environmental protection in company management and strategy, and GIC is integrated into strategic decisions. Its application consolidates the environmental image but increases costs and contributes to social and environmental performance.
Interviewee 4	GEO facilitates the formation of GICs, which can have a positive impact on firm performance indirectly through GICs.
Interviewee 5	GEO guides product design and manufacturing, and GIC plays a bridging role in driving the adoption of green technologies.GEO, through its intellectual capital, may increase corporate SuP.
Interviewee 6	The implementation of GEO has led the sales team to focus on green products, increasing market acceptance and further shaping the GIC. The GIC acts as a bridge to facilitate internal and external collaboration to drive the SuP.
Interviewee 7	GEO pushes the technical team to go deeper into green technology to form a specialized R&D team focused on environmental protection, forming a GIC that can act as a bridge between GEO and SuP.
Interviewee 8	GEO enhances the environmental awareness and professional skills of its employees and helps to form GICs.GICs play an essential role in the implementation of GEO and promote SuP.
Interviewee 9	GEO's emphasis on green development and the formation of environmentally focused professional teams has contributed to the formation of GIC. There is a facilitating effect on the relationship between GEO and SuP.
Interviewee10	GEO prompts enterprises to focus on green innovation, technological innovation, and talent training and helps them to improve their SuP through GIC's knowledge-sharing and cooperation mechanism.
Interviewee11	The implementation of GEO improves the sales team's environmental literacy. It strengthens the transmission of green characteristics of the products, which is also a manifestation of green capital accumulation, which can enhance market competitiveness and contribute to the sustainable development of the enterprise.

Table 4.4 Results of the In-depth Interview Question 3 (Cont.)

Interviewee	Answer to the question
Interviewee12	GEO promotes environmentally friendly R&D, introduces green technologies, promotes green product transformation, enhances the GIC of R&D teams, and helps corporate SuP.
Interviewee13	GEO improves production efficiency, meets market demand, builds employee GIC, strengthens corporate image, and, in turn, promotes SuP.
Interviewee14	GEO pushes companies to go green, builds GICs, and becomes a critical bridge between orientation and SuP.
Interviewee15	GEO inspires environmental innovation, and whole-process green thinking prompts companies to cultivate GIC, enhance competitiveness, and realize SuP.

For question 3, most respondents agreed that GIC, promoted by GEO, has played a bridging role by enhancing employees' environmental awareness and professional skills, promoting technological innovation and green product development, and significantly contributing to the enterprise's SuP (1, 4, 5, 6, 7, 8, 9, 10, 12, 13,14,15). The accumulation and application of GIC has helped the enterprise to better respond to changes in the market and regulations, to improve market competitiveness and environmental image (1, 3, 6, 11, 15), and further consolidate enterprises' green strategies and practices through knowledge sharing and internal collaboration mechanisms (7, 10, 14). However, some interviewees pointed out that the formation and application of GIC may increase the operating costs of enterprises in the short term, but in the long term, it has a significant contribution to the SuP of enterprises (2, 3, 12). Overall, GIC plays a vital role as a bridge between GEO and SuP and lays a solid foundation for firms to achieve sustainable development by upgrading environmental technology and knowledge and optimizing production processes and supply chain management.

Table 4.5 Results of the In-depth Interview Question 4

"In your opinion, what is the role of green supply chain management in the impact of green entrepreneurial orientation on sustainable performance?"

Interviewee	Answer to the question
Interviewee 1	The implementation of GEO in enterprises has a positive impact on the adjustment and optimization of green supply chains. GSCM plays an essential role in GEO and corporate SuP, transforming environmental concepts into practical supply chain strategies and improving corporate SuP.
Interviewee 2	It is implementing GEO for GSCM. GSCM is the bridge that drives GEO and enterprise SuP, enhancing competitiveness and leadership.
Interviewee 3	GEO has a positive impact on GSCM. Focusing on environmental practices, selecting suppliers that meet standards, and driving environmental innovation, GSCM is the key to connecting GEO and corporate SuP, improving product competitiveness, and consolidating leadership positions.
Interviewee 4	GEO drives the supply chain in a green direction. GSCM is a bridge between GEO and corporate SuP, improving competitiveness and reducing production costs.
Interviewee 5	The implementation of GEO has a facilitating effect on GSCM. GSCM connects GEO and enterprise SuP, improves product competitiveness, and facilitates enterprise SuP.
Interviewee 6	GEO's impact on the supply chain ranges from the selection of environmentally friendly materials to an emphasis on green manufacturing, which actively promotes corporate image and market competitiveness.
Interviewee 7	The implementation of GEO has had a significant impact in terms of GSCM and technological innovation, and GSCM can be seen as a bridge between GEO and SuP.
Interviewee 8	GEO promotes a corporate focus on overall environmental awareness and cooperation with suppliers, and GSCM is a vital tool for achieving SuP.
Interviewee 9	GEO promotes close cooperation with green suppliers, selects environmentally friendly suppliers, and drives SuP enhancement through green logistics.
Interviewee10	At the macro level, it was noted that GEO pushes manufacturing companies to be more environmentally conscious, while GSCM plays a crucial role in SuP.
Interviewee11	The implementation of GEO has a positive impact on GSCM, promoting environmentally friendly purchasing, optimizing production, improving corporate SuP, and creating a virtuous circle.

Table 4.5 Results of the In-depth Interview Question 4 (Cont.)

Interviewee	Answer to the question
Interviewee12	GEO stimulates attention to the green supply chain, making environmental protection concepts deeply integrated into the corporate culture, promoting SuP enhancement, and forming a long-term competitive advantage.
Interviewee13	The implementation of GEO introduces more environmentally friendly materials and processes in the supply chain, improves environmental friendliness by optimizing the supply chain, drives up SuP, and achieves efficient use of resources.
Interviewee14	GEO promotes the deeper application of GSCM to improve corporate SuP by working with partners to develop environmental standards that connect environmental and economic benefits.
Interviewee15	GEO introduces environmental protection concepts to the supply chain, realizes consistent internal and external management model, improves market competitiveness, and promotes the comprehensive improvement of SuP.

For question 4, most respondents agreed that GSCM played a vital role as a bridge between GEO and SuP (1, 3, 4, 5,6, 7, 8, 9, 11,12,13, 14).GSCM implemented environmental protection concepts by optimizing every link in the supply chain, from raw material procurement to production to logistics and distribution, which enhanced the market competitiveness and environmental benefits of the company (1, 3, 6, 11, 13).GSCM promotes close cooperation with green suppliers, selects suppliers and materials that meet environmental standards, and promotes technological innovation and environmental practices (2, 3, 7, 9, 13, 14). Some interviewees pointed out that GSCM not only improves firms' SuP but also has a positive effect in reducing production costs and improving product competitiveness (4, 5, 12, 13). However, the implementation of GSCM may also face the challenges of increased costs and complexity in the short term. However, in the long term, these challenges can be transformed into long-term competitive advantages and sustainable development for the organization through the facilitation of GEO (2, 10, 15). Overall, GSCM plays a crucial bridging role in the impact of GEO on SuP and significantly improves firms' SuP and market competitiveness by transforming environmental protection concepts into practical supply chain strategies through cooperation with suppliers, optimization of production processes, and logistics management.

Table 4.6 Results of the In-depth Interview Question 5

"In your opinion, what is environmental uncertainty and what is its impact on sustainable performance?"

Interviewee	Answer to the question
Interviewee 1	Fluctuating market demand, unstable raw material prices, and changes in policies and regulations characterize the current manufacturing EU. Enterprises need to be more resilient in strategic planning and performance management, such as optimizing the supply chain, in order to remain competitive.
Interviewee 2	Manufacturing EU is diversified in its manifestations, including market competition, technological upgrading, supply chain risks, etc. EU may have an impact on SuP, and the accumulation of green capital is also essential.
Interviewee 3	EU is mainly manifested in market demand fluctuations, raw material price instability, global supply chain risks, and policy and regulatory changes.EU may indirectly affect the enterprise's SuP.
Interviewee 4	Market demand fluctuations have a significant impact on production planning, and raw material price instability directly affects production cost control. Enterprises need to be flexible in their strategic plans and strengthen green management of the supply chain to reduce uncertainty in order to ensure the sustainability of their performance.
Interviewee 5	Market demand, raw material prices, global supply chain risks, policies, and regulations are the main manifestations of the current EU. Enterprises should focus on market forecasting and establish reliable supply chain partners to adapt to dynamic changes in the market.
Interviewee 6	Manufacturing industries need to cope with environmental uncertainties such as market volatility and technological change and need to be flexible in adjusting their strategic planning. The impact of environmental uncertainty on performance is not directly reflected.
Interviewee 7	Global economic uncertainty and raw material price volatility have a direct impact on the manufacturing industry, and flexible strategic planning and comprehensive performance assessment are even more critical for companies.
Interviewee 8	Market demand, technological advances, and policy changes are the uncertainties facing the manufacturing sector, and the impact of environmental uncertainty on SuP needs to be further determined.
Interviewee 9	Uncertainty about market volatility, supply chain risks, raw material prices, and the introduction of new technologies require manufacturing industries to establish more flexible strategic planning mechanisms, with implications for long-term or sustainable business performance.

Table 4.6 Results of the In-depth Interview Question 5 (Cont.)

Interviewee	Answer to the question
Interviewee10	Competition in the market, the rapid development of new technologies, and the complexity of global supply chains have challenged the manufacturing industry with the need for differentiated strategies and flexible performance assessment to remain competitive, and corporate SuP will inevitably be affected by the environment.
Interviewee11	In the manufacturing sector, the EU is mainly characterized by fluctuations in raw material prices and changes in market demand. It has a direct impact on sales planning and production scheduling, requiring more flexible strategic planning and enhanced supplier cooperation in order to maintain performance.
Interviewee12	EU is mainly reflected in the availability of raw materials and changes in market demand. In essence, they are all related to the management of the supply chain, and the green supply chain can increase the risk resistance of enterprises, which also has an impact on SuP.
Interviewee13	In the textile manufacturing industry, the supply of raw materials, changes in production technology, and adjustments in environmental regulations are significant uncertainties. Careful production management and environmental technology development are required to improve the competence and capability of employees and to promote supply chain management and technological innovation continuously.
Interviewee14	The overall development of the manufacturing sector is affected by uncertainties in the international trade environment, policy adjustments, and technological innovations. Sensitivity, timely adjustment of business structure, focus on technological innovation, and close communication with the Government are necessary for enterprises to maintain sustainable performance.
Interviewee15	EU manifests itself for the manufacturing sector in the form of fluctuations in market demand, changes in the financial market, and uncertainty in the labor market, which can indirectly affect the short- and long-term performance of firms.

For question 5, many respondents believe that factors such as fluctuating market demand, technological changes, and unstable raw material prices pose essential challenges to firms' strategic planning and SuP management (1, 2, 3, 4, 5, 6, 7, 8, 9, 10). Some interviewees pointed out that in the face of the EU, companies need to establish flexible strategic planning mechanisms to better cope with market changes and supply chain risks (1, 4, 6, 9, 11). Several interviewees emphasized the importance of GIC accumulation, such as technological innovation and cost control, in coping with the EU,

especially in the management of supply chain raw material sourcing and production planning (2, 4, 12, 13).EU is seen as an essential opportunity to push firms to strengthen their cooperation with government and industry associations to adapt and influence future environmental changes (8, 11, 14).

Table 4.7 Results of the In-depth Interview Question 6

"What role do you think environmental uncertainty plays in green intellectual capital and sustainable performance?"

Interviewee	Answer to the question
Interviewee 1	The EU may affect the relationship between GICs and SuPs. Market volatility and raw material instability make firms need to be more flexible, which may weaken the foresight and resilience of strong GICs, further affecting sustainable competitiveness.
Interviewee 2	EU has an impact on SuP presence, technological renewal, and sensitivity to changing market needs, with an emphasis on responding to environmental change and sustainable innovation through GIC.
Interviewee 3	Market demand fluctuations and technological changes make the EU a variable that regulates the relationship between GIC and SuP, and firms need to be flexible in adjusting their strategies.
Interviewee 4	In the production area, market demand fluctuations and raw material price instability make the EU a variable that regulates the relationship between GIC and SuP. Firms need to be flexible in adjusting their production plans and procurement strategies, emphasizing the resilience of GIC.
Interviewee 5	EU has a significant impact on business operations and will have an impact on the GIC-SuP relationship. Enterprises need to be flexible in adjusting their R&D and production programs, emphasizing the adaptability and resilience of the GIC.
Interviewee 6	EU is a variable in the relationship between GIC and SuP in the manufacturing industry. Firms need to pay attention to market fluctuations, adjust their sales strategies, and balance short-term performance with long-term sustainable goals in order to respond flexibly to the EU.
Interviewee 7	EU moderates the relationship between GIC and SuP. Firms need to be prudent in their R&D strategies, adapt to technological and market uncertainties, and balance short-term competitive and long-term sustainability goals to maintain performance flexibly.

Table 4.7 Results of the In-depth Interview Question 6 (Cont.)

Interviewee	Answer to the question
Interviewee 8	The EU can have far-reaching implications for manufacturing firms, arguing that it may moderate the relationship between GIC and SuP. In the midst of uncertainty, firms need to strengthen GIC to enhance resilience while focusing on flexibility and innovation and establishing effective risk management mechanisms.
Interviewee 9	In the manufacturing sector, the EU has some influence on the GIC-SuP relationship. The need for firms to adjust their strategies in the face of market volatility and to balance short-term needs and long-term goals is a challenge for the fulfillment of the GIC role.
Interviewee 10	EU is a significant factor in manufacturing firms and may reduce the relationship between GIC and SuP to some extent. Businesses need to be flexible in their response to drive sustainable development.
Interviewee 11	EU directly affects sales plans and marketing strategies as a variable regulating the relationship between GIC and SuP. Focus on the intelligent use of green technology to adapt to market changes and maintain SuP.
Interviewee 12	EU is both a challenge and an opportunity. Enterprises need to use it in conjunction with market changes to strengthen their GICs and thus realize SuP.
Interviewee 13	In textile manufacturing, the EU becomes a critical variable regulating the relationship between GIC and SuP. Companies need to focus on the use of GIC to reduce the impact of the EU in order to improve product sustainability.
Interviewee14	EU plays a regulating role between GIC and SuP. Facing the EU, enterprises should actively use GIC, flexibly formulate green development strategies, and improve SuP.
Interviewee 15	From an economic perspective, the EU has an impact on the GIC-SuP relationship. It motivates firms to focus on environmental protection and sustainability, strengthens GIC's ability to adapt to market changes, and improves SuP.

For question 6, 15 professionals agreed that the EU affects the relationship between GIC and SuP. Some interviewees believe that environmental uncertainty may play a moderating role (1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15), and most respondents believe that EU factors such as fluctuations in market demand and technological changes, which affect the resilience of firms' GIC and the performance of their SuPs, may reduce the impact of GIC on SuP (1, 5, 6, 9, 10, 13). Some interviewees pointed out the need for firms to focus on the use of GICs, such as technological innovation and market sensitivity, in responding to the challenges posed by environmental change in order to drive

sustainable innovation and performance (4, 5, 8, 9, 10). Some interviewees emphasized that, by enhancing firms' environmental sensitivity and innovation capabilities, firms could better balance short-term performance with long-term sustainability goals and thus stay ahead in a competitive market (3, 8, 10, 14). Overall, the EU regulates the relationship between GIC and SuP in the manufacturing industry, and firms should effectively respond to the challenges posed by market changes and technological advances by enhancing their GIC foresight, resilience, and innovativeness in order to achieve the long-term goal of sustainable development.

Table 4.8 Results of the In-depth Interview Question 7

"What role do you think environmental uncertainty plays in green supply chain management and sustainable performance?"

Interviewee	Answer to the question
Interviewee 1	Uncertainty both poses a challenge to business development and can negatively affect the relationship between GSCM and SuP.
Interviewee 2	EU may be regulating the relationship between GSCM and SuP. Technological demand uncertainty requires innovative supply chain management and working closely with partners to realize SuP.
Interviewee 3	The EU is affecting GSCM and SuP relationships. Demand fluctuations and technological changes reduce the role of the supply chain and have a negative impact on SuP.
Interviewee 4	EU is the variable that affects the relationship between GSCM and SuP.GSCM enhances SuP through flexibility, rationalization of procurement, and adaptation to regulatory changes.
Interviewee 5	EU affects the relationship between GSCM and SuP. Through the flexible adjustment of the green supply chain, enterprises can better adapt to market changes and improve SuP.
Interviewee 6	Business development requires flexibility to respond to market fluctuations and to adjust supply chain strategies, and it needs to realize the synergy between GSCM and performance in an uncertain environment.
Interviewee 7	EU has a negative impact on green supply chains and manufacturing performance. Attention needs to be paid to the selection and management of supply chain partners to adapt to market changes and ensure SuP fulfillment.
Interviewee 8	EU plays a key role in the relationship between GSCM and SuP in manufacturing, possibly as a moderating relationship. A more in-depth empirical study is needed for the exact justification of this view.

Table 4.8 Results of the In-depth Interview Question 7 (Cont.)

Interviewee	Answer to the question
Interviewee 9	EU is the variable that regulates the relationship between GSCM and SuP. Enterprises need to be flexible in adjusting their partnerships, focusing on costs and benefits to ensure synergistic development of GSCM and performance.
Interviewee 10	EU can negatively affect GSCM in the manufacturing sector. Companies need the flexibility to adjust their supply chain strategies to uncertainties such as raw material price fluctuations, regulatory changes, etc., to ensure that SuP targets are met.
Interviewee 11	Sales operations are directly affected by market and supply chain fluctuations.EU is a crucial variable affecting the relationship between green supply chains and SuP.
Interviewee 12	EU directly affects the viability of raw materials and technical support.GSCM reduces the impact of raw material fluctuations, improves the stability of R&D projects, and enhances SuP.
Interviewee 13	Production processes are governed by raw material supply and environmental regulations. EU is the crucial regulating variable, and GSCM choices stabilize raw material supply, adapt to changes in regulations, improve production sustainability, and thus maintain long-term business performance.
Interviewee 14	EU has an impact on both the product mix and the chain, which may modulate the green supply chain-SuP relationship.
Interviewee 15	Market mechanisms and firms' behavior are affected by the EU.GSCM is also affected by fluctuations in market demand, which in turn affects resource allocation and firms' SuP.

For question 7, the respondents agreed that environmental uncertainty affects the effectiveness of supply chain management on the sustainable performance of a company (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15). Some of the respondents believed that environmental uncertainty may be the variable that moderates the relationship between green supply chain management and sustainable performance (1, 2, 3, 4, 5, 6, 7, 8, 9, 13, 14, 15) and maybe a negative influence (1, 3, 7, 10). A number of interviewees emphasized the need for firms to address the challenges posed by environmental uncertainty through flexible supply chain strategies and close collaboration with partners (1, 6, 7, 8, 9, 10, 11, 12, 13, 14). This includes adapting product mix, improving logistics management, optimizing resource utilization, and complying with changing environmental regulations in order to maintain competitive advantage and sustainability in an uncertain market environment (1, 6, 7, 8, 9, 10, 11, 12, 13, 14).

4.1.3 Summary of Qualitative Research

Further, in conjunction with the research hypotheses presented earlier, this paper focuses on summarising the responses of the 15 interviewees to interview questions 2, 3, 4, 6, and 7 (See Table 4.9).

Table 4.9 Summary Table of Qualitative Interviews

	GEO→SuP (Question 2)	**GEO→GIC×EU→SuP (Questions 3 and 6)**		**GEO→GSCM×EU→SuP (Questions 4 and 7)**	
		GEO→GIC→SuP (Question 3)	**GIC×EU→SuP (Question 6)**	**GEO→GSCM→SuP (Question 4)**	**GSCM×EU→SuP(Question 7)**
Interviewee 1	/	/	/	/	/
Interviewee 2					/
Interviewee 3			/	/	/
Interviewee 4	/	/	/	/	/
Interviewee 5	/	/	/	/	/
Interviewee 6	/	/	/	/	/
Interviewee 7	/	/	/	/	/
Interviewee 8	/	/	/	/	/
Interviewee 9	/	/	/	/	/
Interviewee 10		/	/		
Interviewee 11	/			/	
Interviewee 12	/	/		/	
Interviewee 13	/	/	/	/	/
Interviewee 14	/	/	/	/	/
Interviewee 15	/	/	/		
Total	12	12	12	13	11

4.2 IOC Inspection and Pre-survey

4.2.1 Data Coding and Entry

The variables were coded in this research to simplify the process of processing and interpreting the data. The abbreviations used for the variables are shown in Table 4.10.

Table 4.10 Abbreviation of Constructs and Observed Variables

Second-order variables	First-order variables	Item	Type of variable
Sustainable Performance(SuP)	Economic Performance(EcP)	EcP1	Dependent Variable
		EcP2	
		EcP3	
		EcP4	
	Environmental Performance(EP)	EP1	
		EP2	
		EP3	
		EP4	
		EP5	
	Social Performance(SP)	SP1	
		SP2	
		SP3	
		SP4	
Green Entrepreneurial Orientation(GEO)	Environmental Orientation(EO)	EO1	Independent Variable
		EO2	
		EO3	
		EO4	
	Green Innovativeness(GI)	GI1	
		GI2	
		GI3	
	Green Risk Taking(GRT)	GRT1	
		GRT2	
		GRT3	
Green Intellectual Capital(GIC)	Green Human Capital(GHC)	GHC1	Mediating Variable
		GHC2	
		GHC3	
		GHC4	
	Green Relational Capital(GRC)	GRC1	
		GRC2	
		GRC3	
		GRC4	
	Green Structural Capital(GSC)	GSC1	
		GSC2	
		GSC3	
		GSC4	

Table 4.10 Abbreviation of Constructs and Observed Variables (Cont.)

Second-order variables	First-order variables	Item	Type of variable
Green Supply Chain Management(GSCM)	Internal Environmental Management(IEM)	IEM1	Mediating Variable
		IEM2	
		IEM3	
		IEM4	
	Green Purchasing(GP)	GP1	
		GP2	
		GP3	
		GP4	
	Cooperation with Customers(CC)	CC1	
		CC2	
		CC3	
	Eco-design(ECO)	ECO1	
		ECO2	
		ECO3	
	Investment Recovery(IR)	IR1	
		IR2	
		IR3	
Environmental Uncertainty(EU)	Demand Uncertainty(DU)	DU1	Moderating Variables
		DU2	
		DU3	
	Technological Uncertainty(TU)	TU1	
		TU2	
		TU3	
		TU4	

4.2.2 Instrument Validation and Pretesting

This research utilized the Item-Objective Consistency Index Method (IOC) to validate and evaluate the items used in the questionnaire to assess the validity of content validity. Three university experts used the Item-Objective Consistency Index method to assess the questionnaire and ensure that it was scientifically and comprehensibly sound. The assessment process focused on examining whether the main question items in the questionnaire were proposed in a way that met scientific standards, whether there were errors or differences in understanding and situations that could lead to content overlap or omission between question items.

Each scale item was assessed according to Rovinelli and Hambleton (1976) methodology and was categorized into three levels ranging from 0 to 1, whereas the item

agreement (IOC) value needed to be greater than 0.5. Across items, the IOC results of the analysis ranged from 0.9 to 1, indicating good agreement. The results of the combined assessment showed that the item-objective congruence index was 0.99, indicating that the content validity of the questionnaire was acceptable on the whole. The high score of this index reflects the experts' unanimous approval of the questionnaire. It confirms the scientific validity and accuracy of the questionnaire in terms of design and content.

Considering the authority of expert scores in content validity assessment, this score provided a reliable basis for the study. Based on the comments made by the experts, the researchers revised the questionnaire accordingly. This feedback process helped further enhance the scientific validity and accuracy of the questionnaire. It ensured that the instrument used in the study had higher reliability and validity in measuring the areas of concern. Through comprehensive expert assessment and revision, this research has effectively validated the content validity of the questionnaire at the design stage, providing a more reliable basis for subsequent data collection and analysis.

4.2.3 Pre-survey Test and Analysis of Results

Once the results of the questionnaire collation and revision were completed, a pre-survey was conducted to pretest the questionnaire to determine whether the items of the questionnaire contained ambiguities. The measurement items were analyzed using the pretest data, and unreliable items were removed. The pretest questionnaire for this research was started on 11/27/2023. The distribution and collection of the questionnaire lasted for a total of seven days. The online channel was used to create the questionnaire through Questionnaire Star. Then, the link to the electronic version was sent to invite 30 middle and senior leaders working in manufacturing companies in Sichuan Province. Cronbach's Alpha is used as a means to assess the internal consistency of close relationships of a collection of items as a group and is considered a reliability coefficient. Theoretically, Cronbach's alpha values range from 0 to 1; higher values indicate higher reliability, with values of 0.80 or higher being considered reliable. Hair Jr et al. (2010)suggest that for a variable to have good reliability, Cronbach's alpha coefficient must be greater than 0.7. Running PLS to obtain Cronbach's alpha coefficients for both the first and second-order constructs was a good idea. Cronbach's Alpha for the first and second-order constructs, as shown in Figure 4.11.

Table 4.11 Reliability Statistics

Second-order variables	First-order variables	N of Items		Cronbach's Alpha
SuP	EcP	4	.876	.924
	EP	5	.909	
	SP	4	.885	
GEO	EO	4	.887	.904
	GI	3	.876	
	GRT	3	.829	
GIC	GHC	4	.892	.919
	GRC	4	.881	
	GSC	4	.890	
GSCM	IEM	4	.884	.933
	GP	4	.879	
	CC	3	.849	
	ECO	3	.836	
	IR	3	.840	
EU	DU	3	.872	.869
	TU	3	.829	

The Cronbach's Alpha for the pretest SuP was 0.951, the Cronbach's Alpha for the GEO was 0.939, the Cronbach's Alpha for the GIC was 0.959, the GSCM's Cronbach's Alpha was 0.963, and EU's Cronbach's Alpha was 0.918. Cronbach's alpha coefficients for each dimension ranged from 0.803 to 0.879, which are all greater than 0.7, indicating that these items have high reliability.

4.3 Data Preparation

Symbols and meanings of symbols used to represent variables.

Table 4.12 Data Analysis Indicator Abbreviations and Meanings

Abbreviation	Meaning
$\overline{X}$	Arithmetic Mean
CV	Coefficient of variation
SD	Standard Deviation
β	Path Coefficient
R^2	Coefficient of determination
T-value	Test statistic with a t-distribution
P-value	The critical region of the error is the area beyond the rejection regi on, and it is a value that can be calculated from observed data
AVE	The average of the variance can be calculated
CR	Composite Reliability
HTMT	Heterotrait-Monotrait Ratio of Correlations
VIF	Inner model collinearity statistics
PLS	SmartPLS
CILL	95% confidence interval lower limit
CIUL	95% confidence interval upper limit

4.3.1 The Population and Sample Response Rate

In this research, the questionnaire was administered through online web-based distribution. The online e-questionnaire was created based on the final measurement scale. Questionnaire Star designed the e-questionnaire, and then the link to the e-questionnaire was distributed to the communication platform related to the manufacturing industry in Sichuan Province. Relevant scholars and manufacturing practitioners forwarded the questionnaire for snowballing data collection. The survey respondents were explicitly corporate management personnel.

Cho et al. (2008) suggest that an emailed questionnaire should have a response rate of at least 20% to be accepted. Therefore, to avoid the problem of low response rate, the questionnaire was distributed to the managers of 650 companies in Sichuan Province with the help of the Questionnaire Star platform. Due to the arbitrary nature of the online e-questionnaire survey process, this research must take specific measures to improve the validity of the questionnaire in the process of questionnaire distribution. Firstly, the researcher maintains contact with the respondents of the questionnaire distribution to answer and deal

with them promptly according to their feedback and doubts. Secondly, the questionnaire of this research used specific incentives to motivate the respondents during the survey process. The questionnaire was designed in such a way that the terms of measurement of the relevant variables were expressed clearly and concisely manner, and user interface friendliness was given due consideration to ensure that the respondents were able to complete the answers conveniently on different terminals of electronic devices.

The study commenced the questionnaire survey exercise from January 2024 to February 2024, totalling one month. A total of 700 questionnaires were distributed, and a total of 581 questionnaires were recovered. The number of valid questionnaires obtained after removing omissions and consistency issues was 516. The Table of questionnaire characteristics returned by the manufacturing industry in Sichuan Province is shown in Table 4.13.

Table 4.13 Characteristics of the Returned Questionnaire

Industry clusters	Sample size	Sent by Mail	Returned Questionnaire	Sent by Mail
Light textile industry (including food, beverages, tobacco processing, clothing, textiles, leather, wood processing, furniture, papermaking and printing, culture, education, industry, beauty, sports and entertainment supplies, etc.)	2505	247	110	44.53%
Resource processing industry (including petrochemicals, chemical fibers, pharmaceutical manufacturing, rubber, plastics, metal products, non-metallic mineral products, etc.)	5577	550	244	44.36%
Machinery and electronic manufacturing (including machinery and other equipment manufacturing, transportation, electronic communication equipment, instrumentation, equipment and metal product maintenance, waste resource utilization, other manufacturing industries, etc.)	4080	403	162	40.20%
Total	12162	1200	516	43.00%

4.3.2 Profile of the Respondents

All the respondents' answers were organized into EXCEL and imported into SPSS, and the basic situation was analysed using SPSS 21.0 software, as shown in Table 4.14.

Table 4.14 Profile of the Respondents

Demographic	Frequency	Respondent percentage
Gender		
Male	346	67.05
Female	170	32.95
Age		
20 and below	0	0.00
21-30 years old	67	12.98
31-40 years old	145	28.10
41-50 years old	200	38.76
51 or above	104	20.16
Education Level		
Secondary school and below	14	2.71
College	109	21.12
Undergraduate	293	56.78
Master and above	100	19.38
Status in the Enterprise		
Top management	91	17.64
Middle management	344	66.67
General manager	81	15.70
Others	0	0.00
Enterprise Size		
50 persons and below	0	0.00
51-299 people	84	16.28
300-1000 people	283	54.84
1000 and above	149	28.88
Type of Business		
Light textile industry (including food, beverages, tobacco processing, clothing, textiles, leather, wood processing, furniture, papermaking and printing, culture, education, industry, beauty, sports and entertainment supplies, etc.)	110	21.32
Resource processing industry (including petrochemicals, chemical fibers, pharmaceutical manufacturing, rubber, plastics, metal products, non-metallic mineral products, etc.)	244	47.29

Table 4.14 Profile of the Respondents (Cont.)

Demographic	Frequency	Respondent percentage
Machinery and electronic manufacturing (including machinery and other equipment manufacturing, transportation, electronic communication equipment, instrumentation, equipment and metal product maintenance, waste resource utilization, other manufacturing industries, etc.)	162	31.40
Others (non-manufacturing industries)	0	0.00

The organizational background of the respondents depends on the size and type of business. The manufacturing industry is categorized into three types: Light textile industry, resource processing industry, and machinery and electronic manufacturing. The size of the enterprise is mostly 300-1000 employees, accounting for 54.84%, followed by more than 1,000 employees, accounting for 54.84% of the total. The enterprise size is mostly 300-1000 employees, accounting for 54.84%, followed by more than 1000 employees, accounting for 28.88%. Industry type Light textile industry accounts for 21.32%; Resource processing industry accounts for 47.29%; Machinery and electronic manufacturing accounts for 31.40%. Most of the respondents' information is as follows.

Table 4.15 Summary of the Demographic

	Characteristics	Percentage
Respondent Profile	The most significant number of males	67.05
	Age between 41-50 years old	38.76
	With undergraduate education	56.78
	Job position as Middle management	66.67
Organizational Profile	Number of employees 300-1000	54.89
	Manufacturing type Resource processing i ndustry	47.29

The data from the survey showed that men constituted the vast majority of respondents, with a proportion of 67.05%. The age distribution of this group of respondents was concentrated between 41 and 50 years of age, with a percentage of 38.76%, reflecting the importance of professionals in this age group in this type of research. In addition, the respondents generally have a high educational background, with

56.41% of them holding a bachelor's degree, which indicates that the respondents as a whole have a strong level of knowledge and professionalism.

In terms of professional roles, 66.67% of the respondents hold middle management positions, which highlights their crucial role in organizational decision-making and management. In terms of organizational type, the majority of the respondents were in medium-sized manufacturing firms, especially in the resource processing industry, which accounted for 47.29% of the respondents. This indicates that the research sample mainly focuses on enterprises with specific scale and resource advantages in the manufacturing industry.

This section characterizes the data for this research by providing a quantitative comparison of each variable.

4.4.1 Sustainable Performance

Sustainable performance is HOC, which consists of 3 LOCs, namely Economic Performance (ECP), Environmental Performance (EP), and Social Performance (SP). It consists of 4 items, EP consists of 5 items, and SP consists of 4 items. The statistical analyses of the level, mean, and standard deviation values of the sustainable performance of the companies that were used are shown in Table 4.16.

Table 4.16 Descriptive Statistics for Sustainable Performance

Variable	$\overline{X}$	SD	CV	Level of pinion
Economic Performance (EcP)				
EcP1: Our company reduces the cost of energy consumption	3.560	1.249	35.08%	Agree
EcP2:Our company has improved the capacity utilization rate	3.500	1.242	35.49%	Neutral
EcP3:Our company has decreased the fee for waste treatment	3.541	1.169	33.01%	Agree
EcP4: Our company’s sales of green products have increased significantly	3.578	1.200	33.54%	Agree
Environmental Performance (EP)				
EP1: Our company has achieved important environment-related certifications	3.628	1.178	32.47%	Agree
EP2: On average, the overall environmental performance of our company has improved over the past 3 years	3.636	1.155	31.77%	Agree

Table 4.16 Descriptive Statistics for Sustainable Performance (Cont.)

Variable	$\bar{X}$	SD	CV	Level of pinion
EP3: The resource consumption of our company(e.g. water, electricity, and gas) has decreased during the last 3 years	3.663	1.200	32.76%	Agree
EP4: Our company has improved on environmental compliance	3.700	1.191	32.19%	Agree
EP5: Our company is complying with environmental regulations (i.e., carbon dioxide emissions, waste disposal)	3.669	1.163	31.70%	Agree
Social Performance (SP)				
SP1: Our company has seen an increase in customer satisfaction over the past 3 years	3.591	1.223	34.06%	Agree
SP2: Our company has improved customer motivation in the last 3 years.	3.607	1.203	33.35%	Agree
SP3: Our company serving more beneficiaries (disadvantaged people) or solving environmental issues	3.523	1.223	34.71%	Agree
SP4: Our company actively participates in public welfare activities and pays attention to social issues	3.610	1.190	32.96%	Agree

For the sustainable performance variable, the item with the highest mean was "EP4" ($\overline{X}$=3.700, SD=1.191), and the item with the lowest mean was "EcP2" ($\overline{X}$=3.500, SD=1.242). For the economic performance variable, the item with the highest mean was "EcP4" ($\overline{X}$=3.578, SD=1.200), and the item with the lowest mean was "EcP2" ($\overline{X}$=3.500, SD=1.242). For the environmental performance variable, the item with the highest mean was "EP4" ($\overline{X}$=3.700, SD=1.191), and the item with the lowest mean was "EP1" ($\overline{X}$=3.628, SD=1.178). For the social performance variable, the item with the highest mean was "SP4" (M=3.610, SD=1.190), and the item with the lowest mean was "SP3" ($\overline{X}$=3.523, SD=1.223).

In addition, the CV of all the indicators are above 30%, which suggests that there is a wide divergence of opinion among respondents on these performance indicators, especially EcP2 in economic performance and SP3 in social performance, with CVs of 35.49% and 34.71%, respectively, which show the most significant divergence of opinion in these areas. In contrast, the CV for the environmental performance indicator is lower but still around 30 percent, indicating that respondents are relatively united in their opinions on environmental performance.

4.4.2 Green Entrepreneurial Orientation

Green Entrepreneurial Orientation is the HOC which is measured by three LOC which are Environmental Orientation (EO), Green Innovativeness (GI), and green risk Taking (GRT) consists of 3 items. EO consists of 4 items, GI consists of 3 items, and GRT consists of 3 items for respondents' level of agreement. The statistical analysis of the minimum and maximum scores, mean values, and standard deviation values are shown in Table 4.17.

Table 4.17 Descriptive Statistics for Green Entrepreneurial Orientation

Variable	$\bar{X}$	SD	CV	Level of opinion
Environmental Orientation (EO)				
EO1:Our company is committed to improving its overall environmental awareness	3.467	1.184	34.15%	Neutral
EO2:Our company is very concerned about the impact of its business activities on the environment	3.523	1.211	34.37%	Agree
EO3:Our company has invested in controlling the environmental impact of its operations	3.548	1.199	33.79%	Agree
EO4:Our company believes that mankind and nature should coexist harmoniously	3.537	1.178	33.31%	Agree
Green Innovativeness (GI)				
GI1: Our company has developed new green product (service) lines to a greater extent	3.386	1.274	37.63%	Agree
GI2:Our company's green transformation of existing product (service) lines to a greater extent	3.395	1.267	37.32%	Agree
GI3:Our company emphasizes green product innovation, technological leadership, and research and development to a greater extent	3.510	1.281	36.50%	Agree
Green risk Taking (GRT)				
GRT1:The extent to which Our company participates in the development of green projects with high risks and high returns	3.500	1.263	36.09%	Neutral
GRT2:The extent to which Our company tends to take bold and swift action to meet corporate objectives	3.537	1.254	35.45%	Agree
GRT3:The extent to which Our company tends to take a bolder and more proactive approach to capitalizing on potential green opportunities	3.494	1.209	34.60%	Neutral

For the green entrepreneurial orientation variable, the item with the highest mean value was "EO3" ($\overline{X}$=3.548, SD=1.199), and the item with the lowest mean value was "GI1" ($\overline{X}$=3.386, SD=1.274). For the environmental orientation variable, the item with the highest mean value was 'EO3' ($\overline{X}$=3.548, SD=1.199), and the item with the lowest mean value was 'EO1' ($\overline{X}$=3.467, SD=1.184). For the green innovation variable, the item with the highest mean was "GI3" ($\overline{X}$=3.510, SD=1.281), and the item with the lowest mean was "GI1" ($\overline{X}$=3.386, SD=1.274). For the Green risk taking variable, the item with the highest mean value was "GRT2" ($\overline{X}$=3.537, SD=1.254) and the item with the lowest mean value was "GRT3" ($\overline{X}$=3.494, SD=1.209).

The results of this survey show that on the three critical dimensions of environmental orientation, green innovation capacity, and green risk-taking capacity, respondents generally believe that companies are doing something about these aspects (the majority of the indicators are at the "agree" level). However, as the CV for all the indicators is over 30%, this suggests that there is a difference of opinion in terms of implementation and evaluation. This high variability suggests that companies need to pay more attention to the diversity of internal and external stakeholder perspectives when formulating and implementing strategies to ensure comprehensiveness and consistency.

4.4.3 Green Intellectual Capital

Green Intellectual Capital is the HOC and consists of three LOCs. Green Human Capital (GHC), Green Relational Capital (GRC), and Green Structural Capital (GSC) respectively consisting of three items, GHC consisting of four items, GRC consisting of four items, and GSC consisting of four items for the respondents' level of agreement. The statistical analysis of the minimum and maximum scores, mean values, and standard deviation values are shown in Table 4.18.

Table 4.18 Descriptive Statistics for Green Intellectual Capital

Variable	$\bar{X}$	SD	CV	Level of opinion
Green Human Capital (GHC)				
GHC1: Our company's employees are actively involved in production and contribute to ecological protection	3.384	1.271	37.56%	Neutral
GHC2: Our company's employees have adequate ecological protection skills	3.444	1.289	37.43%	Neutral
GHC3: Our company has a high level of teamwork in ecological protection	3.341	1.257	37.62%	Neutral
GHC4: Our company's managers can fully support their employees in ecological conservation work	3.304	1.280	38.74%	Neutral
Green Relational Capital (GRC)				
GRC1:Our company designs products or services by environmental requirements	3.430	1.229	35.83%	Neutral
GRC2: Our company's relationship with strategic partners in ecological and environmental protection is stable	3.444	1.222	35.48%	Neutral
GRC3: Our company's relationship with its supply chain in terms of eco-environmental protection is stable	3.486	1.225	35.14%	Neutral
GRC4:Our company's cooperative relationship with customers in terms of ecological and environmental protection is stable	3.494	1.258	36.00%	Neutral
Green Structural Capital (GSC)				
GSC1: Our company has a perfect ecological environmental protection management system	3.366	1.325	39.36%	Agree
GSC2: Our company has invested sufficient funds in ecological environmental protection facilities	3.531	1.268	35.91%	Agree
GSC3: Our company's overall operation process for ecological environmental protection is effective	3.463	1.236	35.69%	Neutral
GSC4: Our company's knowledge management system is conducive to accumulating and sharing environmental knowledge	3.469	1.244	35.86%	Neutral

For the green intellectual capital variable, the item with the highest mean value is "GSC2" ($\overline{X}$=3.531, SD=1.268), and the item with the lowest mean value is "GHC4" ($\overline{X}$=3.304, SD=1.280). For the green human capital variable, the item with the highest mean was "GHC2" ($\overline{X}$=3.444, SD=1.289), and the item with the lowest mean was "GHC4" ($\overline{X}$=3.304, SD=1.280). For the green relational capital variable, the item with the highest mean was "GRC4" ($\overline{X}$=3.494, SD=1.258), and the item with the lowest mean was "GRC1" ($\overline{X}$=3.430, SD=1.229). For the green structural capital variable, the item with the highest mean was "GSC2" ($\overline{X}$=3.531, SD=1.268), and the item with the lowest mean was "GSC1" ($\overline{X}$=3.366, SD=1.325).

In addition, the CVs of all indicators exceeded 30%, indicating significant disagreement among respondents on the evaluation of these green capital indicators, especially in GHC4 in green human capital and GSC1 in green structural capital, with CV of 38.74 % and 39.36 %, respectively, showing the most significant divergence of opinion in these areas. In contrast, the CV value for green relational capital is relatively low but still around 35 percent, indicating that respondents are relatively united in their opinions on this dimension, although divergence still exists.

4.4.4 Green Supply Chain Management

Green Intellectual Capital is HOC, which consists of 5 LOCs. respectively, consisting of Internal Environmental Management (IEM), Green Purchasing (GP), Cooperation with Customers (CC), Eco-design (ECO), and Investment Recovery (IR) 5 items IIEM consists of 4 items, GP consists of 4 items, CC consists of 3 items, Eco-design consists of 3 items, and IR consists of 3 items for respondents' level of agreement. The statistical analysis of the minimum and maximum scores, the mean values, and standard deviation values are shown in Table 4.19.

Table 4.19 Descriptive Statistics for Green Supply Chain Management

Variable	$\bar{X}$	SD	CV	Level of opinion
Internal Environmental Management (IEM)				
IEM1: Commitment of our company's senior management to GSCM	3.463	1.220	35.23%	Neutral
IEM2: Middle management's support for GSCM in our company	3.426	1.242	36.25%	Neutral
IEM3: Our company's cross-functional collaboration promotes environmental improvement	3.419	1.205	35.24%	Neutral
IEM4: Our company's use of total quality environmental management	3.484	1.231	35.33%	Neutral
Green Purchasing (GP)				
GP1: Eco-labeling of Products	3.578	1.260	35.22%	Agree
GP2: Our company cooperates with our suppliers to achieve environmental goals	3.484	1.249	35.85%	Neutral
GP3: Our company conducts environmental audits of suppliers' internal management	3.576	1.166	32.61%	Agree
GP4: Assessment of environmental practices of second-tier suppliers	3.494	1.228	35.15%	Neutral
Cooperation with Customers (CC)				
CC: Our company cooperates with customers for eco-design	3.434	1.264	36.81%	Neutral
CC2: Our company cooperates with customers to realize clean production	3.512	1.247	35.51%	Agree
CC3：Our company cooperates with customers for eco-design	3.473	1.315	37.86%	Neutral
Eco-design (ECO)				
ECO1：Our company designs products that reduce material/energy consumption	3.450	1.248	36.17%	Neutral
ECO2：Our company designs products that reuse, recycle, and recover materials and components	3.517	1.267	36.03%	Agree
ECO3：Our company designs products to avoid or minimize the use of hazardous products and/or their manufacturing processes	3.469	1.270	36.61%	Neutral
Investment Recovery (IR)				
IR1:Investment recovery (sale) of excess inventory/materials of our company	3.636	1.192	32.78%	Agree
IR2:Sale of scrap and used materials by our company	3.523	1.253	35.57%	Agree
IR3:Sale of surplus capital equipment by our company	3.589	1.177	32.79%	Agree

For the green supply chain management variable, the item with the highest mean value is "IR1" ($\overline{X}$=3.636, SD=1.192), and the item with the lowest mean value is "IEM3" ($\overline{X}$=3.419, SD=1.205). For the IEM variable, the item with the highest mean value was "IEM4" ($\overline{X}$=3.484, SD=1.231), and the item with the lowest mean value was "IEM3" ($\overline{X}$=3.419, SD=1.205). For the green purchasing variable, the item with the highest mean was "GP1" ($\overline{X}$=3.578, SD=1.260), and the item with the lowest mean was "GP2" ($\overline{X}$=3.484, SD=1.249). For the variable of cooperation with clients, the project with the highest mean value was "CC2" ($\overline{X}$=3.512, SD=1.247), and the project with the lowest mean value was "CC1" ($\overline{X}$=3.434, SD=1.264). For the ecological design variable, the project with the highest mean value was "ECO2" ($\overline{X}$=3.517, SD=1.267), and the project with the lowest mean value was "ECO1" ($\overline{X}$=3.450, SD=1.248). For the payback variable, the item with the highest mean value was "IR1" ($\overline{X}$=3.636, SD=1.192), and the item with the lowest mean value was "IR2" ($\overline{X}$=3.523, SD=1.253).

Taken together, the CV values of these indicators are above 30%, which clearly indicates that there is a wide divergence in respondents' evaluation of these green management practice indicators. In particular, CC3 in the Cooperation with Customers dimension and IEM2 in Internal Environmental Management, with a CV of 37.86% and 36.25%, respectively, show the most significant divergence of opinion in these areas. In contrast, specific indicators in Green Purchasing and Investment Recovery, such as GP3 and IR1, had lower CV of around 32 percent, indicating that respondents were relatively unanimous in their opinions on these indicators. However, there was still a degree of disagreement overall.

4.4.5 Environmental Uncertainty

Environmental Uncertainty is HOC, which consists of 2 LOCs. It consists of 2 items: Demand Uncertainty (DU) and Technological Uncertainty (TU) respectively. DU consists of 3 items, and TU consists of 4 items, which were used to analyse the level of agreement, mean statistically, and standard deviation values of the respondents as shown in Table 4.20.

Table 4.20 Descriptive Statistics for Environmental Uncertainty

Variable	$\bar{X}$	SD	CV	Level of opinion
Demand Uncertainty (DU)				
DU1：Our company has difficulty accurately assessing customer demand for environmental products	2.589	1.244	48.05%	Neutral
DU2：Our company's forecasts of demand for environmental products are often inaccurate	2.545	1.289	50.65%	Neutral
DU3：It is difficult for Our company to predict customers' future preferences for environmental products	2.514	1.222	48.61%	Neutral
Technological Uncertainty (TU)				
TU1: Technology in our industry is changing rapidly	2.556	1.185	46.36%	Neutral
TU2: It is difficult to predict the level of our technology in 3-5 years	2.492	1.211	48.60%	Disagree
TU3: Technological changes provide great opportunities for Our company	2.502	1.208	48.28%	Neutral

For the environmental uncertainty variable, the item with the highest mean value was "DU1" ($\bar{X}$=2.589, SD=1.244), and the item with the lowest mean value was "TU2" ($\bar{X}$=2.492, SD=1.211). For the demand uncertainty variable, the item with the highest mean was "DU1" ($\bar{X}$=2.589, SD=1.244), and the item with the lowest mean was "DU3" ($\bar{X}$=2.514, SD=1.222). For the technical uncertainty variable, the item with the highest mean was "TU1" ($\bar{X}$=2.556, SD=1.185), and the item with the lowest mean was "TU2" ($\bar{X}$=2.492, SD=1.211).

The CV for all of these metrics is well above 30%, suggesting that there is significant disagreement in respondents' evaluations of Demand Uncertainty (DU2) and Technological Uncertainty (TU2). In particular, DU2 (CV = 50.65%) for Demand Uncertainty and TU2 (CV = 48.60%) for Technological Uncertainty show the most significant disagreement in these areas, especially in the case of Technological Uncertainty, where TU2 not only has a high CV value but also receives a rating of "Disagree." This may reflect that the respondents are uneasy or lack confidence in the uncertainty of technology.

4.5 Assessment of the Measurement Model

The questionnaire of this research contains five measurement scales: sustainable performance measurement scale, green entrepreneurial orientation measurement scale, green supply chain management measurement scale, green intellectual resources measurement scale, and environmental uncertainty measurement scale, all of which are two-dimensional scales. Among them, the sustainable performance measurement scale includes 3 first-order variables with 13 items, the green entrepreneurial orientation measurement scale includes 3 first-order variables with 10 items, the green intellectual capital measurement scale includes 3 first-order variables with 12 items, the green supply chain management measurement scale includes 5 first-order variables with 17 items, and the environmental uncertainty measurement scale includes 2 dimensions with 7 items. The Environmental Uncertainty Measurement Scale consists of 2 dimensions and 7 items.

4.5.1 Modelling

The measurement model test of this research was conducted using SmartPLS 4.0.9 analysis software. The questionnaire data were organized into EXCEL format and imported into PLS. The empirical model of the impact of green entrepreneurial orientation on sustainable performance was built in PLS based on the hypotheses presented in Chapter 2 and the potential variables set in Chapter 3. The model in this paper is a high-order model, which is a reflective-reflective structure, and the operation of the repeated indicator method requires the same or similar number of issues between each LOC indicator, and a significant difference in the number will affect the results of the model measurements. The number of each LOC indicator in this model is 3-5 between each LOC indicator, which can be calculated by applying the repeated indicator approach. Therefore, Model 1 is constructed using the repeated indicator method, as shown in Figure 4.1.

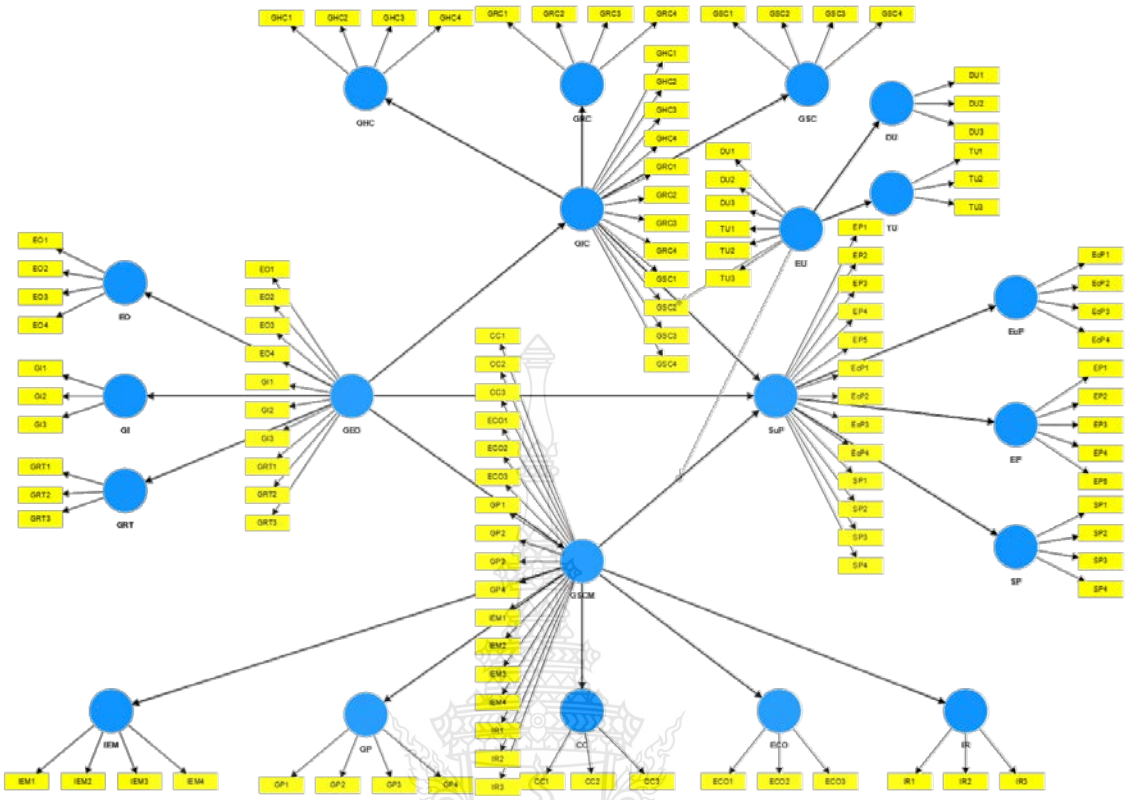


Figure 4.1 Model Constructed using Reflective Measurement Model (Model 1)

In the measurement model, Model 1 is mainly used for the analysis of the reliability and validity of the first-order variables, the test of differential validity, and the test of covariance.

4.5.2 Reliability Analysis

Reliability can test the consistency and stability of questionnaire measurements, and most scholars usually use Cronbach's coefficient and combined reliability CR. In this paper, the collected sample data were tested for reliability by PLS software. It is generally believed that Cronbach's coefficient > .70 indicates that the internal homogeneity of the questionnaire measure is good. According to Hair et al. (2011), indicator loadings should ideally be higher than .70. Meanwhile, the average variance extracted (AVE) of the construct is above .50 (Hair et al., 2012; Hulland, 1999).

Model 1 was run through the algorithm to obtain first-order validity and reliability, as shown in Table 4.21. It can be seen that the factor loading values for each question item in the first order range from .835 to .903, all of which are greater than .7,

indicating that the measurement terms meet the requirements of scale measurement and are of good quality. Cronbach's Alpha range values were .829~.909, all greater than .70; CR range values for all measured variables were .830~.909, all greater than .70, and AVE values ranged from .730~.802, all greater than .50.

Taken together, it indicates that the model of this research is reliable. The designed measurement scale has high reliability and stability system measurement terms that meet the requirements of scale measurement and are of good quality. The first-order and second-order reliability indexes meet the judgment criteria.

Table 4.21 Validity and Reliability of Measurement Model

First-order variables	Item	Loadings	Cronbach's Alpha	CR	AVE
Economic performance(EcP)	EcP1	.863	.876	.877	.730
	EcP2	.840			
	EcP3	.860			
	EcP4	.853			
Environmental performance(EP)	EP1	.883	.909	.909	.733
	EP2	.842			
	EP3	.863			
	EP4	.835			
	EP5	.855			
Social performance (SP)	SP1	.869	.885	.885	.743
	SP2	.865			
	SP3	.864			
	SP4	.851			
Environmental orientation(EO)	EO1	.877	.887	.887	.747
	EO2	.868			
	EO3	.858			
	EO4	.854			
(Green innovativeness)GI	GI1	.902	.876	.877	.802
	GI2	.890			
	GI3	.895			
Green risk-taking (GRT)	GRT1	.871	.829	.830	.745
	GRT2	.872			
	GRT3	.846			
Green human capital(GHC)	GHC1	.891	.892	.893	.756
	GHC2	.855			
	GHC3	.850			
	GHC4	.881			

Table 4.21 Validity and Reliability of Measurement Model (Cont.)

First-order variables	Item	Loadings	Cronbach's Alpha	CR	AVE
Green relational capital(GRC)	GRC1	.848	.881	.881	.736
	GRC2	.846			
	GRC3	.880			
	GRC4	.859			
Green structural capital(GSC)	GSC1	.858	.890	.890	.751
	GSC2	.868			
	GSC3	.873			
	GSC4	.869			
Internal environmental management (IEM)	IEM1	.891	.884	.885	.742
	IEM2	.842			
	IEM3	.856			
	IEM4	.855			
Green purchasing (GP)	GP1	.860	.879	.880	.734
	GP2	.845			
	GP3	.862			
	GP4	.860			
Cooperation with customers(CC)	CC1	.882	.849	.849	.768
	CC2	.880			
	CC3	.866			
Eco-design(ECO)	ECO1	.873	.836	.837	.753
	ECO2	.872			
	ECO3	.859			
Investment recovery (IR)	IR1	.858	.840	.841	.758
	IR2	.879			
	IR3	.875			
Demand uncertainty(DU)	DU1	.903	.872	.873	.796
	DU2	.882			
	DU3	.891			
Technological uncertainty(TU)	TU1	.876	.829	.830	.745
	TU2	.863			
	TU3	.849			

4.5.3 Discriminant Validity

To assess the discriminant validity, the study tested the Fornell-Larcker criterion (Fornell & Larcker, 1981b) as well as the cross-loadings analysis (Chin, 1998). Henseler et al. (2015) proposed an alternative method to assess discriminant validity based on a multi-trait-multi-method matrix: the heterozygote-mono-trait correlation ratio (HTMT).

(1) Fornell-Larcker Criterion

The Fornell and Larcker criterion stipulates that the square root of the AVE of each construct should be greater than its correlation with other constructs (Hair et al., 2012; Vinzi et al., 2010).

Regarding the discriminant validity, Model 1 was run through the PLS algorithm to get the First-order Discriminant Validity, as shown in Table 4.22. The bolded numbers in the diagonal row of the table shown represent the square root of the mean-variance extracted values between the first-order variables, while the numbers below the diagonal represent the correlation coefficients between each of the measured variables. The comparison reveals that the square root of the mean-variance extraction degree value for each of the measured variables is greater than the value in the matrix of correlation coefficients in the same row as well as in the columns.

Therefore, the measurement scale used in this research has good discriminant validity.

Table 4.22 Discriminant Validity (Fornell-larcker Criterion)

	C	U	CO	EO	EP	EcP	HC	GI	GP	GRC	GRT	GSC	EM	IR	SP	TU
CC	**876**															
DU	-.186	**892**														
ECC	.563	-.223	**868**													
EO	.406	-.195	.425	**864**												
EP	.374	-.248	.406	.389	**856**											
EcP	.391	-.251	.364	.333	.559	**854**										
GHC	.257	-.233	.333	.396	.378	.353	**869**									
GI	.409	-.248	.413	.631	.410	.412	.432	**895**								
GP	.537	-.260	.538	.386	.392	.407	.333	.415	**857**							
GRC	.253	-.183	.261	.407	.338	.365	.551	.488	.277	**858**						
GRT	.402	-.229	.405	.518	.381	.402	.356	.493	.390	.336	**863**					
GSC	.297	-.183	.314	.367	.364	.365	.565	.427	.335	.570	.343	**867**				
IEM	.515	-.264	.542	.458	.424	.470	.302	.429	.553	.266	.388	.257	**861**			
IR	.569	-.309	.541	.441	.435	.461	.387	.477	.585	.358	.423	.384	.595	**871**		
SP	.389	-.229	.379	.407	.584	.540	.363	.477	.422	.377	.375	.381	.453	.444	**862**	
TU	-.226	.571	-.228	-.183	-.219	-.260	-.272	-.231	-.293	-.260	-.280	-.240	-.200	-.299	-.265	**863**

Note: Diagonal numbers = squared correlation
Off-diagonal numbers= Square root of AVE

(2) Cross Loadings

In addition, discriminant validity is also tested by applying a cross-compliance approach. Cross-loading approach means that the factor loadings of an indicator on the construct to which it belongs should be greater than the loadings between the indicator and other constructs in the model (Chin, 1998). Heterotrait-monotrait ratio of correlations (HTMT)

Running Model 1 through the algorithm yields a table of cross-loadings for the first-order variables, as in Table 4.23.

Table 4.23 Cross-loading Analysis

	EcP	EP	SP	EO	GI	GRT	GHC	GRC	GSC	IEM	GP	CC	ECO	IR	DU	TU	EU x GIC	EU x GIC
EcP1	**.863**	.468	.479	.281	.360	.350	.324	.317	.332	.409	.336	.322	.291	.357	-.222	-.238	-.291	-.161
EcP2	**.840**	.490	.461	.243	.350	.335	.297	.290	.281	.368	.321	.334	.283	.386	-.194	-.240	-.295	-.154
EcP3	**.860**	.508	.470	.298	.313	.360	.284	.294	.322	.423	.393	.334	.327	.418	-.256	-.206	-.267	-.205
EcP4	**.853**	.443	.433	.314	.387	.328	.301	.349	.312	.404	.339	.347	.344	.415	-.183	-.206	-.249	-.163
EP1	.485	**.883**	.524	.338	.373	.357	.340	.288	.329	.380	.341	.325	.356	.407	-.221	-.179	-.303	-.226
EP2	.446	**.842**	.462	.274	.317	.253	.286	.245	.294	.341	.286	.293	.319	.340	-.204	-.180	-.301	-.205
EP3	.506	**.863**	.527	.339	.346	.335	.319	.300	.327	.352	.363	.323	.347	.357	-.196	-.194	-.279	-.233
EP4	.490	**.835**	.468	.347	.353	.331	.331	.318	.325	.376	.349	.362	.352	.378	-.219	-.200	-.248	-.214
EP5	.465	**.855**	.516	.363	.363	.351	.338	.296	.281	.367	.338	.296	.363	.380	-.223	-.183	-.297	-.248
SP1	.492	.507	**.869**	.373	.426	.319	.286	.314	.299	.414	.389	.375	.334	.400	-.207	-.209	-.259	-.215
SP2	.485	.521	**.865**	.354	.422	.355	.290	.315	.316	.397	.360	.344	.335	.402	-.218	-.243	-.267	-.236
SP3	.445	.503	**.864**	.319	.382	.299	.303	.329	.358	.386	.360	.298	.316	.338	-.163	-.217	-.288	-.247
SP4	.438	.482	**.851**	.355	.417	.319	.378	.345	.343	.364	.345	.322	.323	.392	-.202	-.245	-.253	-.214
EO1	.298	.349	.359	**.877**	.564	.434	.354	.347	.328	.411	.341	.367	.362	.378	-.160	-.158	-.080	-.065
EO2	.274	.325	.359	**.868**	.523	.464	.335	.361	.330	.382	.347	.342	.391	.378	-.170	-.170	-.083	-.081
EO3	.302	.342	.340	**.858**	.529	.456	.358	.344	.298	.408	.325	.364	.347	.387	-.162	-.173	-.068	-.056
EO4	.276	.328	.348	**.854**	.564	.437	.323	.355	.314	.383	.321	.329	.369	.383	-.181	-.132	-.082	-.072
GI1	.350	.362	.438	.577	**.902**	.449	.377	.429	.391	.380	.388	.373	.387	.416	-.224	-.231	-.110	-.066
GI2	.377	.389	.437	.572	**.890**	.423	.409	.449	.376	.405	.377	.345	.382	.445	-.243	-.194	-.167	-.083
GI3	.380	.349	.407	.546	**.895**	.450	.375	.434	.379	.366	.350	.380	.341	.422	-.201	-.194	-.116	-.089
GRT1	.330	.325	.342	.466	.460	**.871**	.307	.275	.257	.343	.315	.337	.346	.368	-.212	-.267	-.043	-.046
GRT2	.388	.337	.339	.466	.409	**.872**	.306	.313	.348	.344	.359	.358	.380	.397	-.170	-.222	-.058	-.067
GRT3	.322	.325	.288	.406	.404	**.846**	.310	.281	.285	.316	.337	.348	.323	.328	-.210	-.236	-.083	-.104
GHC1	.287	.305	.334	.349	.398	.302	**.891**	.501	.495	.267	.293	.226	.287	.337	-.221	-.233	-.055	-.155
GHC2	.346	.353	.305	.327	.370	.297	**.855**	.458	.493	.248	.293	.223	.306	.326	-.208	-.254	-.123	-.172
GHC3	.299	.332	.305	.331	.366	.321	**.850**	.478	.485	.264	.242	.204	.264	.341	-.187	-.236	-.080	-.157
GHC4	.295	.323	.319	.372	.368	.319	**.881**	.479	.493	.272	.328	.240	.301	.343	-.194	-.224	-.108	-.160

Table 4.23 Cross-loading Analysis (Cont.)

	EcP	EP	SP	EO	GI	GRT	GHC	GRC	GSC	IEM	GP	CC	ECO	IR	DU	TU	EU x GIC	EU x GIC
GRC1	.311	.295	.323	.350	.399	.311	.450	**.848**	.486	.219	.205	.187	.229	.272	-.204	-.232	-.065	-.177
GRC2	.315	.252	.303	.341	.428	.292	.458	**.846**	.512	.206	.267	.208	.193	.318	-.151	-.220	-.039	-.155
GRC3	.318	.280	.303	.367	.420	.274	.505	**.880**	.483	.249	.234	.263	.252	.315	-.133	-.220	-.051	-.146
GRC4	.309	.335	.367	.339	.428	.276	.479	**.859**	.475	.237	.245	.209	.222	.322	-.143	-.221	-.061	-.111
GSC1	.296	.304	.324	.318	.353	.277	.478	.500	**.858**	.237	.289	.234	.235	.330	-.135	-.185	-.130	-.094
GSC2	.331	.332	.344	.292	.380	.318	.471	.484	**.868**	.225	.285	.249	.275	.339	-.152	-.209	-.085	-.113
GSC3	.318	.317	.338	.303	.374	.302	.546	.488	**.873**	.218	.312	.265	.315	.321	-.150	-.175	-.097	-.085
GSC4	.321	.310	.315	.361	.372	.292	.464	.503	**.869**	.212	.274	.282	.265	.341	-.200	-.263	-.073	-.111
IEM1	.438	.373	.418	.393	.380	.342	.237	.234	.223	**.891**	.496	.476	.476	.534	-.243	-.190	-.187	-.059
IEM2	.389	.363	.389	.411	.366	.327	.285	.249	.224	**.842**	.460	.402	.440	.484	-.219	-.193	-.204	-.036
IEM3	.372	.331	.348	.385	.349	.299	.247	.182	.195	**.856**	.456	.456	.435	.495	-.220	-.125	-.188	-.034
IEM4	.417	.394	.404	.391	.381	.365	.275	.249	.243	**.855**	.492	.437	.513	.533	-.227	-.182	-.184	-.045
GP1	.350	.333	.370	.349	.371	.337	.268	.247	.295	.501	**.860**	.483	.458	.514	-.203	-.278	-.087	.009
GP2	.335	.330	.351	.313	.350	.300	.284	.213	.288	.469	**.845**	.426	.440	.498	-.214	-.224	-.101	-.035
GP3	.378	.367	.374	.325	.364	.370	.274	.247	.283	.474	**.862**	.458	.482	.494	-.240	-.248	-.100	-.034
GP4	.331	.314	.351	.334	.337	.328	.317	.243	.281	.452	**.860**	.471	.463	.498	-.234	-.253	-.109	-.034
CC1	.315	.301	.291	.348	.327	.311	.213	.237	.255	.410	.482	**.882**	.460	.461	-.157	-.199	-.112	-.009
CC2	.349	.319	.362	.361	.375	.397	.253	.223	.251	.468	.462	**.880**	.517	.529	-.164	-.226	-.066	-.035
CC3	.363	.361	.367	.356	.370	.347	.209	.206	.275	.473	.468	**.866**	.501	.505	-.168	-.170	-.158	-.045
ECO1	.330	.336	.338	.342	.363	.344	.291	.221	.269	.452	.479	.501	**.873**	.487	-.172	-.212	-.118	-.023
ECO2	.306	.378	.333	.396	.349	.335	.284	.199	.243	.506	.475	.482	**.872**	.443	-.204	-.170	-.089	-.001
ECO3	.311	.343	.316	.369	.364	.377	.291	.260	.308	.452	.447	.483	**.859**	.478	-.204	-.211	-.111	-.018
IR1	.380	.401	.387	.393	.418	.381	.367	.357	.329	.476	.509	.492	.467	**.858**	-.260	-.241	-.111	-.056
IR2	.390	.357	.357	.374	.389	.343	.333	.269	.341	.524	.513	.491	.487	**.879**	-.258	-.263	-.134	-.004
IR3	.433	.380	.416	.387	.440	.381	.313	.309	.333	.552	.505	.505	.457	**.875**	-.288	-.275	-.174	-.007
DU1	-.251	-.221	-.196	-.175	-.221	-.219	-.226	-.183	-.189	-.242	-.220	-.156	-.176	-.294	**.903**	.546	.061	.022
DU2	-.202	-.217	-.205	-.174	-.194	-.163	-.160	-.133	-.124	-.215	-.207	-.141	-.203	-.243	**.882**	.466	.057	.038

Table 4.23 Cross-loading Analysis (Cont.)

	EcP	EP	SP	EO	GI	GRT	GHC	GRC	GSC	IEM	GP	CC	ECO	IR	DU	TU	EU x GIC	EU x GIC
DU3	-.217	-.227	-.213	-.174	-.249	-.229	-.236	-.173	-.176	-.248	-.268	-.200	-.218	-.287	**.891**	.515	-.010	.002
TU1	-.248	-.209	-.243	-.157	-.200	-.258	-.256	-.246	-.215	-.185	-.277	-.197	-.211	-.262	.526	**.876**	.021	.021
TU2	-.222	-.182	-.223	-.152	-.200	-.207	-.224	-.215	-.203	-.156	-.239	-.172	-.166	-.238	.493	**.863**	.035	.057
TU3	-.203	-.173	-.219	-.167	-.197	-.261	-.224	-.211	-.204	-.178	-.242	-.218	-.213	-.274	.457	**.849**	.013	.029
EU x GIC	-.323	-.334	-.309	-.091	-.146	-.070	-.105	-.063	-.111	-.221	-.116	-.128	-.122	-.161	.040	.027	**1.000**	.462
EU x GSCM	-.200	-.264	-.265	-.079	-.089	-.083	-.185	-.172	-.116	-.051	-.027	-.034	-.016	-.025	.023	.041	.462	**1.000**

As can be seen in Table 4.22, the loading factors for Economic Performance (EcP) ranged from .840 to .863, all of which were greater than the cross-loadings with the other variables. The loading factors for Environmental Performance (EP) ranged from .835 to .883, all of which were greater than the cross-loadings with the other variables. The loading factors for Social Performance (SP) ranged from .851 to .869, all of which were greater than the cross-loadings with the other variables.

The loading factors for Environmental Orientation (EO) ranged from .854 to .877, all of which were greater than the cross-loadings with the other variables. The loading factors for Green Innovativeness (GI) ranged from .890 to .902, all of which were greater than the cross-loadings with the other variables. The loading factors for Green risk Taking (GRT) ranged from .846 to .872, all of which were greater than the cross-loadings with the other variables.

Green Human Capital (GHC) has a loading factor ranging from .850 to .891, which is greater than the cross-loading with other variables. Green Relational Capital (GRC) has a loading factor ranging from .846 to .880, which is greater than the cross-loading with other variables. Green Structural Capital (GSC) had loading factors ranging from .858 to .873, all of which were greater than the cross-loadings with the other variables.

Internal Environmental Management (IEM) has a loading factor between .842 and .891, all of which are greater than the cross-loadings with the other variables. Green Purchasing (GP) has a loading factor ranging from .845 to .862, all of which are greater than the cross-loadings with the other variables. Cooperation with Customers (CC) has a loading factor between .866 and .882, all of which are greater than the cross-loadings with the other variables. The loading factors for Eco-design (ECO) ranged from .859 to .873, which were all greater than the cross-loadings with the other variables. The loading factors for Investment Recovery (IR) ranged from .858 to .879, all of which were greater than the cross-loadings with the other variables.

Demand Uncertainty (DU) has a loading factor ranging from .882 to .903, which is greater than the cross-loading with other variables, and Technological Uncertainty (TU) has a loading factor ranging from .849 to .876, which is greater than the

cross-loading with other variables. This indicates that the model has good discriminant validity.

Taken together, in the combination of Table 4.26 with Table 4.27, all indicator values (in bold) for external loading for each construct are higher than their values for all cross-loadings on the other constructs. Thus, discriminant validity was generated from the cross-loading values test.

(3) Heterotrait-monotrait Ratio of Correlations (HTMT)

Henseler et al. (2015) proposed an alternative method to assess discriminant validity based on a multi-trait-multi-method matrix: the heterozygote-mono-trait correlation ratio (HTMT). If the HTMT value is below 0.90, discriminant validity is established between the two reflectometry constructs.

Table 4.24 Heterotrait-monotrait Ratio (HTMT)

	CC	DU	ECO	EO	EP	EcP	GHC	GI	GP	GRC	GRT	GSC	IEM	IR	SP	TU	EU x GIC	EU x GSCM
CC																		
DU	.216																	
ECO	.667	.261																
EO	.467	.222	.493															
EP	.425	.279	.465	.432														
EcP	.453	.286	.426	.377	.626													
GHC	.295	.263	.385	.446	.420	.400												
GI	.473	.284	.483	.716	.459	.471	.489											
GP	.621	.296	.627	.437	.438	.463	.376	.473										
GRC	.292	.209	.305	.461	.378	.416	.622	.555	.315									
GRT	.479	.269	.487	.603	.438	.471	.415	.577	.457	.393								
GSC	.342	.207	.364	.414	.405	.413	.634	.483	.378	.644	.400							
IEM	.593	.300	.629	.518	.473	.533	.341	.487	.627	.301	.452	.290						
IR	.673	.360	.645	.511	.498	.537	.448	.557	.680	.416	.506	.444	.689					
SP	.447	.261	.441	.459	.650	.612	.410	.542	.478	.428	.436	.430	.511	.515				
TU	.270	.670	.274	.214	.252	.305	.316	.270	.342	.304	.338	.280	.234	.358	.309			
EU x GIC	.139	.051	.133	.096	.350	.345	.112	.157	.124	.067	.078	.118	.236	.175	.329	.029		
EU x GSCM	.037	.025	.018	.084	.276	.213	.196	.095	.035	.183	.092	.123	.054	.028	.281	.045	.462	

Model 1 was run through the PLS algorithm to obtain the First-order HTMT, as shown in Table 4.24. From Table 4.23, it can be seen that the First-order HTMT values range from .018 to .716, which is less than 0.9, which indicates that discriminatory validity is established between the two reflectance measurement structures.

4.5.5 Collinearity Issue

If the model covariance problem is not eliminated, there is a high degree of correlation between the variables, which can easily lead to bias in the interpretation of the model. When performing model validation, covariance must be ruled out first. Multicollinearity is generally tested using the variance inflation factor VIF. A tolerance value greater than or equal to 0.2 and a VIF value less than or equal to 5 implies that no covariance problem exists between the indicators (Hair et al., 2011). The algorithm for running PLS with Model selects the Collinearity Statistics (VIF) values as shown in Table 4.24 below.

From Table 4.25, it can be seen that the VIF values of the first-order variables in this research are in the range of 1.808 to 2.883, which are both less than 5, which means that the covariance problem of the constructs in the structural model is not more than significant. Therefore, the covariance problem does not adversely affect the path coefficients of the structural model in this research.

Table 4.25 VIF Value

Observed Variable	VIF
EcP1	2.266
EcP2	2.027
EcP3	2.214
EcP4	2.218
EP1	2.883
EP2	2.352
EP3	2.543
EP4	2.248
EP5	2.443
SP1	2.345
SP2	2.288
SP3	2.318
SP4	2.178
EO1	2.493

Table 4.25 VIF Value (Cont.)

Observed Variable	VIF
EO2	2.370
EO3	2.283
EO4	2.214
GI1	2.471
GI2	2.294
GI3	2.398
GRT1	1.917
GRT2	1.968
GRT3	1.808
GHC1	2.779
GHC2	2.219
GHC3	2.154
GHC4	2.621
GRC1	2.166
GRC2	2.111
GRC3	2.503
GRC4	2.235
GSC1	2.244
GSC2	2.383
GSC3	2.390
GSC4	2.383
IEM1	2.675
IEM2	2.115
IEM3	2.239
IEM4	2.181
GP1	2.211
GP2	2.104
GP3	2.255
GP4	2.253
CC1	2.201
CC2	2.095
CC3	1.935
ECO1	1.995
ECO2	1.983
ECO3	1.883
IR1	1.893
IR2	2.063
IR3	2.017
DU1	2.453
DU2	2.236
DU3	2.297
TU1	1.978
TU2	1.898
TU3	1.817

4.6 Hypothesis Testing

To further analyse the impact of green entrepreneurial orientation on sustainable performance and the mediating role of green intellectual capital (GIC) and green supply chain management (GSCM), as well as the moderating role of environmental uncertainty. This research uses SPSS-PROCESS to test the path coefficients. The specific procedures are as follows. Firstly, using SmartPLS, run algorithm to select Latent variables to convert all multicriteria variables to single construct scores. Secondly, the study used SPSS-PROCESS for model hypothesis testing.

Where green entrepreneurial orientation is the independent variable (X), sustainable performance is the dependent variable (Y), green intellectual capital and green supply chain management are the mediating variables (M), and environmental uncertainty is the moderating variable (W). This is consistent with model 14 in PROCESS (Hayes, 2013). Further 5000 spontaneous samples were used for the direct effect (GEO→SuP), indirect effect (GEO→GIC→SuP, GEO→GSCM→SuP), and moderating effect of EU on the indirect effect (GEO→GIC→SuP, GEO→GSCM→SuP). The results are shown in Table 4.26 and Fig.4.2 shown.

Table 4.26 Direct Effect Results

Dependent	GIC				GSCM				SuP			
Variable	**β**	**SE**	**T-value**	**95% CI**	**β**	**SE**	**T-value**	**95% CI**	**β**	**SE**	**T-value**	**95% CI**
GEO	.561***	.037	15.367	[.489, .633]	.620***	.035	17.931	[.552, .688]	.180***	.041	4.367	[.099, 0.262]
GIC									.185***	.037	4.968	[.112, 0.258]
GSCM									.343***	.040	8.607	[.265, .421]
GIC*EU									-.218***	.034	-6.311	[-.285, -.150]
GSCM*EU									-.121***	.034	-3.558	[-.188, -.054]
R^2			.315				.385				.552	
F			236.133				321.509				104.683	

Note: * denotes P<.05, ** denotes P<.01, *** denotes P<.001

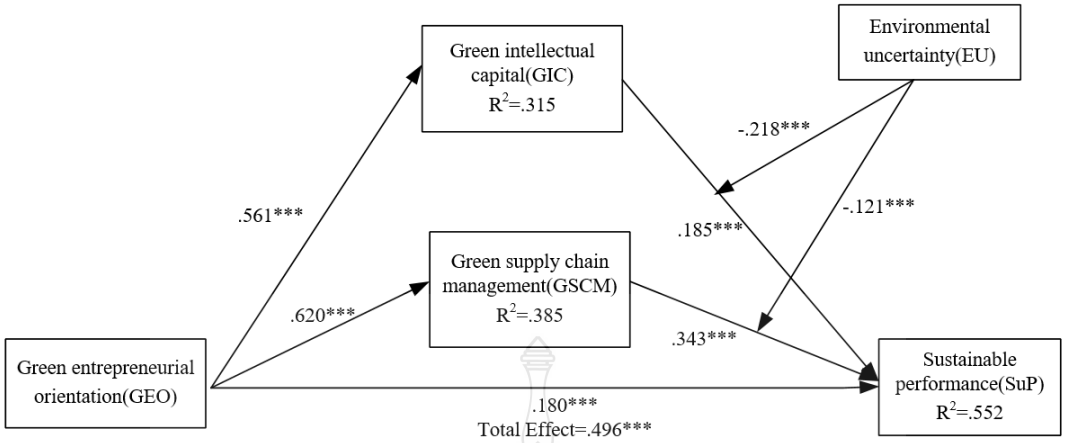


Figure 4.2 Estimated Conceptual Framework

From the results in Table 4.20, GEO has a significant positive effect on SuP (β=0.180, p=0.000; 95% CI=[0.099, 0.262]). This suggests that green entrepreneurial orientation can significantly improve the sustainable performance of firms, thus supporting hypothesis 1.

Further, the explanatory power of the analytical model is examined. Research by Hair Jr et al. (2010) and others showed that the existence of R^2 has three critical values of 0.25, 0.5, and 0.75, which reflect the strength of the explanation, representing weak, medium, and strong respectively. As shown in Table 4.36, the sustainable performance (SP) R^2 is .559, which is medium explanatory power. Green Intellectual Capital (GIC) R^2 is .319 with weak explanatory power. Green supply chain management (GSCM) R^2 is .390 with weak explanatory power.

Further analysing the tabular data, this research find that GEO has a significant positive effect on GIC (β=.561, p=.000, 95% CI=[.489, .633]), which suggests that a green entrepreneurial orientation can effectively enhance a firm's green intellectual capital, thus laying the foundation for sustainable development. Meanwhile, GIC also has a positive effect on SuP (β=.185, p=.000, 95% CI=[.112, .258]), which suggests that green intellectual capital can enhance firms' sustainable performance and promote their long-term development. In addition, GEO has a positive effect on GSCM (β=.620, p=.000, 95% CI=[.552, .688]), suggesting that green entrepreneurial orientation can promote firms' efforts in green supply chain management and optimise the greening of the supply

chain. Finally, GSCM also shows a positive effect on SuP (β=.343, p=.000, 95% CI=[.265, .421]), suggesting that green supply chain management can effectively enhance the sustainable performance of firms and create a competitive advantage for them.

In addition, the interaction term between GIC and EU exhibits a negative moderating effect on SuP (β = -.218, p = .000, 95% CI = [-.285, -.150]), which suggests that the contribution of green intellectual capital to sustainable performance is significantly weaker under higher environmental uncertainty, and that firms need to pay more attention to the effective intellectual capital when coping with environmental changes. management. Meanwhile, the interaction term between GSCM and EU also presents a negative moderating effect on SuP (β=-.121, p=.000, 95% CI=[-.188, -.054]), which means that under the influence of environmental uncertainty, the positive impact of green supply chain management on the firm's sustainable performance is also suppressed, and the firms need to flexibly adjust its green supply chain strategies to cope with potential challenges.

Therefore, this research provides an in-depth analysis of the relationship between green entrepreneurial orientation, green intellectual capital, green supply chain management, sustainable performance, and environmental uncertainty, and two conditional paths will be explored below.

(1) Path Chain 1: GEO → GIC → SuP (Conditional upon EU)

The first path is GE0→GIC→SuP conditional on EU. As can be seen from the table, the total effect (TE) of GEO on SuP is .496 (p < .001), and the direct effect of GEO on SuP is .180 (p < .001). The effect of GEO on SuP was significantly lower after including GIC as a mediating variable, suggesting that this mediating variable plays a crucial role. In addition, environmental uncertainty moderates the relationship of GE0→GIC→SuP. With the enhancement of EU, the effect of GEO on SuP through GIC is weakening. The results are shown in Table 4.27 shown.

Table 4.27 Conditional Indirect Effect of GEO on SuP through EU

Paths	Condition	Effect	SE	LLCI	ULCI
Indirect effect 1 GEO→GIC→SuP	Low EU	.226	.034	.163	.294
	Medium EU	.104	.024	.059	.151
	High EU	-.018	.032	-.081	.043
	Index of Moderated Mediation (EU				
	Index		**SE**	**LLCI**	**ULCI**
	-.122		.023	-.167	-.080

Note: * denotes P<.05, ** denotes P<.01, *** denotes P<.001

Subsequently, this research provides more insight into how the moderator variable EU affects the impact of GEO→GIC→SuP. Further analyses of Table 4.27 show that there are significant differences in the indirect effects of GEO→GIC→SuP at different levels of EU. The detailed conditional effects are presented below:

In the Low EU, the moderating influence is highest. The value of GEO→GIC→SuP effect is .226 and CI= [.163, .294] does not include 0. GEO promotes the accumulation of GIC and the further formation of SuP.

When environmental uncertainty is at a medium level (EU=0), the value of GEO→GIC→SuP effect is .104 and CI= [.059, .151] does not include 0, suggesting that green intellectual capital plays a key mediating role between green entrepreneurial orientation and sustainable performance. The mediating effect of GIC holds. Therefore, hypothesis 2 is supported.

In the High EU, the negative moderating influence increases. the value of GEO→GIC→SuP effect is -.018 and CI= [-.081, .043] including 0. At this time, the path of GEO→GIC→SuP does not hold. In other words, as environmental uncertainty increases, the impact of green entrepreneurship orientation on sustainable performance through green intellectual capital weakens.

The index of moderated mediation for GE0→GIC→SuP conditional on EU is -.122, CI= [-.167, -.080], indicating EU help play the conditions on GE0→GIC→SuP. The mediating effect holds at medium and low EU but not at high EU. This suggests that environmental uncertainty plays a crucial role in moderating the sequential effects observed in this path chain. Basically, the strength of the mediating effect (GE0→GIC→SuP) depends on the level of environmental dynamism. Therefore, the

lower levels of environmental uncertainty are better moderators for the relationship between green entrepreneurial orientation, green intellectual capital, and sustainable firm performance. H2 and H4 are supported.

(2) Path Chain 2: GEO → GSCM → SuP (Conditional upon EU)

The second path is GE0→GSCM→SuP conditional on EU. As can be seen from the table, the total effect (TE) of GEO on SuP is .496 ($p < .001$), and the direct effect of GEO on SuP is .180 ($p < .001$). The effect of GEO on SuP was significantly lower after including GSCM as a mediating variable, suggesting that this mediating variable plays a crucial role. In addition, environmental uncertainty negatively moderates the GE0→GIC→SuP relationship. The negative regulation on this path is enhanced with the enhancement of the EU, and GEO→GSCM→SuP is also changing. The results are shown in Table 4.28.

Table 4.28 Conditional Indirect Effect of GEO on SuP through EU

Paths	**Condition**	**Effect**	**SE**	**LLCI**	**ULCI**
Indirect effect 2 GEO→GSCM→SuP	Low EU	.288	.039	.215	.365
	Medium EU	.213	.029	.159	.271
	High EU	.137	.034	.072	.205
	Index of Moderated Mediation (EU				
	Index		**SE**	**LLCI**	**ULCI**
	-.075		.023	-.120	-.031

Further, this research provides more insight into how the moderator variable EU affects the impact of GEO→GSCM→SuP. Further analysis of Table 4.28 shows that the indirect effect of GEO→GSCM→SuP differs significantly at different levels of EU, but the path GEO→GSCM→SuP is significant. The detailed conditional effects are shown below:

In Low EU, the GEO→GSCM→SuP effect value is highest at .288, CI= [.215, .365] not include 0. GEO promotes GSCM accumulation and further SuP formation.

When environmental uncertainty is at a moderate level (EU=0), the effect of GEO→GSCM→SuP is 0.213 and CI= [.159, .271] does not include 0, suggesting that

green supply chain management plays a key mediating role between green entrepreneurial orientation and sustainable performance. Therefore, the GSCM mediation effect holds and Hypothesis 3 is supported.

In the High EU, the negative moderating influence increases. the value of GEO→GSCM→SuP effect is smallest as .137 and CI= [.072, .205] not include 0. Currently, the path coefficient of GEO→GSCM→SuP decreases significantly, which indicates that the influence of Green Supply Chain Management is higher at lower values of. In other words, the impact of green entrepreneurship orientation on sustainable performance through green supply chain management is weakened as environmental uncertainty increases.

The index of moderated mediation for GE0→GSCM→SuP conditional on EU is -.075, CI= [-.120, -.031], which is statistically significant and negatively moderated by EU. The mediating effect holds at low, medium, and high EU. This suggests that environmental uncertainty helps play a crucial role in moderating the sequential effects observed in this path chain. Basically, the strength of the mediating effect (GE0→GSCM→SuP) depends on the level of environmental dynamism. Thus, environmental uncertainty moderates the relationship between green entrepreneurial orientation, green supply chain management, and sustainable firm performance and does so negatively. Hypotheses 3 and 5 are supported.

4.7 Summary of Qualitative and Quantitative Studies

Table4.29 Summary of Qualitative and Quantitative Studies

Hypothesis	Qualitative Results	Quantitative Results
H1	Supported (In conjunction with **interview questions 1 and 2**, the majority of respondents believe that GE0 has an impact or a positive impact on SuP, is favorable to sustainable business development, can contribute to the development of the company individually, or contributes only to economic performance)	Supported

Table 4.29 Summary of Qualitative and Quantitative Studies (Cont.)

Hypothesis	Qualitative Results	Quantitative Results
H2	Supported (In conjunction with **interview question 2,** interviewees agreed that the implementation of GEO promotes companies to focus on green products, which contributes to the accumulation of GIC. In conjunction with **interview question 3**, the majority of interviewees see GIC as a bridge between GEO and SuP and a facilitator of their relationship, while a small number believe that GEO through GIC may increase competitiveness, which in turn affects sustainable performance)	Supported
H3	Supported (In conjunction with interview **question 2,** respondents agreed that GEO has driven GSCM optimization in a green direction. In conjunction with **interview question 4**， most respondents see GSCM as a key or bridging link between GEO and SuP and a catalyst for corporate sustainability)	Supported
H4	Supported (Combined with **interview questions 5 and 6,** respondents agree that DU has some impact on business operations, with most believing that DU may moderate the relationship between GIC and SuP. Therefore, in conjunction with the conclusions of **interview questions 3, 5, and 6**, DU moderates the effects of SuP through GIC on SuP)	Supported
H5	Supported (In conjunction with **interview questions 5 and 7**, respondents agreed that DU poses a challenge to business development and affects the relationship between GSCM and SuP, with some suggesting that it is DU that may have a moderating effect. Therefore, in conjunction with the findings of **interview questions 4,5,7,** DU moderates the impact of SuP through GSCM on SuP)	Supported

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

This chapter systematically elaborates on the empirical results of the research questions, objectives, and hypotheses, presenting corresponding research conclusions. Furthermore, it delves into the consistency and discrepancies between this study and existing literature, aiming to clarify the academic positioning of this research. Additionally, this chapter outlines the study's theoretical and managerial contributions. Lastly, the limitations of the research are acknowledged, and potential directions for future research are proposed.

5.1 Conclusions

5.2 Discussion

5.3 Contribution of the Study

5.4 Research Limitations and Recommendations for Further

5.1 Conclusions

The research question of this paper, whether green intellectual capital and green supply chain management conditionally transmit the effects of green entrepreneurial orientation to sustainable performance on values of environmental uncertainty, will now be addressed.

Based on entrepreneurial process theory and resource base theory, this research constructs a comprehensive research model with manufacturing enterprises in Sichuan Province as the research object. Three research objectives are proposed. First, to investigate the impact of green entrepreneurial orientation on sustainable performance in manufacturing firms. Second, investigate the mediating roles of green intellectual capital and green supply chain management between green entrepreneurial orientation and sustainable performance. Third, to investigate the impact of green entrepreneurial orientation on sustainable performance through green intellectual capital and green supply chain management with the varying conditions of environmental uncertainty.

Based on these research objectives, this paper proposes five hypotheses. H1: Green entrepreneurial orientation positively affects sustainable performance. H2: Green intellectual capital mediates the relationship between green entrepreneurial orientation and sustainable

performance. H3: Green supply chain management mediates the relationship between green entrepreneurial orientation and sustainable performance. H4: Green entrepreneurial orientation impacts sustainable performance through green intellectual capital conditionally upon the effect of environmental uncertainty. H5: Green entrepreneurial orientation impacts sustainable performance through green supply chain management conditionally upon the effect of environmental uncertainty.

To address this issue, fulfill the research purpose, and validate the five hypotheses, this paper first defines five key variables, namely green entrepreneurial orientation, green intellectual capital, green supply chain management, sustainable performance, and environmental uncertainty, through a literature review and combing, and proposes the interactions between the variables through literature. This paper uses a combination of quantitative and qualitative approaches to conduct the study. Qualitatively, through in-depth interviews with 15 middle and senior managers and experts from manufacturing companies, this paper delves into the relationship between these variables. Quantitatively, 516 valid samples were collected through questionnaires, and the model and hypotheses were empirically tested using SmartPLS and SPSS-PROCESS. Both qualitative and quantitative findings proved that all H1, H2, H3, H4, and H5 hypotheses are valid. Therefore, the conclusions drawn from this research are as follows:

(1) Green entrepreneurial orientation has a positive impact on sustainable performance. Firms were found to be able to enhance their sustainability in both environmental and economic dimensions by implementing green entrepreneurship strategies. This finding suggests that green entrepreneurial orientation not only improves the environmental performance of firms directly but also contributes to long-term financial performance through enhanced competitiveness and regulatory compliance.

(2) Green intellectual capital and green supply chain management play a mediating role between green entrepreneurial orientation and sustainable performance. This research suggests that green entrepreneurial orientation is not solely dependent on the firm's strategic planning but can also be achieved by integrating green intellectual capital and green supply chain management to achieve sustainable development.

(3) The higher the environmental uncertainty, the weaker the positive impact of green entrepreneurial orientation on sustainable performance through green intellectual

capital or green supply chain management. In addition, the effect of environmental uncertainty on green intellectual capital (GEO→GIC→SuP) is higher than that of green supply chain management (GEO→GSCM→SuP). This research suggests that firms should focus more on optimizing intellectual capital and supply chain management in complex and uncertain market environments.

5.2 Discussion

According to the research model, green entrepreneurial orientation impacts sustainable performance with green intellectual capital and green supply chain management as mediating variables and environmental uncertainty as moderating effects. This research discusses three research objectives and five research hypotheses in detail.

5.2.1 Discussion of the Impact of Green Entrepreneurial Orientation on Sustainable Performance

The first research objective is to investigate the impact of green entrepreneurial orientation on sustainable performance in manufacturing companies. This research proposes to address this research objective.

H1: Green entrepreneurial orientation positively affects Sustainable Performance.

Hypothesis 1 is supported. Most respondents in the qualitative study believe that green entrepreneurial orientation significantly influences sustainable performance, promoting sustainable development within firms. Quantitative research corroborates this assertion, revealing a positive correlation between green entrepreneurial orientation and sustainable performance. Firms with a green entrepreneurial orientation prioritize and implement environmentally friendly measures during production and operational processes. This includes reducing the emissions of toxic and harmful substances, minimizing resource consumption, and enhancing resource conversion efficiency (Triguero et al., 2013), and this is aligned with findings from other scholars (Jiang et al., 2018). Fatoki (2019) presented a model illustrating the impact of green entrepreneurial orientation on sustainable performance, which was tested using data from hospitality firms, confirming the causal relationship whereby green entrepreneurial orientation positively affects sustainable performance.

Furthermore, research has indicated that green entrepreneurial orientation positively influences firms' sustainable development performance. For instance, Alfandi and

Bataineh (2023) emphasized the advantages of adopting a green entrepreneurial orientation, as it encourages firms to pursue environmentally friendly innovations and improve resource efficiency, ultimately leading to enhanced sustainable performance.

In summary, the findings of this study confirm that green entrepreneurial orientation is an effective strategy for improving firm performance. The results suggest managers should consider implementing sustainability principles in their business strategies. Adopting green entrepreneurial practices can create long-term competitive advantages and contribute significantly to sustainable development.

5.2.2 Discussion of Green Intellectual Capital and the Mediating Role of Green Supply Chain Management

The second research objective is to investigate the mediating role of green intellectual capital and green supply chain management between green entrepreneurial orientation and sustainable performance. H2 and H3 are proposed to address this research objective.

H2: Green intellectual capital mediates the relationship between green entrepreneurial orientation and sustainable performance.

Hypothesis 2 is supported. The qualitative study revealed that green intellectual capital bridges green entrepreneurial orientation and sustainable performance, facilitating the relationship between the two. Certain respondents contend that green entrepreneurial orientation has the potential to enhance competitiveness through green intellectual capital, subsequently impacting sustainable performance. The quantitative findings indicate that green entrepreneurial orientation positively impacts firms' sustainable performance through the mediating effect of green intellectual capital. This mediating effect is reflected in the firm's increased environmental awareness, enhanced environmental management capabilities, and green relationships with external partners. These aspects drive firms towards a more environmentally friendly and sustainable direction and achieve sustainable performance. Currently, no literature has empirically validated the mediating role of green intellectual capital between green entrepreneurial orientation and sustainable performance. This study integrates relevant literature, particularly drawing on the resource-based view, to explore the mediating mechanism of green intellectual capital in this relationship.

Firstly, the qualitative research and interview findings confirm that green entrepreneurial orientation significantly enhances sustainable performance, a conclusion that diverges notably from previous studies. Current literature predominantly focuses on the impact of green intellectual capital on green entrepreneurial orientation. For instance, Wu and Yu (2023) demonstrated a high positive correlation between green intellectual capital and entrepreneurial orientation using hospitals as their sample, indicating that relational and structural capital positively influences entrepreneurial orientation. Additionally, Al-Jinini et al. (2019) researched small and medium-sized enterprises in Jordan, asserting that intellectual capital positively affects entrepreneurial orientation, thereby highlighting the connection between green intellectual capital and entrepreneurial orientation. However, this study presents a distinct background compared to prior research. It is based on the macro context of the Chinese government's energy-saving and emission-reduction policies, encouraging enterprises to seek pathways for green transformation actively.

Consequently, green entrepreneurial orientation emerges as a viable solution that promotes the positive influence of green entrepreneurial orientation on green intellectual capital. The natural resource-based view emphasizes that a firm’s sustainable development relies on the effective management and utilization of natural resources (McDougall et al., 2019). As an affirmative environmental strategy, green entrepreneurial orientation facilitates the adoption of green technologies, innovations, and sustainable business practices, thus reducing excessive consumption of natural resources. In this process, a firm’s engagement with green entrepreneurial orientation may foster a greater emphasis on cultivating and developing green intellectual capital, enabling it to adapt more effectively to environmental changes and resource constraints. Furthermore, Chen (2008) posits that an in-depth understanding of the green industry is crucial for a firm's success in the green market. In practice, firms accumulate specialized knowledge of the green market through green entrepreneurial orientation via experiential learning. Thus, green entrepreneurial orientation positively influences the construction and development of green intellectual capital.

Secondly, the study found that green intellectual capital positively affects sustainable performance. This conclusion is consistent with the study by Yusliza et al. (2020), which has revealed the critical role of green intellectual capital as an intangible resource in achieving sustainable performance and enhancing the competitive advantage of future

researchers based on measurement model data from Malaysian manufacturing companies. Therefore, developing and developed countries' manufacturing industries may consider this model a strategic approach to enhance their production capabilities. Additionally, numerous prior studies have supported this viewpoint, demonstrating a direct positive relationship between green intellectual capital and firms' sustainable performance (Martínez-Falcó et al., 2023; Wang & Juo, 2021). Notably, through effective management methods, firms can enhance their management capabilities regarding intellectual capital, improving their resource utilization efficiency and further promoting sustainable performance.

Therefore, as an internal resource, green intellectual capital plays a crucial mediating role between green entrepreneurial orientation and sustainable performance. The knowledge perspective emphasizes the significant impact of knowledge capital on organizational performance (Xu & Li, 2022). Ramírez et al. (2021) pointed out that firms could more effectively address environmental challenges by transforming and applying internal knowledge, thereby enhancing sustainable performance. Notably, the configuration of internal resources affected innovation capability and market competitiveness and was directly related to achieving sustainable performance. Related studies indicated that internal knowledge and skills were vital for innovation (Delmas & Toffel, 2008), and such innovation further promoted the sustainable performance of firms. Therefore, as a knowledge resource, green intellectual capital actively mediated the relationship between green entrepreneurial orientation and sustainable performance by enhancing the accumulation of knowledge in environmental innovation and sustainable business practices.

In summary, combining qualitative and quantitative interview results, Hypothesis 2 holds that green intellectual capital mediates the effect of green entrepreneurial orientation on sustainable performance. Green entrepreneurial orientation may contribute to more significant results in environmental management and sustainable development by guiding firms to pay more attention to cultivating green intellectual capital.

H3: Green supply chain management mediates the relationship between green entrepreneurship orientation and sustainable performance.

Hypothesis 3 is supported, indicating that green supply chain management significantly mediates green entrepreneurial orientation and sustainable performance. This conclusion is validated through both qualitative and quantitative research. In qualitative

studies, green supply chain management is regarded as a critical link between green entrepreneurial orientation and sustainable performance, serving as a bridge that effectively promotes a company's sustainable development. In quantitative analysis, the data show that green entrepreneurial orientation enhances the focus on environmental protection, innovation, and risk-taking across various supply chain stages through the mediating effect of green supply chain management, thereby achieving sustainable performance objectives.

This study first discusses the positive influence of green entrepreneurial orientation on green supply chain management. Linton et al. (2007) indicated that companies with a green entrepreneurial orientation tend to share environmental information and experience with their supply chain partners, thereby raising the environmental standards of the entire supply chain through collaborative efforts. This cooperation not only aids in the efficient use of resources but also promotes the sustainability of environmental protection. Ilmudeen (2020) further substantiated this claim by providing evidence from the Bangladeshi textile industry, showing through a causal relationship model that the positive impact of green entrepreneurial orientation on green supply chain management is significant. These studies collectively reinforce the role of green entrepreneurial orientation in driving green management within the supply chain.

Secondly, the direct impact of green supply chain management on sustainable performance is validated in multiple studies. Green supply chain management optimizes various stages of the supply chain, reduces resource consumption, and minimizes environmental impact, thereby assisting companies in achieving their sustainable development goals. Chin et al. (2015) confirm this in their research within the Malaysian manufacturing sector. Their causal model shows that green supply chain management provides robust support for enhancing economic benefits, environmental sustainability, and social responsibility and strengthens a company's long-term competitiveness in the market. Furthermore, Yildiz Çankaya and Sezen (2019) find that green supply chain management is critical in enhancing multidimensional sustainable performance, including environmental, economic, and social benefits. Collectively, these studies indicate that green supply chain management promotes corporate environmental responsibility and lays a solid foundation for maintaining sustainable development in long-term competition.

Therefore, green entrepreneurial orientation positively influences sustainable performance through green supply chain management. This finding is consistent with the results of Habib et al. (2020). Based on data from 246 textile manufacturing enterprises in Bangladesh, Habib's research validates the positive impact of green entrepreneurial orientation on green supply chain management and further demonstrates the significant effects of green supply chain management on economic, environmental, and social performance. Green entrepreneurial orientation emphasizes a company's concern for the environment and promotes sustainable operations throughout the supply chain through green supply chain management. Sarkis et al. (2011) found that green supply chain management enhances sustainable performance by optimizing resource allocation and reducing environmental impacts. Companies implementing green entrepreneurial orientation by integrating and utilizing their internal resources through green supply chain management, enhance their environmental management capabilities and positively influence sustainable performance.

In conclusion, green supply chain management critically mediates green entrepreneurial orientation and sustainable performance, validating Hypothesis 3. Green entrepreneurial orientation effectively promotes sustainable performance through green supply chain management, providing an important pathway for companies to achieve long-term sustainable development in a highly competitive market environment.

5.2.3 Discussion of the Moderating Role of Environmental Uncertainty

The third research objective is to investigate the impact of green entrepreneurial orientation on sustainable performance through green intellectual capital and green supply chain management under different conditions of environmental uncertainty. To address this research objective, H4 and H5 are proposed.

H4: Green entrepreneurial orientation impacts sustainable performance through green intellectual capital conditionally upon the effect of environmental uncertainty.

Establishing Hypothesis 4 indicates that green entrepreneurial orientation impacts sustainable performance through green intellectual capital, moderated by environmental uncertainty. The qualitative research findings reveal that environmental uncertainty significantly influences business operations. Most interviewees agreed that environmental uncertainty moderates the relationship between green intellectual capital and sustainable

performance, further affecting the role of green entrepreneurial orientation in sustainable performance through green intellectual capital. This view was corroborated by quantitative analysis, where the results demonstrated a negative moderating effect of environmental uncertainty on the relationship between green entrepreneurial orientation, green intellectual capital, and sustainable performance. Significant differences were observed in the indirect effects of green entrepreneurial orientation on sustainable performance through green intellectual capital under varying levels of environmental uncertainty. Thus, this study further integrates dynamic capability theory and the resource-based view to explore this complex relationship's underlying mechanisms.

Environmental uncertainty and green intellectual capital jointly influence a firm's sustainable performance. This finding aligns with the results of Hapsari et al. (2021), who highlighted that firm performance is shaped by the dual impact of environmental uncertainty and intellectual capital. Environmental uncertainty increases the complexity and dynamism of business operations (Freel, 2005), and forces firms to confront external market and technological changes more frequently during the decision-making process. According to dynamic capability theory, firms must continuously adapt their capabilities to accommodate external shifts in uncertain environments. However, a high level of environmental uncertainty may drive firms to focus more on short-term external changes, thereby neglecting long-term investments in accumulating green intellectual capital. This phenomenon hinders the effective utilization of green intellectual capital, weakening its positive impact on sustainable performance.

Additionally, environmental uncertainty plays a critical role in formulating green strategies. The development of a firm's capabilities is constrained in uncertain environments (Haarhaus and Liening, 2020). In such environments, firms face resource acquisition and utilization challenges, leading to a more conservative decision-making process, particularly exercising caution in innovation investments (Halberstadt et al., 2021). According to the resource-based view (RBV), the effectiveness of green intellectual capital, as a key resource of the firm, largely depends on the stability of the external environment. Green intellectual capital consists of green human capital, green relational capital, and green structural capital (Inayat et al., 2022), all of which play a pivotal role in the firm’s green transformation. However, firms can more efficiently allocate these resources and improve sustainable

performance only in relatively stable environments (Choe, 2003; Paulraj & Chen, 2007). This suggests that firms can better leverage green intellectual capital under lower environmental uncertainty, thereby converting green entrepreneurial orientation into sustainable performance. Conversely, under higher uncertainty, the efficiency of resource allocation diminishes, making it easier for firms to exploit the potential of green intellectual capital fully, thus weakening its positive impact on sustainable performance.

As a result, under higher environmental uncertainty, firms face more severe resource allocation and dynamic capability development challenges, thus weakening the contribution of green entrepreneurial orientation to sustainable performance through green intellectual capital. This research confirms the negative moderating effect of environmental uncertainty on the relationship between green entrepreneurial orientation, intellectual capital, and sustainable performance, which supports the formulation of hypothesis 4.

H5: Green entrepreneurial orientation impacts sustainable performance through green supply chain management conditionally upon the effect of environmental uncertainty.

Hypothesis 5 is supported. The results of both qualitative and quantitative studies suggest that environmental uncertainty plays an important moderating role in the role of green entrepreneurial orientation on sustainable performance through green supply chain management. Combined with contingency theory, this finding emphasizes the need for firms to adapt their strategies and operational practices to specific contexts to achieve optimal performance in complex and changing environments. Qualitative research reveals that environmental uncertainty poses significant challenges to business development. Most interviewees believed that environmental uncertainty moderates the relationship between green supply chain management and sustainable performance and further affects the indirect effect of green entrepreneurial orientation on sustainable performance through green supply chain management. This view concurs with the research of Aisjah and Prabandari (2021), who stated that the effects of environmental uncertainty and green supply chain integration on sustainable performance are complex. Environmental uncertainty and managers' discretionary accruals can constrain a business (Ghosh & Olsen, 2009).

The quantitative study further validates this view. The data show that environmental uncertainty produces a significant negative moderating effect between green entrepreneurial orientation, green supply chain management, and green sustainable

performance. Indirect effect analyses reveal a significant difference in the indirect effect of green entrepreneurship orientation through green supply chain management on green sustainable performance under different levels of environmental uncertainty. Under high environmental uncertainty, firms may face supply chain complexity and management challenges that limit the effectiveness of green supply chain management. Environmental uncertainty mainly consists of demand and technological uncertainty (Fynes et al., 2004).

Similarly, high technological uncertainty may lead to deficiencies in firms' knowledge of green technologies, further affecting their performance in green supply chain management (Wu, 2013). Paulraj (2011) argues that the critical role that resources can play in managing sustainable supply practices and organizational sustainability provides strong support. Under these circumstances, firms have become more conservative and cautious about investing in green technologies and building supply chain networks.

The significant impact of environmental uncertainty on firms' supply chain management and decision-making has been verified in several studies. This uncertainty affects firm performance in a negative way (Samsami et al., 2015). Qi et al. (2011) pointed out that environmental uncertainty increases the decision-making of a firm's complexity, leading firms to be more cautious in uncertain markets and technological developments. This uncertainty affects firm performance and triggers the application of conservative strategies in supply chain management. For example, uncertainty arises when firms cannot accurately predict market demand or technological advances (Lo & Shiah, 2016). Their decision-makers tend to adopt a more conservative mode of operation to reduce potential risks (Gölgeci & Ponomarov, 2015).

Specifically, under low environmental uncertainty, green entrepreneurial orientation promotes green supply chain management most significantly, thus significantly enhancing green sustainability performance. However, the strength of this positive indirect effect significantly diminishes as the level of environmental uncertainty increases. The moderating effects of technological uncertainty and demand uncertainty on supply chain and customer delivery performance are confirmed by Boon-itt and Wong (2011), where high environmental uncertainty prompts firms to adopt more conservative strategies in green innovation and supply chain management.

Therefore, these studies suggest that environmental uncertainty, as a weighting factor, plays a significant negative moderating role in the role of green entrepreneurial orientation on green sustainable performance through green supply chain management, further supporting the validity of Hypothesis 5. Firms facing different levels of environmental uncertainty need to adjust their strategies accordingly, especially in green supply chain management, to ensure that green, sustainable performance is achieved.

5.3 Contributions of the Study

5.3.1 Theoretical Contribution

(1) Expanding the Research Domain of Green Entrepreneurship and Sustainable Performance

Research on green entrepreneurial orientation is still in its infancy, with many related concepts still needing clarification and existing divergences in dimensions and measurement methods. By systematically clarifying and defining green entrepreneurial orientation, this study provides a clear theoretical framework for the field, highlighting its crucial role in promoting corporate sustainable performance. Particularly in exploring the "black box" mechanism between green entrepreneurial orientation and sustainable performance, the qualitative and quantitative research methods effectively reveal the intrinsic relationship between the two, filling gaps in the existing literature. Furthermore, this research offers new theoretical perspectives for the academic community. It provides practical guidance for enterprises in formulating green strategies, emphasizing the significance of green entrepreneurial orientation in achieving sustainable development.

(2) Deepening the Mediating Role of Green Intellectual Capital and Green Supply Chain Management

This study combines entrepreneurial process and resource-based theory to provide a new perspective for exploring green entrepreneurial orientation by constructing a comprehensive theoretical model. It systematically analyzes the dynamic relationships among green entrepreneurial orientation, green intellectual capital, green supply chain management, and sustainable performance. The model underscores the mediating roles of green intellectual capital and green supply chain management in driving sustainable performance, offering a theoretical framework for understanding how enterprises can achieve

sustainable development through green strategies. Furthermore, the findings indicate that effectively integrating green intellectual capital and green supply chain management is crucial for enhancing sustainable performance when implementing green entrepreneurial orientation. Thus, this research fills gaps in the relevant literature and provides a solid theoretical foundation for practical operations within enterprises.

(3) An Innovative Perspective by Introducing Environmental Uncertainty as a Moderating Variable

This study is the first to incorporate environmental uncertainty into the relationship model between green entrepreneurial orientation and sustainable performance, revealing the moderating effect of environmental uncertainty on the mediating roles of green intellectual capital and green supply chain management. The research indicates that under conditions of high environmental uncertainty, the impact of green entrepreneurial orientation on sustainable performance, mediated by green intellectual capital and green supply chain management, is significantly weakened. This finding provides a new theoretical perspective for understanding the decision-making processes of enterprises in uncertain market environments, emphasizing the importance of environmental uncertainty in strategic formulation.

In summary, this research expands the field of study regarding the relationship between green entrepreneurship and sustainable performance, clarifying the mediating roles of green intellectual capital and green supply chain management while introducing environmental uncertainty as a moderating variable. These theoretical contributions enrich the relevant literature and provide practical, theoretical support for enterprises implementing green strategies, establishing an important theoretical foundation for promoting sustainable development.

5.3.2 Managerial Contribution

This research investigates the determinants of sustainable performance of manufacturing industries in Sichuan Province based on natural resource management perspectives for sustainable business development. This research provides further evidence that the natural basis theory perspective is supported. The results of this research can be used to improve business performance, and business managers should consider long-term business development. Hypothesis testing in this research proved that there is a significant positive

effect of green intellectual capital and green supply chain management on sustainable performance, and the results of this research proved that active green supply chain management and strengthening green intellectual capital are the key initiatives to improving sustainable performance in the manufacturing industry.

(1) Provide a Feasible Path for the Synergistic Development of Economic Growth and Environmental Protection

As the backbone of its economy, China's manufacturing sector has placed a considerable burden on the environment during its rapid development. However, with the deepening global concern for sustainable development and the gradual tightening of government environmental regulations, the manufacturing industry needs to find a practical path for synergistic development between economic growth and environmental protection. This research shows that green entrepreneurial orientation can significantly enhance the sustainable performance of firms, providing strong support for a business model that combines economic growth with environmental sustainability. By implementing a green entrepreneurial orientation, firms can improve their long-term profitability and effectively reduce their negative environmental impact. Specifically, companies can integrate environmental concepts into their strategic planning and operations by developing green products and adopting cleaner production technologies to reduce resource consumption and minimize pollution. For example, manufacturing companies can install solar panels to reduce reliance on traditional energy sources or introduce advanced wastewater treatment technologies to reduce industrial emissions and protect water resources. Such initiatives improve resource efficiency, reduce operating costs, and achieve a win-win situation regarding economic benefits and environmental responsibility. In addition, green practices create a healthier work environment and enhance the quality of life for employees, customers, and the community while creating more job opportunities. Particularly in emerging areas such as renewable energy, eco-tourism, and sustainable agriculture, a green entrepreneurial orientation not only provides companies with the opportunity to open up new markets but also enhances long-term competitiveness by improving employees' green knowledge and skills. This win-win model lays a solid foundation for the green transformation of the manufacturing sector and promotes synergy between economic growth and environmental protection.

(2) Empowering Manufacturing Firms with Innovative and Adaptive Strategic Advantages

A green entrepreneurial orientation provides manufacturing firms with significant innovative and adaptive strategic advantages, helping them to make a smooth green transition in the face of environmental uncertainty and to promote sustainable development. Although green production has been widely recognized at the theoretical and policy levels, many manufacturing firms must be more cautious about its implementation. This research shows through empirical analyses that green entrepreneurial orientation can stimulate the innovation vitality of enterprises, enabling them to allocate resources and win strategic advantages rationally under limited resources. In the process of green transformation, enterprises need to continuously innovate in products, services, and production processes to meet the growing demand of the environmental market. By introducing new technologies, adopting environmentally friendly materials, and providing green solutions, companies can develop product designs such as biodegradable packaging or recycling to meet consumer expectations for environmentally friendly products. For example, some companies have adopted 3D printing technology to reduce material waste and improve production efficiency. These innovations not only enhance the market competitiveness of enterprises but also help them to comply with environmental regulations, laying the foundation for their long-term development.

In promoting green entrepreneurship, businesses must have the courage to take risks. As green entrepreneurship often involves experimentation with new technologies and models, failures and challenges are inevitable. For example, enterprises may risk encountering technical barriers or low market acceptance when developing new environmentally friendly products. In this regard, enterprises can reduce the risk of large-scale investment failure by setting up pilot projects or small-scale production and gradually refining their technology and market strategies. This flexible strategy not only helps enterprises to adapt to changes in an uncertain environment but also enables them to explore sustainable development paths that meet their own development needs and ensure that they maintain an innovative and adaptive edge in a competitive market.

(3) Enhancing the Practical Application Value of Green Intellectual Capital and Green Supply Chain Management

By analyzing the mediating roles of green intellectual capital and green supply chain management in the sustainable performance of enterprises, this research provides practical paths for enterprises to optimize their production processes and make full use of green resources, thus enhancing their execution in green transformation. Enterprises should pay attention to cultivating green intellectual capital and promoting the innovation and application of green technologies by forming professional green R&D teams. The tasks of these teams include developing products and technologies that meet high environmental standards in response to ever-increasing environmental regulations and consumer green demands. One way that enterprises can leverage external resources to promote green innovation is through cooperation with universities and research institutes. For example, Haier has enhanced its green technology R&D capabilities and strengthened the accumulation of green intellectual capital through cooperation with renowned universities.

At the same time, enterprises should also implement green management in all aspects of the supply chain to ensure that every stage, from raw material procurement to product sales, meets environmental standards. This research improves resource utilization efficiency and enhances enterprises' green image and market competitiveness. The core of green supply chain management is the implementation of green procurement policies, prioritizing suppliers that meet environmental requirements, and establishing long-term cooperative relationships with these suppliers to encourage them to improve their green production capacity continuously. The long-term environmental contracts signed by Wal-Mart and its supply chain partners are a typical example of how to promote the implementation of green supply chain management by ensuring the enforcement of procurement standards.

In addition, enterprises should introduce reverse logistics systems in their sales and services to encourage consumers to recycle their used products. For example, Apple has realized the recycling and reuse of old products through its global reverse logistics network, which not only reduces the waste of resources but also effectively lowers production costs and enhances the environmental reputation of the enterprise. This series of measures provides concrete guidance for enterprises to enhance their green intellectual capital and

optimize green supply chain management, which will help them achieve their sustainable development goals.

(4) Strategic Guidance for Sustainable Business Development in the Face of Environmental Uncertainty

This research reveals the negative moderating role of environmental uncertainty in the relationship between green entrepreneurial orientation and sustainable firm performance. It emphasizes the importance of a flexible green strategy to cope with changes in the external environment. Firms must enhance their sustainable competitiveness by improving green intellectual capital and optimizing green supply chain management. They also need to remain responsive to the dynamics of the external environment and adjust their strategies promptly to maintain their competitive advantage. Environmental uncertainty increases the difficulty of predicting future technological evolution and market demand, limiting investment in green innovation and intellectual capital. Firms face higher risks and uncertainties in developing green technologies and enhancing employees' environmental knowledge, which may inhibit their innovative capabilities. In addition, environmental uncertainty makes it difficult for firms to plan and adjust their green supply chain strategies. Changes in market demand and environmental standards make it difficult for enterprises to respond flexibly, affecting their green supply chains' construction and operational efficiency and weakening the potential for sustainable performance.

Therefore, enterprises must develop highly adaptive green strategies and resilient supply chain management programs to respond effectively to environmental uncertainty. By establishing a multi-level supplier network and strengthening close collaboration with partners, enterprises can quickly adjust their strategies to ensure the stability and continuity of their supply chains when they are disrupted. At the same time, enterprises should enhance their employees' environmental awareness and professional knowledge to strengthen their ability to cope with changes. Enhanced internal and external cooperation can help mitigate the negative impacts of environmental uncertainty on green intellectual capital and supply chain management, thus ensuring sustainable performance. Enterprises should also set up environmental risk assessment teams to regularly monitor market demand, policy changes, and technology trends to identify potential risks promptly. By developing contingency plans, such as optimizing supply chains or product design when

environmental policies are tightened, companies can ensure sustainable operations in uncertain environments, avoid significant shocks, and enhance their strategic advantage over industry competition.

(5) Provide Policy References for Governments to Promote Green Practices in Enterprises

The role of government in promoting enterprises' green practices is crucial, and the formulation of effective policies can help enterprises implement greening strategies and achieve win-win economic and environmental benefits. This research provides a reference for governments to help identify the key factors that promote green entrepreneurship in enterprises and formulate targeted incentive policies to promote the manufacturing industry's transition to greenness. As a first step, governments should stimulate green entrepreneurship among enterprises by implementing economic incentives, such as tax breaks and financial subsidies. By setting up green technology innovation funds and green industrial parks, governments provide a benign external environment for enterprises to help them gain more development opportunities in the green marketplace. For example, governments can set up special funding for green entrepreneurship to support small and medium enterprises (SMEs) in the research, development, and application of green technologies to reduce initial investment costs. In addition, economic incentives such as low-interest loans and financial subsidies can further increase the willingness of enterprises to make green investments and promote the widespread application and development of green technologies. Governments can also set up green innovation awards to recognize enterprises that have performed outstandingly in green technologies, products, and management. Through financial incentives and policy support, governments can not only incentivize the green innovation drive of enterprises but also create a demonstration effect to encourage more enterprises to participate in green practices. For example, award-winning enterprises could receive government support in marketing and publicity resources, expanding their market share and enhancing their competitiveness.

In addition, government awareness-raising and education in promoting green entrepreneurial practices among businesses is crucial. Through the wide dissemination of successful cases and organizing green entrepreneurship forums and competitions, governments can enhance enterprises' confidence in green entrepreneurship and motivate

more enterprises to participate in developing green business opportunities. For example, governments can use various media platforms such as television, radio, and the Internet to publicize successful practices of green entrepreneurship, raise the environmental awareness of enterprises, and promote the active adoption of green technologies by enterprises to reduce their negative impact on the environment. To improve the green entrepreneurship capacity of enterprise management, governments can organize diversified training activities covering green technology application, environmental management, and other aspects. By cooperating with universities and research institutions, governments can enhance the expertise of business managers in green innovation and management. For example, holding advanced workshops on green entrepreneurship or organizing field trips on green technologies can help enterprises gain a deeper understanding of the advantages of green technologies, learn from advanced green management experience, and enhance their market response capabilities.

Governments should also increase financial support for green high-tech innovation projects, especially for technologies that address the problems of resource wastage and environmental pollution. For example, governments can set up special funds for green technology research and development to support enterprises in the research, development, and application of technologies in environmental protection equipment, clean energy, and the circular economy. Through cooperation with financial institutions, governments can launch green credit products and provide low-interest loans to ease the economic pressure on enterprises engaging in green technology research and development. Finally, governments should establish a monitoring mechanism for green entrepreneurship development to better understand industry dynamics and adjust policies accordingly. By collecting and analyzing enterprises' green entrepreneurship data, governments can change policy direction according to the actual needs of enterprises. For example, the Chinese government could publish a report on green entrepreneurship development to summarize the effectiveness of policy implementation and provide a scientific basis for future policy optimization. These comprehensive measures will support enterprises and push China's manufacturing industry toward a greener and more sustainable direction. The joint efforts of the Chinese government and enterprises will not only enhance the market competitiveness of enterprises but also promote the green transformation of the whole manufacturing sector and realize the organic combination of economic benefits and environmental responsibility. This research will help

China's manufacturing industry occupy a favorable position in the global market and contribute to global environmental protection and sustainable development.

5.4 Research Limitations and Suggestions for Future Research

5.4.1 Research Limitations

Although this study provides valuable insights, several limitations warrant careful consideration. First, regarding sample representativeness, this research is limited to manufacturing enterprises in Sichuan Province, which may restrict the application of the findings. Different regions and industries may exhibit varying dynamics in the relationships among green entrepreneurial orientation, green intellectual capital, and sustainable performance, necessitating validation in a broader context. Second, using a cross-sectional design, which collects data simultaneously, imposes limitations on causal inferences regarding the relationships among variables as it needs to account for the potential temporal changes in attitudes and behaviors. Additionally, in terms of measuring environmental uncertainty, this study incorporates it as a moderating variable; however, the measurement of this construct may vary due to differences in contextual factors. Therefore, further research should focus on refining environmental uncertainty's conceptualization and measurement methods. Lastly, the study primarily emphasizes mediating and moderating effects, particularly the mediating roles of green intellectual capital and green supply chain management and the moderating role of environmental uncertainty, which may overlook other potential mediating or moderating factors, such as organizational culture or the influence of external stakeholders. This limitation may constrain the comprehensive understanding of the mechanisms involved.

5.4.2 Suggestions for Future Research

To address the limitations above and further expand the findings of this study, the following recommendations for future research are proposed. First, researchers should broaden the sample scope to include enterprises from various industries and geographical regions. This would enhance the application of the findings and provide a more comprehensive understanding of how green entrepreneurial orientation influences sustainable performance across diverse contexts. Second, conducting longitudinal studies would help uncover causal relationships among variables. Researchers can gain deeper

insights into the dynamics involved by tracking changes in green entrepreneurial orientation, green intellectual capital, and sustainable performance.

Furthermore, future research should explore the inclusion of other relevant variables, such as organizational culture, leadership styles, or the influence of external stakeholders, as these factors may further elucidate the mechanisms by which green entrepreneurial orientation affects sustainable performance.

Additionally, developing more detailed measurement methods for environmental uncertainty would be beneficial, considering the specific challenges and risks different sectors face. A comprehensive understanding of how various dimensions of environmental uncertainty interact with green entrepreneurial orientation will provide deeper insights into strategic decision-making. Finally, future research could investigate alternative mediating or moderating variables influencing the relationship between green entrepreneurial orientation and sustainable performance. For instance, examining the roles of employee engagement, innovation capability, or organizational learning may reveal new pathways to achieving sustainable outcomes. The framework could also be expanded to explore the antecedents of green entrepreneurial orientation, thereby constructing new theoretical models and continuously enriching the theoretical landscape of green entrepreneurship research.

List of Bibliography

Abbade, E. B., Mores, G. d. V., & Spanhol, C. P. (2014). The impact of entrepreneurial orientation on sustainable performance: Evidence of MSMES from Rio Grande do Sul. ***Revista de Gestão Social e Ambiental, 8***(2), 49-62.

Afum, E., Issau, K., Agyabeng-Mensah, Y., Baah, C., Dacosta, E., Essandoh, E., & Agyenim Boateng, E. (2023). The missing links of sustainable supply chain management and green radical product innovation between sustainable entrepreneurship orientation and sustainability performance. *Journal of* ***Engineering, Design and Technology, 21***(1), 167-187.

Ahmad, N., Li, H.-Z., & Tian, X.-L. (2019). Increased firm profitability under a nationwide environmental information disclosure program? Evidence from China. ***Journal of Cleaner Production, 230***, 1176-1187. https://doi.org/https://doi.org/10.1016/j.jclepro.2019.05.161

Aisjah, S., & Prabandari, S. P. (2021). Green supply chain integration and environmental uncertainty on performance: the mediating role of green innovation. **In** ***Environmental, Social, and Governance Perspectives on Economic Development in Asia*** (Vol. 29, pp. 39-62). Emerald Publishing Limited.

Al-Jinini, D. K., Dahiyat, S. E., & Bontis, N. (2019). Intellectual capital, entrepreneurial orientation, and technical innovation in small and medium-sized enterprises. ***Knowledge and Process Management, 26***(2), 69-85.

Alegre, J., & Chiva, R. (2013). Linking entrepreneurial orientation and firm performance: The role of organizational learning capability and innovation performance. ***Journal of Small Business Management, 51***(4), 491-507.

Alfandi, A. M. T., & Bataineh, M. S. E. (2023). The Impact of Green Entrepreneurship Orientation on Sustainable Performance: The Mediating Effect of Knowledge Management. ***Journal of Academic Research in Economics and Management and Sciences, 12***(1), 388-404.

Aman, S., Seuring, S., & Khalid, R. U. (2023). Sustainability performance measurement in risk and uncertainty management: An analysis of base of the pyramid supply chain literature. ***Business Strategy and the Environment, 32***(4), 2373-2398.

Ameer, F., & Khan, N. R. (2020). Manager's age, sustainable entrepreneurial orientation and sustainable performance: a conceptual outlook. ***Sustainability (Switzerland), 12***(8), 3196.

Ameer, F., & Khan, N. R. (2022). Green entrepreneurial orientation and corporate environmental performance: A systematic literature review. ***European Management Journal, 44***(5), 755-778. https://doi.org/10.1016/j.emj.2022.04.003

Andersen, A. D., Marìn, A., & Simensen, E. O. (2018). Innovation in natural resource-based industries: a pathway to development? Introduction to special issue. ***Innovation and Development, 8***(1), 1-27. https://doi.org/10.1080/2157930X.2018.1439293

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. ***Psychological Bulletin, 103***(3), 411-423. https://doi.org/10.1037/0033-2909.103.3.411

Anderson Jr, T. N., & Kida, T. E. (1985). The effect of environmental uncertainty on the association of expectancy attitudes, effort, and performance. ***The Journal of social psychology, 125***(5), 631-636.

Angell, L. C., & Klassen, R. D. (1999). Integrating environmental issues into the mainstream: an agenda for research in operations management. ***Journal of operations management, 17***(5), 575-598.

Arocena, P., Orcos, R., & Zouaghi, F. (2021). The impact of ISO 14001 on firm environmental and economic performance: The moderating role of size and environmental awareness. ***Business Strategy and the Environment, 30***(2), 955-967.

Asadi, S., Pourhashemi, S. O., Nilashi, M., Abdullah, R., Samad, S., Yadegaridehkordi, E., Aljojo, N., & Razali, N. S. (2020). Investigating influence of green innovation on sustainability performance: A case on Malaysian hotel industry. ***Journal of Cleaner Production, 258***, 120860. https://doi.org/10.1016/j.jclepro.2020.120860

Asiaei, K., O'Connor, N. G., Barani, O., & Joshi, M. (2023). Green intellectual capital and ambidextrous green innovation: The impact on environmental performance. ***Business Strategy and the Environment, 32***(1), 369-386.

Baggio, R., & Valeri, M. (2022). Network science and sustainable performance of family businesses in tourism. ***Journal of Family Business Management, 12***(2), 200-213.

Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. ***Journal of the academy of marketing science, 16***, 74-94.

Bansal, P., & Song, H.-C. (2017). Similar but not the same: Differentiating corporate sustainability from corporate responsibility. ***Academy of Management Annals, 11***(1), 105-149.

Beal, R. M., & Lockamy III, A. (1999). Quality differentiation for competitive advantage: a contingency approach. ***European Journal of Innovation Management, 2***(2), 71-81.

Ben-Daya, M., Hassini, E., & Bahroun, Z. (2019). Internet of things and supply chain management: a literature review. ***International journal of production research, 57***(15-16), 4719-4742.

Benevene, P., Buonomo, I., Kong, E., Pansini, M., & Farnese, M. L. (2021). Management of green intellectual capital: Evidence-based literature review and future directions. ***Sustainability, 13***(15), 8349; https://doi.org/10.3390/su13158349

Bodansky, D. (2016). The Paris climate change agreement: a new hope? ***American Journal of International Law, 110***(2), 288-319.

Bollen, K. A., & Long, J. S. (1993). ***Testing structural equation models*** (Vol. 154). Sage.

Bontis, N. (2000). Managing organizational knowledge by diagnosing intellectual capital. ***Knowledge Management: Classic and Contemporary Works***. MIT Press, Cambridge.

Boon-itt, S., & Wong, C. Y. (2011). The moderating effects of technological and demand uncertainties on the relationship between supply chain integration and customer delivery performance. ***International Journal of Physical Distribution & Logistics Management, 41***(3), 253-276.

Boxiong, L., Xiaona, Z., & Xin, X. (2012). Supply Chain Management in E-Commerce Era. ***Chinese Management Science, 3***, 2-8.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. ***Qualitative research in psychology, 3***(2), 77-101.

Brennan, N., & Connell, B. (2000). Intellectual capital: current issues and policy implications. ***Journal of Intellectual Capital, 1***(3), 206-240.

Caiado, R. G. G., Quelhas, O. L. G., Nascimento, D. L. d. M., Anholon, R., & Leal Filho, W. (2019). Towards sustainability by aligning operational programmes and sustainable performance measures. ***Production Planning & Control, 30***(5-6), 413-425.

Carroll, A. B. (1979). A three-dimensional conceptual model of corporate performance. ***Academy of management Review, 4***(4), 497-505.

Chan, R. Y. (2001). Determinants of Chinese consumers' green purchase behavior. ***Psychology & marketing, 18***(4), 389-413.

Chang, C. H., & Chen, Y. S. (2012). The determinants of green intellectual capital. ***Management Decision, 50***(1), 74-94.

Cheah, J., Amran, A., & Yahya, S. (2019). Internal oriented resources and social enterprises' performance: How can social enterprises help themselves before helping others? ***Journal of Cleaner Production, 211***, 607-619.

Chen, I. J., & Paulraj, A. (2004). Towards a theory of supply chain management: the constructs and measurements. ***Journal of operations management, 22***(2), 119-150.

Chen, S., Shen, W., Qiu, Z., Liu, R., & Mardani, A. (2023). Who are the green entrepreneurs in China? The relationship between entrepreneurs' characteristics, green entrepreneurship orientation, and corporate financial performance. ***Journal of Business Research, 165***, 113960. https://doi.org/10.1016/j.jbusres.2023.113960

Chen, Y.-S. (2008). The positive effect of green intellectual capital on competitive advantages of firms. ***Journal of business ethics, 77***, 271-286.

Chen, Y.-S., & Chang, C.-H. (2011). Enhance environmental commitments and green intangible assets toward green competitive advantages: an analysis of structural equation modeling (SEM). ***Quality & Quantity, 47***(1), 529-543. https://doi.org/10.1007/s11135-011-9535-9

Chen, Y.-S., Lai, S.-B., & Wen, C.-T. (2006). The influence of green innovation performance on corporate advantage in Taiwan. ***Journal of business ethics, 67***, 331-339.

Chin, T. A., Hamid, A. B. A., Rasli, A., & Tat, H. H. (2014). A literature analysis on the relationship between external integration, environmental uncertainty and firm performance in Malaysian SMEs. ***Procedia-Social and Behavioral Sciences, 130***, 75-84.

Chin, T. A., Tat, H. H., & Sulaiman, Z. (2015). Green supply chain management, environmental collaboration and sustainability performance. ***Procedia Cirp, 26***, 695-699.

Chin, W. W. (1998). The partial least squares approach to structural equation modeling. ***Modern methods for business research, 295***(2), 295-336.

Cho, J. J. K., Ozment, J., & Sink, H. (2008). Logistics capability, logistics outsourcing and firm performance in an e-commerce market. ***International journal of physical distribution & logistics management, 38***(5), 336-359.

Choe, J.-m. (2003). The effect of environmental uncertainty and strategic applications of IS on a firm's performance. ***Information & Management, 40***(4), 257-268.

Christensen, C. M. (2001). Competitive advantage. ***mit sloan management review, 42***(2), 105-109.

Christopher, M. (2016). ***Logistics and Supply Chain Management: Logistics & Supply Chain Management***. Pearson UK.

Chuang, S.-P., & Yang, C.-L. (2014). Key success factors when implementing a green-manufacturing system. ***Production Planning & Control, 25***(11), 923-937.

Ciemleja, G., & Lace, N. (2011). The model of sustainable performance of small and medium-sized enterprise. ***Engineering economics, 22***(5), 501-509.

Clarkson, M. E. (1995). A stakeholder framework for analyzing and evaluating corporate social performance. ***Academy of management Review, 20***(1), 92-117.

Coase, R. H. (1974). The lighthouse in economics. ***The journal of law and economics, 17***(2), 357-376.

Cohen, B., & Winn, M. I. (2007). Market imperfections, opportunity and sustainable entrepreneurship. ***Journal of business Venturing, 22***(1), 29-49.

Combs, J. G., Russell Crook, T., & Shook, C. L. (2005). The dimensionality of organizational performance and its implications for strategic management research. ***In Research methodology in strategy and management*** (pp. 259-286). Emerald Group Publishing Limited.

Covin, J. G., & Miles, M. P. (1999). Corporate entrepreneurship and the pursuit of competitive advantage. ***Entrepreneurship theory and practice, 23***(3), 47-63.

Covin, J. G., & Slevin, D. P. (1991). A conceptual model of entrepreneurship as firm behavior. ***Entrepreneurship theory and practice, 16***(1), 7-26.

Cox, A. (1997). On power, appropriateness and procurement competence. *Supply Management*, *2*(20), 24-27.

Cox, A. (1999). Power, value and supply chain management. ***Supply Chain Management: An International Journal, 4***(4), 167-175.

Criado-Gomis, A., Iniesta-Bonillo, M. Á., & Cervera-Taulet, A. (2018). Sustainable entrepreneurial orientation within an intrapreneurial context: effects on business performance. ***International Entrepreneurship and Management Journal, 14***, 295-308.

Criscuolo, C., & Menon, C. (2015). Environmental policies and risk finance in the green sector: Cross-country evidence. ***Energy Policy, 83***, 38-56.

Darnall, N., & Edwards Jr, D. (2006). Predicting the cost of environmental management system adoption: the role of capabilities, resources and ownership structure. ***Strategic management journal, 27***(4), 301-320.

Davis, T. (1993). Effective supply chain management. ***Sloan management review, 34***, 35-35.

De Giovanni, P. (2012). Do internal and external environmental management contribute to the triple bottom line?. ***International journal of operations & production management, 32***(3), 265-290.

Dean, T. J., & McMullen, J. S. (2007). Toward a theory of sustainable entrepreneurship: Reducing environmental degradation through entrepreneurial action. ***Journal of business Venturing, 22***(1), 50-76.

Delmas, M., & Blass, V. D. (2010). Measuring corporate environmental performance: the trade-offs of sustainability ratings. ***Business Strategy and the Environment, 19***(4), 245-260.

Delmas, M. A., & Toffel, M. W. (2008). Organizational responses to environmental demands: Opening the black box. ***Strategic management journal, 29***(10), 1027-1055.

Dess, G. G., & Beard, D. W. (1984). Dimensions of organizational task environments. ***Administrative science quarterly, 9***(1), 52-73.

Diabat, A., & Govindan, K. (2011). An analysis of the drivers affecting the implementation of green supply chain management. ***Resources, conservation and recycling, 55***(6), 659-667.

Ding, L., Velicer, W. F., & Harlow, L. L. (1995). Effects of estimation methods, number of indicators per factor, and improper solutions on structural equation modeling fit indices. ***Structural Equation Modeling: A Multidisciplinary Journal, 2***(2), 119-143.

Donaldson, L. (2001). ***The contingency theory of organizations***. Sage.

Dubey, R., Gunasekaran, A., & Papadopoulos, T. (2017). Green supply chain management: theoretical framework and further research directions. ***Benchmarking: An International Journal, 24***(1), 184-218.

Duncan, R. B. (1972). Characteristics of organizational environments and perceived environmental uncertainty. *Administrative science quarterly*, 313-327.

Edvinsson, L. (1997). Developing intellectual capital at Skandia. ***Long range planning, 30***(3), 366-373.

Elkington, J., & Rowlands, I. H. (1999). Cannibals with forks: The triple bottom line of 21st century business. ***Alternatives Journal, 25***(4), 42.

Evans, S., Vladimirova, D., Holgado, M., Van Fossen, K., Yang, M., Silva, E. A., & Barlow, C. Y. (2017). Business model innovation for sustainability: Towards a unified perspective for creation of sustainable business models. ***Business Strategy and the Environment, 26***(5), 597-608.

Fang, E., & Zou, S. (2010). The effects of absorptive and joint learning on the instability of international joint ventures in emerging economies. ***Journal of International Business Studies, 41***, 906-924.

Fang, Y. (2022). Green entrepreneurial orientation, boundary-spanning search and enterprise sustainable performance: The moderating role of environmental dynamism. ***Frontiers in Psychology, 13***, 978274.

Farinelli, F., Bottini, M., Akkoyunlu, S., & Aerni, P. (2011). Green entrepreneurship: the missing link towards a greener economy. ***Atdf Journal, 8***(3/4), 42-48.

Fatoki, O. (2019). Green entrepreneurial orientation and firm performance in South Africa. ***Entrepreneurship and Sustainability Issues, 7***(1), 247.

Feng, T., Wang, D., Lawton, A., & Luo, B. N. (2019). Customer orientation and firm performance: The joint moderating effects of ethical leadership and competitive intensity. ***Journal of Business Research, 100***, 111-121.

Feng, Z., & Chen, W. (2018). Environmental regulation, green innovation, and industrial green development: An empirical analysis based on the Spatial Durbin model. ***Sustainability (Switzerland), 10***(1), 223.

Fernando, Y., Jabbour, C. J. C., & Wah, W.-X. (2019). Pursuing green growth in technology firms through the connections between environmental innovation and sustainable business performance: does service capability matter? ***Resources, conservation and recycling, 141***, 8-20.

Flammer, C. (2013). Corporate social responsibility and shareholder reaction: The environmental awareness of investors. ***Academy of Management Journal, 56***(3), 758-781.

Foley, J. A., DeFries, R., Asner, G. P., Barford, C., Bonan, G., Carpenter, S. R., Chapin, F. S., Coe, M. T., Daily, G. C., & Gibbs, H. K. (2005). Global consequences of land use. ***science, 309***(5734), 570-574.

Fornell, C., & Larcker, D. F. (1981a). Evaluating structural equation models with unobservable variables and measurement error. ***Journal of marketing research, 18***(1), 39-50.

Freel, M. S. (2005). Perceived environmental uncertainty and innovation in small firms. ***Small business economics, 25***, 49-64.

Fynes, B., De Burca, S., & Marshall, D. (2004). Environmental uncertainty, supply chain relationship quality and performance. ***Journal of Purchasing and Supply Management, 10***(4-5), 179-190.

Garcés-Ayerbe, C., Rivera-Torres, P., Murillo-Luna, J. L., & Suárez-Gálvez, C. (2022). Does it pay more to be green in family firms than in non-family firms?. ***Review of Managerial Science, 16***(5), 1365-1386.

Gast, J., Gundolf, K., & Cesinger, B. (2017). Doing business in a green way: A systematic review of the ecological sustainability entrepreneurship literature and future research directions. ***Journal of Cleaner Production, 147***, 44-56.

Gevrenova, T. (2015). Nature and characteristics of green entrepreneurship. ***Trakia Journal of Sciences, 13***(2), 321-323.

Ghosh, D., & Olsen, L. (2009). Environmental uncertainty and managers' use of discretionary accruals. ***Accounting, Organizations and Society, 34***(2), 188-205.

Gölgeci, I., & Ponomarov, S. Y. (2015). How does firm innovativeness enable supply chain resilience? The moderating role of supply uncertainty and interdependence. ***Technology Analysis & Strategic Management, 27***(3), 267-282.

Golicic, S. L., & Smith, C. D. (2013). A meta-analysis of environmentally sustainable supply chain management practices and firm performance. ***Journal of supply chain management, 49***(2), 78-95.

Golsefid-Alavi, M., Sakhdari, K., & Alirezaei, A. (2021). A review of the literature on entrepreneurship and the environment: opportunities for researching on the green entrepreneurial orientation. ***Environmental Engineering and Management Journal, 20***(5), 819-839.

Gorsuch, R. L. (1983). Factor analysis Lawrence Erlbaum Associates. *Hillsdale, NJ*.

Govindan, K., Khodaverdi, R., & Jafarian, A. (2013). A fuzzy multi criteria approach for measuring sustainability performance of a supplier based on triple bottom line approach. ***Journal of Cleaner Production, 47***, 345-354.

Green, K. W., Zelbst, P. J., Meacham, J., & Bhadauria, V. S. (2012). Green supply chain management practices: impact on performance. ***Supply Chain Management: An International Journal, 17***(3), 290-305. https://doi.org/10.1108/13598541211227126

Guan, D., Liu, Z., Geng, Y., Lindner, S., & Hubacek, K. (2012). The gigatonne gap in China's carbon dioxide inventories. ***Nature Climate Change, 2***(9), 672-675.

Haarhaus, T., & Liening, A. (2020). Building dynamic capabilities to cope with environmental uncertainty: The role of strategic foresight. ***Technological Forecasting and Social Change, 155***, 120033. https://doi.org/10.1016/j.techfore.2020.120033

Habib, M. A., Bao, Y., & Ilmudeen, A. (2020). The impact of green entrepreneurial orientation, market orientation and green supply chain management practices on sustainable firm performance. ***Cogent Business & Management, 7***(1), 1743616. https://doi.org/10.1080/23311975.2020.1743616

Habidin, N. F., Zubir, A. F. M., Fuzi, N. M., Latip, N. A. M., & Azman, M. N. A. (2015). Sustainable performance measures for Malaysian automotive industry. ***World Applied Sciences Journal, 33***(6), 1017-1024.

Hair, J. F. (2009). Multivariate data analysis.

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. ***Journal of Marketing theory and Practice, 19***(2), 139-152.

Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. ***Journal of the academy of marketing science, 40***, 414-433.

Hair Jr, J. F., Babin, B. J., & Anderson, R. E. (2010). ***A global p-erspect-ivie***. Kennesaw: Kennesaw State University.

Hakala, H. (2011). Strategic orientations in management literature: Three approaches to understanding the interaction between market, technology, entrepreneurial and learning orientations. ***International Journal of Management Reviews, 13***(2), 199-217.

Halberstadt, J., Niemand, T., Kraus, S., Rexhepi, G., Jones, P., & Kailer, N. (2021). Social entrepreneurship orientation: Drivers of success for start-ups and established industrial firms. ***Industrial Marketing Management, 94***, 137-149.

Handfield, R., Walton, S. V., Sroufe, R., & Melnyk, S. A. (2002). Applying environmental criteria to supplier assessment: A study in the application of the Analytical Hierarchy Process. ***European journal of operational research, 141***(1), 70-87.

Handfield, R. B., Walton, S. V., Seegers, L. K., & Melnyk, S. A. (1997). 'Green'value chain practices in the furniture industry. ***Journal of operations management, 15***(4), 293-315.

Hart, S. L. (1995). A natural-resource-based view of the firm. ***Academy of management Review, 20***(4), 986-1014.

Hassan, M. G., Abidin, R., Nordin, N., & Yusoff, R. Z. (2016). GSCM practices and sustainable performance: A preliminary insight. ***Journal of Advanced Management Science, 4***(5), 430-434.

Helfat, C. E., & Peteraf, M. A. (2015). Managerial cognitive capabilities and the microfoundations of dynamic capabilities. ***Strategic management journal, 36***(6), 831-850.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. ***Journal of the academy of marketing science, 43***, 115-135.

Hernández-Espallardo, M., Rodríguez-Orejuela, A., & Sánchez-Pérez, M. (2010). Inter-organizational governance, learning and performance in supply chains. ***Supply Chain Management: An International Journal, 15***(2), 101-114.

Hillman, A. J., & Keim, G. D. (2001). Shareholder value, stakeholder management, and social issues: what's the bottom line? ***Strategic management journal, 22***(2), 125-139.

Hoogland, J. J., & Boomsma, A. (1998). Robustness studies in covariance structure modeling: An overview and a meta-analysis. ***Sociological Methods & Research, 26***(3), 329-367.

Horbach, J., Rammer, C., & Rennings, K. (2012). Determinants of eco-innovations by type of environmental impact: The role of regulatory push/pull, technology push and market pull. ***Ecological economics, 78***, 112-122.

Huajing, L. (2015). Research on the relationship between institutional environment, green entrepreneurial orientation and performance. ***Journal of Social Sciences, 2***, 92-99.

Huang, C. L., & Kung, F. H. (2011). Environmental consciousness and intellectual capital management: Evidence from Taiwan's manufacturing industry. ***Management Decision, 49***(9), 1405-1425.

Hughes, P., Hodgkinson, I. R., Hughes, M., & Arshad, D. (2018). Explaining the entrepreneurial orientation–performance relationship in emerging economies: The intermediate roles of absorptive capacity and improvisation. ***Asia Pacific Journal of Management, 35***, 1025-1053.

Hulland, J. (1999). Use of partial least squares (PLS) in strategic management research: A review of four recent studies. ***Strategic management journal, 20***(2), 195-204.

Ilmudeen, A. (2020). The impact of green entrepreneurial orientation, market orientation and green supply chain management practices on sustainable firm performance. ***Habib et al., Cogent Business & Management, 7***, 1743616. https://doi.org/10.1080/23311975.2020.1743616Page 3 of 26

Inayat, A., Afridi, S., & Javed, A. (2022). Green intellectual capital, green absorptive capacity, green dynamic capabilities, and sustainable performance. ***CITY UNIVERSITY RESEARCH JOURNAL, 12***(2), 152-170.

İyigün, N. Ö. (2015). What could entrepreneurship do for sustainable development? A corporate social responsibility-based approach. ***Procedia-Social and Behavioral Sciences, 195***, 1226-1231.

Jabbour, C. J. C., & Santos, F. C. A. (2008). The central role of human resource management in the search for sustainable organizations. *The International* ***Journal of Human Resource Management, 19***(12), 2133-2154.

Jiang, W., Chai, H., Shao, J., & Feng, T. (2018). Green entrepreneurial orientation for enhancing firm performance: A dynamic capability perspective. ***Journal of Cleaner Production, 198***, 1311-1323.

Kai, L. (2011). ***Research on Green Entrepreneurship Orientation and Action Model Based on Vision Interpretation Behavior Focus Taking New Energy Enterprises as an Example.*** Hangzhou: Zhejiang University Doctoral Dissertation].

Ketchen Jr, D. J., & Bergh, D. D. (2006). ***Research methodology in strategy and management***. Emerald Group Publishing.

Khan, S. H., Yasir, M., Shah, H. A., & Majid, A. (2021). Role of social capital and social value creation in augmenting sustainable performance of social enterprises: Moderating role of social innovation. ***Pakistan Journal of Commerce and Social Sciences (PJCSS), 15***(1), 118-137.

Kim, D., Chiou, J.-S., & Calantone, R. (2018). Strategic orientations, joint learning, and innovation generation in international customer-supplier relationships. ***International Business Review, 27***(4), 838-851.

Kirkwood, J., & Walton, S. (2014). How green is green? Ecopreneurs balancing environmental concerns and business goals. ***Australasian Journal of Environmental Management, 21***(1), 37-51.

Koberg, C. S., & Ungson, G. R. (1987). The effects of environmental uncertainty and dependence on organizational structure and performance: A comparative study. ***Journal of Management, 13***(4), 725-737.

Kreiser, P., & Marino, L. (2002). Analyzing the historical development of the environmental uncertainty construct. ***Management Decision, 40***(9), 895-905.

Kumar, M., Vrat, P., & Shankar, R. (2004). A fuzzy goal programming approach for vendor selection problem in a supply chain. ***Computers & industrial engineering, 46***(1), 69-85.

Laari, S., Töyli, J., & Ojala, L. (2018). The effect of a competitive strategy and green supply chain management on the financial and environmental performance of logistics service providers. ***Business Strategy and the Environment, 27***(7), 872-883.

Lam, S. Y., Shankar, V., Erramilli, M. K., & Murthy, B. (2004). Customer value, satisfaction, loyalty, and switching costs: an illustration from a business-to-business service context. ***Journal of the academy of marketing science, 32***(3), 293-311.

Land, S., Engelen, A., & Brettel, M. (2012). Top management's social capital and learning in new product development and its interaction with external uncertainties. ***Industrial Marketing Management, 41***(3), 521-530.

Larson, P. D. (2001). Designing and managing the supply chain: concepts, strategies, and case studies. ***Journal of Business logistics, 22***(1), 259-261

Latan, H., Jabbour, C. J. C., de Sousa Jabbour, A. B. L., Wamba, S. F., & Shahbaz, M. (2018). Effects of environmental strategy, environmental uncertainty and top management's commitment on corporate environmental performance: The role of environmental management accounting. ***Journal of Cleaner Production, 180***, 297-306.

Lawson, B., & Samson, D. (2001). Developing innovation capability in organisations: a dynamic capabilities approach. ***International journal of innovation management, 5***(3), 377-400.

Lee, P. K., Yeung, A. C., & Cheng, T. E. (2009). Supplier alliances and environmental uncertainty: An empirical study. ***International Journal of Production Economics, 120***(1), 190-204.

Lee, S. M., & Rha, J. S. (2016). Ambidextrous supply chain as a dynamic capability: building a resilient supply chain. ***Management Decision, 54***(1), 2-23.

Leonidou, L. C., Christodoulides, P., Kyrgidou, L. P., & Palihawadana, D. (2017). Internal drivers and performance consequences of small firm green business strategy: The moderating role of external forces. ***Journal of business ethics, 140***, 585-606.

Li, Y. (2014). Environmental innovation practices and performance: moderating effect of resource commitment. ***Journal of Cleaner Production, 66***, 450-458.

Liang, Y., & Wang, H. (2019). Sustainable Performance Measurements for Public–Private Partnership Projects: Empirical Evidence from China. ***Sustainability (Switzerland), 11***(13), 3653. https://www.mdpi.com/2071-1050/11/13/3653

Likert, R. (1932). A technique for the measurement of attitudes. ***Archives of Psychology, 22 140***, 55-55.

Lin, R.-J., Tan, K.-H., & Geng, Y. (2013). Market demand, green product innovation, and firm performance: evidence from Vietnam motorcycle industry. ***Journal of Cleaner Production, 40***, 101-107.

Lin, Y.-H., & Chen, Y.-S. (2017). Determinants of green competitive advantage: the roles of green knowledge sharing, green dynamic capabilities, and green service innovation. ***Quality & Quantity, 51***, 1663-1685.

Linton, J. D., Klassen, R., & Jayaraman, V. (2007). Sustainable supply chains: An introduction. ***Journal of operations management, 25***(6), 1075-1082.

Lisi, W., Zhu, R., & Yuan, C. (2020). Embracing green innovation via green supply chain learning: The moderating role of green technology turbulence. ***Sustainable Development, 28***(1), 155-168.

Liu, J., & Xie, J. (2020). Environmental regulation, technological innovation, and export competitiveness: An empirical study based on China's manufacturing industry. *International journal of environmental research and public health, 17*(4), 1427.

Lo, S. M., & Shiah, Y.-A. (2016). Associating the motivation with the practices of firms going green: the moderator role of environmental uncertainty. ***Supply Chain Management: An International Journal, 21***(4), 485-498.

López-Gamero, M. D., Molina-Azorin, J. F., & Claver-Cortés, E. (2011). Environmental uncertainty and environmental management perception: A multiple case study. ***Journal of Business Research, 64***(4), 427-435.

MacKain, K. S., Best, C. T., & Strange, W. (1981). Categorical perception of English/r/and/l/by Japanese bilinguals. ***Applied psycholinguistics, 2***(4), 369-390.

Mahmood, F., & Nasir, N. (2023). Impact of green human resource management practises on sustainable performance: serial mediation of green intellectual capital and green behaviour. ***Environmental Science and Pollution Research***, 1-17.

Maignan, I., & Ferrell, O. (2000). Measuring corporate citizenship in two countries: The case of the United States and France. ***Journal of business ethics, 23***, 283-297.

Makadok, R., & Ross, D. G. (2013). Taking industry structuring seriously: A strategic perspective on product differentiation. ***Strategic management journal, 34***(5), 509-532.

Makhloufi, L., Laghouag, A. A., Meirun, T., & Belaid, F. (2022). Impact of green entrepreneurship orientation on environmental performance: The natural resource-based view and environmental policy perspective. ***Business Strategy and the Environment, 31***(1), 425-444.

Maleki Minbashrazgah, M., & Shabani, A. (2019). Eco-capability role in healthcare facility's performance: Natural-resource-based view and dynamic capabilities paradigm. ***Management of Environmental Quality: An International Journal, 30***(1), 137-156.

Malik, S. Y., Cao, Y., Mughal, Y. H., Kundi, G. M., Mughal, M. H., & Ramayah, T. (2020). Pathways towards sustainability in organizations: Empirical evidence on the role of green human resource management practices and green intellectual capital. ***Sustainability (Switzerland), 12***(8), 3228.

Malm, A. (2016). ***Fossil capital: The rise of steam power and the roots of global warming***. Verso Books.

Marco-Lajara, B., Zaragoza-Sáez, P., Martínez-Falcó, J., & Sánchez-García, E. (2022). Green intellectual capital in the Spanish wine industry. ***In Innovative Economic, Social, and Environmental Practices for Progressing Future Sustainability*** (pp. 102-120). IGI Global.

Markley, M. J., & Davis, L. (2007). Exploring future competitive advantage through sustainable supply chains. ***International Journal of Physical Distribution & Logistics Management, 37***(9), 763-774.

Martinez-Conesa, I., Soto-Acosta, P., & Carayannis, E. G. (2017). On the path towards open innovation: Assessing the role of knowledge management capability and environmental dynamism in SMEs. ***Journal of Knowledge Management, 21***(3), 553-570.

Martínez-Falcó, J., Sánchez-García, E., Millan-Tudela, L. A., & Marco-Lajara, B. (2023). The role of green agriculture and green supply chain management in the green intellectual capital–Sustainable performance relationship: A structural equation modeling analysis applied to the Spanish wine industry. ***Agriculture, 13***(2), 425. https://doi.org/10.3390/agriculture13020425

Masoulas, V. (1998). Organisational requirements definition for intellectual capital management. ***International Journal of Technology Management, 16***(1-3), 126-143.

McCabe, D. L. (1990). The assessment of perceived environmental uncertainty and economic performance. ***Human Relations, 43***(12), 1203-1218.

McDougall, N., Wagner, B., & MacBryde, J. (2019). An empirical explanation of the natural-resource-based view of the firm. ***Production Planning & Control, 30***(16), 1366-1382.

McGahan, A. M. (2021). Integrating insights from the resource-based view of the firm into the new stakeholder theory. ***Journal of Management, 47***(7), 1734-1756.

McWilliams, A., & Siegel, D. (2001). Corporate social responsibility: A theory of the firm perspective. ***Academy of management Review, 26***(1), 117-127.

Melnyk, S. A., Sroufe, R. P., & Calantone, R. (2003). Assessing the impact of environmental management systems on corporate and environmental performance. ***Journal of operations management, 21***(3), 329-351.

Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. ***Journal of Business logistics, 22***(2), 1-25.

Miles, M. P., & Covin, J. G. (2000). Environmental marketing: A source of reputational, competitive, and financial advantage. ***Journal of business ethics, 23***, 299-311.

Miller, D. (1983). The correlates of entrepreneurship in three types of firms. ***Management science, 29***(7), 770-791.

Milliken, F. J. (1987). Three types of perceived uncertainty about the environment: State, effect, and response uncertainty. ***Academy of management Review, 12***(1), 133-143.

Moshman, J. (1978). Review of" Survey and Opinion Research: Procedures for Processing and Analysis, by John A. Sonquist and William C. Dunkelberg", Prentice-Hall, Inc., 1977. ***ACM SIGSOC Bulletin, 10***(1), 22-22.

Moyan, C., & Xuejiao, X. (2022). Green Entrepreneurship Orientation: Review and Conclusion. ***Modern Management, 12***, 788.

Muangmee, C., Dacko-Pikiewicz, Z., Meekaewkunchorn, N., Kassakorn, N., & Khalid, B. (2021). Green entrepreneurial orientation and green innovation in small and medium-sized enterprises (SMEs). ***Social Sciences, 10***(4), 136. https://doi.org/10.3390/socsci10040136

Munawar, S., Yousaf, H. Q., Ahmed, M., & Rehman, S. (2022). Effects of green human resource management on green innovation through green human capital, environmental knowledge, and managerial environmental concern. ***Journal of Hospitality and Tourism Management, 52***, 141-150.

Muo, I., & Azeez, A. A. (2019). Green entrepreneurship: Literature review and agenda for future research. ***International Journal of Entrepreneurial Knowledge, 7(***2), 17-29.

Naughton, B. (2021). ***The rise of China's industrial policy, 1978 to 2020***. Universidad Nacional Autónomica de México, Facultad de Economía México.

Newbert, S. L. (2007). Empirical research on the resource-based view of the firm: an assessment and suggestions for future research. ***Strategic management journal, 28***(2), 121-146.

Orlitzky, M., Schmidt, F. L., & Rynes, S. L. (2003). Corporate social and financial performance: A meta-analysis. ***Organization studies, 24***(3), 403-441.

Pacheco, D. F., Dean, T. J., & Payne, D. S. (2010). Escaping the green prison: Entrepreneurship and the creation of opportunities for sustainable development. ***Journal of business Venturing, 25***(5), 464-480.

Pagell, M., & Wu, Z. (2009). Building a more complete theory of sustainable supply chain management using case studies of 10 exemplars. ***Journal of supply chain management, 45***(2), 37-56.

Pagell, M., Wu, Z., & Wasserman, M. E. (2010). Thinking differently about purchasing portfolios: an assessment of sustainable sourcing. ***Journal of supply chain management, 46***(1), 57-73.

Parrish, B. D. (2010). Sustainability-driven entrepreneurship: Principles of organization design. ***Journal of business Venturing, 25***(5), 510-523.

Paulraj, A. (2011). Understanding the relationships between internal resources and capabilities, sustainable supply management and organizational sustainability. ***Journal of supply chain management, 47***(1), 19-37.

Paulraj, A., & Chen, I. J. (2007). Environmental uncertainty and strategic supply management: a resource dependence perspective and performance implications. ***Journal of supply chain management, 43***(3), 29-42.

Pearce, C. L., & Ensley, M. D. (2004). A reciprocal and longitudinal investigation of the innovation process: The central role of shared vision in product and process innovation teams (PPITs). ***Journal of organizational Behavior, 25***(2), 259-278.

Pereira, M. M. O., Silva, M. E., & Hendry, L. C. (2021). Supply chain sustainability learning: the COVID-19 impact on emerging economy suppliers. ***Supply Chain Management: An International Journal, 26***(6), 715-736.

Pham, H., Pham, T., & Dang, C. N. (2022). Assessing the importance of transformational leadership competencies and supply chain learning to green innovation: construction practitioners' perspectives. ***Construction Innovation, 22***(4), 1138-1154.

Porcelli, A. M. (2022). After the collapse: Evaluating undone science in the wake of a global environmental crisis. ***Geoforum, 132***, 219-228. https://doi.org/https://doi.org/10.1016/j.geoforum.2021.10.011

Porter, M., & Van der Linde, C. (1995). Green and competitive: ending the stalemate. ***The Dynamics of the eco-efficient economy: environmental regulation and competitive advantage, 33***, 120-134.

Porter, M. E., & Kramer, M. R. (2006). The link between competitive advantage and corporate social responsibility. ***Harvard business review, 84***(12), 78-92.

Porter, M. E., & Linde, C. v. d. (1995). Toward a new conception of the environment-competitiveness relationship. ***Journal of economic perspectives, 9***(4), 97-118.

Power, D. (2005). Supply chain management integration and implementation: a literature review. ***Supply Chain Management: An International Journal, 10***(4), 252-263.

Premkumar, G. P. (2001). Interorganizational systems and supply chain management: An information processing perspective. In ***Making Supply Chain Management Work*** (pp. 387-408). Auerbach Publications.

Qi, Y., Zhao, X., & Sheu, C. (2011). The impact of competitive strategy and supply chain strategy on business performance: the role of environmental uncertainty. ***Decision Sciences, 42***(2), 371-389.

Qin, L., Kirikkaleli, D., Hou, Y., Miao, X., & Tufail, M. (2021). Carbon neutrality target for G7 economies: Examining the role of environmental policy, green innovation and composite risk index. ***Journal of Environmental Management, 295***, 113119. https://doi.org/10.1016/j.jenvman.2021.113119

Radu, M. (2012). Empirical study on the indicators of sustainable performance–the sustainability balanced scorecard, effect of strategic organizational change. ***Amfiteatru Economic Journal, 14***(32), 451-469.

Ramírez, Y., Dieguez-Soto, J., & Manzaneque, M. (2021). How does intellectual capital efficiency affect firm performance? The moderating role of family management. ***International Journal of Productivity and Performance Management, 70***(2), 297-324.

Rauch, A., Wiklund, J., Lumpkin, G. T., & Frese, M. (2009). Entrepreneurial orientation and business performance: An assessment of past research and suggestions for the future. ***Entrepreneurship theory and practice, 33***(3), 761-787.

Renn, O., & Walker, K. (2008). Global risk governance. ***Concept and practice using the IRGC framework. Dordrecht***, 77-86.

Rennings, K. (2000). Redefining innovation eco-innovation research and the contribution from ecological economics. ***Ecological economics, 32***(2), 319-332.

Roos, G., & Roos, J. (1997). Measuring your company's intellectual performance. ***Long range planning, 30***(3), 413-426.

Russo, M. V., & Fouts, P. A. (1997). A resource-based perspective on corporate environmental performance and profitability. ***Academy of Management Journal, 40***(3), 534-559.

Samsami, F., Hosseini, S. H. K., Kordnaeij, A., & Azar, A. (2015). Managing environmental uncertainty: from conceptual review to strategic management point of view. ***International journal of business and management, 10***(7), 215.

Saputra, K., Subroto, B., Rahman, A. F., & Saraswati, E. (2023). Mediation Role Of Environmental Management Accounting On The Effect Of Green Competitive Advantage On Sustainable Performance. ***Journal Of Sustainability Science And Management, 18***(2), 103-115.

Sarasvathy, S. D. (2001). Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency. ***Academy of management Review, 26***(2), 243-263.

Sarkis, J. (2003). A strategic decision framework for green supply chain management. ***Journal of Cleaner Production, 11***(4), 397-409.

Sarkis, J., Zhu, Q., & Lai, K.-h. (2011). An organizational theoretic review of green supply chain management literature. ***International Journal of Production Economics, 130***(1), 1-15.

Schaltegger, S. (2002). A framework for ecopreneurship: Leading bioneers and environmental managers to ecopreneurship. ***Greener management international, 38***, 45-58.

Schilke, O. (2014). On the contingent value of dynamic capabilities for competitive advantage: The nonlinear moderating effect of environmental dynamism. ***Strategic management journal, 35***(2), 179-203.

Secundo, G., Ndou, V., Del Vecchio, P., & De Pascale, G. (2020). Sustainable development, intellectual capital and technology policies: A structured literature review and future research agenda. ***Technological Forecasting and Social Change, 153***, 119917.

Seman, N. A. A., Govindan, K., Mardani, A., Zakuan, N., Saman, M. Z. M., Hooker, R. E., & Ozkul, S. (2019). The mediating effect of green innovation on the relationship between green supply chain management and environmental performance. ***Journal of Cleaner Production, 229***, 115-127.

Seuring, S., & Müller, M. (2008a). Core issues in sustainable supply chain management–a Delphi study. ***Business Strategy and the Environment, 17***(8), 455-466.

Seuring, S., & Müller, M. (2008b). From a literature review to a conceptual framework for sustainable supply chain management. ***Journal of Cleaner Production, 16***(15), 1699-1710.

Sharma, S., & Vredenburg, H. (1998). Proactive corporate environmental strategy and the development of competitively valuable organizational capabilities. ***Strategic management journal, 19***(8), 729-753.

Shihua, M., Yong, L., & Zhixiang, C. (2003). ***Supply Chain Management*** (Vol. 8). Higher Education Press.

Simangunsong, E., Hendry, L. C., & Stevenson, M. (2012). Supply-chain uncertainty: a review and theoretical foundation for future research. ***International journal of production research, 50***(16), 4493-4523.

Slavich, G. M., & Irwin, M. R. (2014). From stress to inflammation and major depressive disorder: a social signal transduction theory of depression. ***Psychological bulletin, 140***(3), 774-815.

Smith, W. J., Wokutch, R. E., Harrington, K. V., & Dennis, B. S. (2001). An examination of the influence of diversity and stakeholder role on corporate social orientation. ***Business & Society, 40***(3), 266-294.

Srivastava, S. K. (2007). Green supply-chain management: a state-of-the-art literature review. ***International Journal of Management Reviews, 9***(1), 53-80.

Steele, L. G., & Lynch, S. M. (2013). The pursuit of happiness in China: Individualism, collectivism, and subjective well-being during China's economic and social transformation. ***Social indicators research, 114***, 441-451.

Stern, D. I. (2004). The rise and fall of the environmental Kuznets curve. ***World development, 32***(8), 1419-1439.

Stewart, T. A. (1994). Your company's most valuable asset: intellectual capital. ***Fortune, 130***(7), 68-74.

Storey, J., Emberson, C., Godsell, J., & Harrison, A. (2006). Supply chain management: theory, practice and future challenges. ***International journal of operations & production management, 26***(7), 754-774.

Sukati, I., Hamid, A. B., Baharun, R., & Yusoff, R. M. (2012). The study of supply chain management strategy and practices on supply chain performance. ***Procedia-Social and Behavioral Sciences, 40***, 225-233.

Sun, X., Li, Z., Wang, X., & Li, C. (2020). Technology Development of Electric Vehicles: A Review. ***Energies, 13***(1), 90. https://www.mdpi.com/1996-1073/13/1/90

Sunstein, C. R. (2014). ***Conspiracy theories and other dangerous ideas***. Simon and Schuster.

Sweeney, J. C., & Soutar, G. N. (2001). Consumer perceived value: The development of a multiple item scale. ***Journal of retailing, 77***(2), 203-220.

Tachizawa, E. M., Gimenez, C., & Sierra, V. (2015). Green supply chain management approaches: drivers and performance implications. ***International journal of operations & production management, 35***(11), 1546-1566.

Tan, K. C. (2002). Supply chain management: practices, concerns, and performance issues. ***Journal of supply chain management, 38***(4), 42-53.

Theyel, G. (2000). Management practices for environmental innovation and performance. ***International journal of operations & production management, 20***(2), 249-266.

Thoo, A. C., Abdul Hamid, A. B., Rasli, A., & Zhang, D. W. (2014). The moderating effect of enviropreneurship on green supply chain management practices and sustainability performance. ***Advanced Materials Research, 869***, 773-776.

Tian, X., Wu, Y., Hou, P., Liang, S., Qu, S., Xu, M., & Zuo, T. (2017). Environmental impact and economic assessment of secondary lead production: Comparison of main spent lead-acid battery recycling processes in China. ***Journal of Cleaner Production, 144***(FEB.15), 142-148.

Triguero, A., Moreno-Mondéjar, L., & Davia, M. A. (2013). Drivers of different types of eco-innovation in European SMEs. ***Ecological economics, 92***, 25-33.

Tully, S. M., & Winer, R. S. (2014). The role of the beneficiary in willingness to pay for socially responsible products: A meta-analysis. ***Journal of retailing, 90***(2), 255-274.

Turner, R. C., & Carlson, L. (2003). Indexes of item-objective congruence for multidimensional items. ***International journal of testing, 3***(2), 163-171.

Ullah, H., Wang, Z., Bashir, S., Khan, A. R., Riaz, M., & Syed, N. (2021). Nexus between IT capability and green intellectual capital on sustainable businesses: evidence from emerging economies. ***Environmental Science and Pollution Research, 28***, 27825-27843.

Vachon, S., & Klassen, R. D. (2008). Environmental management and manufacturing performance: The role of collaboration in the supply chain. ***International Journal of Production Economics, 111***(2), 299-315.

Vinzi, V. E., Chin, W. W., Henseler, J., & Wang, H. (2010). ***Handbook of partial least squares*** (Vol. 201). Springer.

Waddock, S. A., & Graves, S. B. (1997). The corporate social performance–financial performance link. ***Strategic management journal, 18***(4), 303-319.

Walker, H., Di Sisto, L., & McBain, D. (2008). Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors. ***Journal of Purchasing and Supply Management, 14***(1), 69-85.

Wang, C.-H. (2019). How organizational green culture influences green performance and competitive advantage: The mediating role of green innovation. ***Journal of Manufacturing Technology Management, 30***(4), 666-683.

Wang, C. H., & Juo, W. J. (2021). An environmental policy of green intellectual capital: Green innovation strategy for performance sustainability. ***Business Strategy and the Environment, 30***(7), 3241-3254.

Wang, Y., Modi, S. B., & Schoenherr, T. (2021). Leveraging sustainable design practices through supplier involvement in new product development: The role of the suppliers' environmental management capability. ***International Journal of Production Economics, 232***, 107919. https://doi.org/https://doi.org/10.1016/j.ijpe.2020.107919

Wiklund, J., & Shepherd, D. (2005). Entrepreneurial orientation and small business performance: a configurational approach. ***Journal of business Venturing, 20***(1), 71-91.

Wold, H. (1975). Path models with latent variables: The NIPALS approach. In ***Quantitative sociology*** (pp. 307-357). Elsevier.

Wu, G.-C., Ding, J.-H., & Chen, P.-S. (2012). The effects of GSCM drivers and institutional pressures on GSCM practices in Taiwan’s textile and apparel industry. ***International Journal of Production Economics, 135***(2), 618-636.

Wu, G. C. (2013). The influence of green supply chain integration and environmental uncertainty on green innovation in Taiwan's IT industry. ***Supply Chain Management: An International Journal, 18***(5), 539-552.

Wu, L., Qing, C., & Jin, S. (2022). Environmental protection and sustainable development of enterprises in China: The moderating role of media attention. ***Frontiers in Environmental Science, 10***. https://doi.org/10.3389/fenvs.2022.966479

Wu, W., & Yu, L. (2023). How Does Environmental Corporate Social Responsibility Affect Technological Innovation? The Role of Green Entrepreneurial Orientation and Green Intellectual Capital. ***Journal of the Knowledge Economy***, 1-32.

Wu, W. Y., Chang, M. L., & Chen, C. W. (2008). Promoting innovation through the accumulation of intellectual capital, social capital, and entrepreneurial orientation. ***R&d Management, 38***(3), 265-277.

Wu, Z., & Pagell, M. (2011). Balancing priorities: Decision-making in sustainable supply chain management. ***Journal of operations management, 29***(6), 577-590.

Xia, H. (2019). Relationship between green entrepreneurial Orientation, Positive market orientation and innovation performance of technology start-ups. ***Sci. Technol. Manage. Res, 16***, 264-274.

Xianjiang, L. (2012). Research on the Influence of Service Industry's Green Entrepreneurship Orientation on Green Service Innovation and Business Performance. ***Research and Development Management, 24***(5), 1-10.

Xu, J., & Li, J. (2022). The interrelationship between intellectual capital and firm performance: evidence from China's manufacturing sector. ***Journal of Intellectual Capital, 23***(2), 313-341.

Xuechun, Y. (2011). The Structural Features of Regional Manufacturing Industrial Association Network:A Case Study of Sichuan Province.

Yadegaridehkordi, E., Foroughi, B., Iranmanesh, M., Nilashi, M., & Ghobakhloo, M. (2023). Determinants of environmental, financial, and social sustainable performance of manufacturing SMEs in Malaysia. ***Sustainable Production and Consumption, 35***, 129-140.

Yan, J., & Yan, L. (2017). Collective entrepreneurship, environmental uncertainty and small business performance: A contingent examination. ***The Journal of Entrepreneurship, 26***(1), 1-26.

Yildiz Çankaya, S., & Sezen, B. (2019). Effects of green supply chain management practices on sustainability performance. ***Journal of Manufacturing Technology Management, 30***(1), 98-121.

Yong, J. Y., Yusliza, M.-Y., Ramayah, T., & Fawehinmi, O. (2019). Nexus between green intellectual capital and green human resource management. ***Journal of Cleaner Production, 215***, 364-374.

York, J. G., & Venkataraman, S. (2010). The entrepreneur–environment nexus: Uncertainty, innovation, and allocation. ***Journal of business Venturing, 25***(5), 449-463.

Yuan, B., & Xiang, Q. (2018). Environmental regulation, industrial innovation and green development of Chinese manufacturing: Based on an extended CDM model. ***Journal of Cleaner Production, 176***, 895-908.

Yusliza, M. Y., Yong, J. Y., Tanveer, M. I., Ramayah, T., Faezah, J. N., & Muhammad, Z. (2020). A structural model of the impact of green intellectual capital on sustainable performance. ***Journal of Cleaner Production, 249***, 119334. https://doi.org/10.1016/j.jclepro.2019.119334

Yusoff, Y. M., Omar, M. K., Zaman, M. D. K., & Samad, S. (2019). Do all elements of green intellectual capital contribute toward business sustainability? Evidence from the Malaysian context using the Partial Least Squares method. ***Journal of Cleaner Production, 234***, 626-637.

Zaid, A. A., Jaaron, A. A., & Bon, A. T. (2018). The impact of green human resource management and green supply chain management practices on sustainable performance: An empirical study. ***Journal of Cleaner Production, 204***, 965-979.

Zhang, J., Liang, G., Feng, T., Yuan, C., & Jiang, W. (2020). Green innovation to respond to environmental regulation: How external knowledge adoption and green absorptive capacity matter? ***Business Strategy and the Environment, 29***(1), 39-53.

Zhang, J., Mauzerall, D. L., Zhu, T., Liang, S., Ezzati, M., & Remais, J. V. (2010). Environmental health in China: progress towards clean air and safe water. ***The lancet, 375***(9720), 1110-1119.

Zhang, Y. (2019). ***A Study on the Relationship between Green Entrepreneurial Traits, Green Entrepreneurial Motivation and Green Entrepreneurial Intention*** Southwest Jiaotong University Chengdu, China].

Zhu, Q., & Geng, Y. (2013). Drivers and barriers of extended supply chain practices for energy saving and emission reduction among Chinese manufacturers. ***Journal of Cleaner Production, 40***, 6-12.

Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. ***Journal of operations management, 22***(3), 265-289.

Zhu, Q., & Sarkis, J. (2007). The moderating effects of institutional pressures on emergent green supply chain practices and performance. ***International journal of production research, 45(***18-19), 4333-4355.

Zhu, Q., Sarkis, J., & Geng, Y. (2005). Green supply chain management in China: pressures, practices and performance. ***International journal of operations & production management, 25***(5), 449-468.

Zhu, Q., Sarkis, J., & Lai, K.-h. (2008). Confirmation of a measurement model for green supply chain management practices implementation. ***International Journal of Production Economics, 111***(2), 261-273.

Zhu, Q., Sarkis, J., & Lai, K.-h. (2013). Institutional-based antecedents and performance outcomes of internal and external green supply chain management practices. ***Journal of Purchasing and Supply Management, 19***(2), 106-117.

Zsidisin, G. A., & Siferd, S. P. (2001). Environmental purchasing: a framework for theory development. ***European journal of purchasing & supply management, 7***(1), 61-73.

APPENDICES

APPENDIX A

Interview Outline on the Impact of Green Entrepreneurial Orientation on Sustainable Performance

Dear Madam/Sir:

Hello! Thank you very much for taking time out of your busy schedule to participate in the academic research of this dissertation. The purpose of this research is to investigate the impact of green entrepreneurial orientation on sustainable performance, hoping to provide theoretical guidance for related research in the field of corporate sustainability and environmental protection. The findings and recommendations of the study can be shared once the study is completed.

This interview is expected to last approximately one hour. Please be assured that the content you provide during the conversation will be used for academic analysis only and will not be used for commercial purposes or disclosed to non-researchers. You do not need to have any concerns during the conversation. Also, please do voice your opinions, as your opinions are important to me and will determine the success or failure of this research. The interviews will be recorded for the smooth running of the study.

Interview Questions

First of all, I would like to know more about you personally. Can you briefly describe your main study and work experience?

1) How do you evaluate the current state of green entrepreneurial orientation, green intellectual capital, green supply chain management and sustainable performance in the context of manufacturing?

2) Do you think green entrepreneurial orientation has an impact on green intellectual capital, green supply chain management and sustainable performance?

3) What role do you think green intellectual capital plays in the impact of green entrepreneurial orientation on sustainable performance?

4) In your opinion, what is the role of green supply chain management in the impact of green entrepreneurial orientation on sustainable performance?

5) In your opinion, what is environmental uncertainty and what is its impact on sustainable performance?

6) What role do you think environmental uncertainty plays in green intellectual capital and sustainable performance?

7) What role do you think environmental uncertainty plays in green supply chain management and sustainable performance?

APPENDIX B

Questionnaire on Green Entrepreneurial Orientation on Sustainable Performance

Dear Sir/Madam:

Greetings! Thank you for your support and help in this questionnaire survey in your busy schedule! This questionnaire is an academic research conducted to understand the relationship between green entrepreneurial orientation and sustainable performance effectiveness. Your answers are very important to our findings! This survey is mainly for the founders and middle and senior managers of manufacturing companies. The questionnaire consists of 59 questions and will take up about 6-10 minutes of your time.

The questionnaire is organized in the form of a five-level Likert scale, in which the five levels of entries represent: Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree. The questionnaire is anonymous and used for academic research, not open to the public. Please fill in the questionnaire carefully item by item, do not miss anything, and this research hope to get the results of your questionnaire as soon as possible, and this research express our heartfelt thanks to you for your strong support and active cooperation!

Note: 1, before submitting the questionnaire, please make sure that all the questions in the questionnaire have been answered and no omissions; 2, there is no correct answer to this research, so choose the answer that is closest to your actual thoughts.

Part 2: Main Questions

Questions		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
		1	2	3	4	5
Sustainable performance	**Economic performance**					
	1.Our company reduces the cost of energy consumption					
	2.Our company has improved the capacity utilization rate					
	3.Our company has decreased the fee for waste treatment					
	4.Our company's sales of green products have increased significantly					
	Environmental performance					
	5.Our company has achieved important environment-related certifications					
	6.On average, the overall environmental performance of our company has improved over the past 3 years					
	7.The resource consumption of our company(e.g. water, electricity, and gas) has decreased during the last 3 years					
	8.Our company has improved on environmental compliance					
	9.Our company is complying with environmental					

Questions		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
		1	2	3	4	5
	regulations (i.e., carbon dioxide emissions, waste disposal)					
	Social performance					
	10.Our company has seen an increase in customer satisfaction over the past 3 years					
	11.Our company has improved customer motivation in the last 3 years					
	12.Our company serving more beneficiaries (disadvantaged people) or solving environmental issues					
	13.Our company actively participates in public welfare activities and pays attention to social issues					
Green entrepreneurial orientation	**Environmental orientation**					
	14.Our company is committed to improving its overall environmental awareness					
	15.Our company is very concerned about the impact of its business activities on the environment					
	16.Our company has invested in controlling the environmental impact of its					

Questions		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
		1	2	3	4	5
	operations					
	17.Our company believes that mankind and nature should coexist harmoniously					
	Green innovativeness					
	18.Our company has developed new green product (service) lines to a greater extent					
	19.Our company's green transformation of existing product (service) lines to a greater extent					
	20.Our company emphasizes green product innovation, technological leadership, and research and development to a greater extent					
	Green risk taking					
	21.The extent to which Our company participates in the development of green projects with high risks and high returns					
	22.The extent to which Our company tends to take bold and swift action to meet corporate objectives					
	23.The extent to which Our company tends to take a bolder and more proactive approach to					

Questions		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
		1	2	3	4	5
	capitalizing on potential green opportunities					
Green intellectual capital	**Green human capital**					
	24.Our company's employees are actively involved in production and contribute to ecological protection					
	25.Our company's employees have adequate ecological protection skills					
	26.Our company has a high level of teamwork in ecological protection					
	27.Our company's managers can fully support their employees in ecological conservation work					
	Green relational capital					
	28.Our company designs products or services by environmental requirements					
	29.Our company's relationship with strategic partners in ecological and environmental protection is stable					
	30.Our company's relationship with its supply chain in terms of eco-environmental protection is stable					

Questions		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
		1	2	3	4	5
	31.Our company's cooperative relationship with customers in terms of ecological and environmental protection is stable					
	Green structural capital					
	32.Our company has a perfect ecological environmental protection management system					
	33.Our company has invested sufficient funds in ecological environmental protection facilities					
	34.Our company's overall operation process for ecological environmental protection is effective					
	35.Our company's knowledge management system is conducive to accumulating and sharing environmental knowledge					
Green supply chain management	**Internal environmental management**					
	36.Commitment of our company's senior management to GSCM					
	37.Middle management's support for GSCM in our company					

Questions		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
		1	2	3	4	5
	38.Our company's cross-functional collaboration promotes environmental improvement					
	39.Our company's use of total quality environmental management					
	Green purchasing					
	40.Eco-labeling of Products					
	41.Our company cooperates with our suppliers to achieve environmental goals					
	42.Our company conducts environmental audits of suppliers' internal management					
	43.Assessment of environmental practices of second-tier suppliers					
	Cooperation with customers					
	44.Our company cooperates with customers for eco-design					
	45.Our company cooperates with customers to realize clean production					
	46.Our company cooperates with customers for eco-design					

Questions		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
		1	2	3	4	5
	Eco-design					
	47.Our company designs products that reduce material/energy consumption					
	48.Our company designs products that reuse, recycle, and recover materials and components					
	49.Our company designs products to avoid or minimize the use of hazardous products and/or their manufacturing processes					
	Investment recovery					
	50.Investment recovery (sale) of excess inventory/materials of our company					
	51.Sale of scrap and used materials by our company					
	52.Sale of surplus capital equipment by our company					
Environmental uncertainty	**Demand uncertainty**					
	53.Our company has difficulty accurately assessing customer demand for environmental products					
	54.Our company's forecasts of demand for environmental products are often inaccurate					

Questions		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
		1	2	3	4	5
	55.It is difficult for Our company to predict customers' future preferences for environmental products					
	Technological uncertainty					
	56.Technology in our industry is changing rapidly					
	57.It is difficult to predict the level of our technology in 3-5 years					
	58.Technological changes provide great opportunities for Our company					

尊敬的先生/女士：

您好！感谢您在百忙之中对本次问卷调查的支持和帮助！本次问卷调查是一项学术研究，旨在了解绿色创业导向与可持续绩效的关系。您的回答对我们的研究结论非常重要！本次调研主要面向制造业企业的创办者和中、高层管理人员，本次问卷共 59个问题，大概占用您 6-10 分钟时间。

本问卷采用李克特五级量表形式编排，其中五级条目分别代表：很不重要、不重要、一般重要、重要、很重要。问卷采用匿名方式作答，完全用于学术研究，不对外公开，请您认真逐项填写，万勿遗漏，希望尽快得到您的问卷结果，对于您的大力支持和积极配合，我们表示衷心感谢！

填写注意事项：1、在提交问卷前，请确保问卷中所有题项均已回答，并无遗漏；2、本次调研并无正确答案，因此选择最接近您实际想法的答案即可。

第一部分：基本信息

1. 您的性别

( ) 男
( ) 女

2. 您的年龄

( ) 25以下
( ) 25-30岁
( ) 31-40岁
( ) 41-50岁
( ) 51以上

3. 您的学历

( ) 中专及以下
( ) 大专
( ) 本科
( ) 硕士及以上

4. 您在企业的身份

( ) 企业高层管理者
( ) 企业中层管理者
( ) 企业一般管理者
( ) 其他

5. 您企业的人员规模

( ) 50 人及以下
( ) 51-299人
( ) 300-1000人
( ) 1000 人及以上

6. 您所在制造业企业的类型

( ) 轻纺工业（包括食品、饮料、烟草加工、服装、纺织、皮革、木材加工、家具、造纸印刷、文教工美体育娱乐用品等）

( ) 资源加工业（包括石油化工、化学纤维、医药制造业、橡胶、塑料、金属制品、非金属矿制品等）

( ) 机械、电子制造业（包括机械等设备制造、交通运输工具、电子通讯设备、仪器仪表、设备及金属制品维修、废弃资源利用、其他制造业等。）

( ) 其他（非制造业）

第二部分：问卷

题项		非常不同意	不同意	一般	同意	非常同意
		1	2	3	4	5
可持续绩效	**可持续绩效——经济绩效**					
	1.本企业降低了能源消耗成本					
	2.本企业提高了产能利用率					
	3.本企业降低了废物处理费用					
	4.本企业绿色产品销售额增长较高					
	可持续绩效——环境绩效					
	5.本企业已经取得了重要的与环境有关的认证					
	6.本企业总体环境绩效有所改善					
	7.过去 3 年中，本企业的资源消耗（如水、电和煤气）有所减少					
	8.本企业在环境合规方面有所改善					
	9.本企业遵守环境法规（如二氧化碳排放、废物处理）					
	可持续绩效——社会绩效					
	10.本企业在过去 3 年中，客户满意度有所提高					
	11.本企业在过去 3 年中，客户的积极性有所提高					
	12.本企业为更多的受益人（弱势群体）服务或解决环境问题					
	13.本企业积极参与公益活动、关注社会问题					
	绿色创业导向——环境导向					
	14.本企业致力于提升自身整体环保意识					
	15.本企业非常关注经营活动对环保造成的影响					

题项		非常不同意	不同意	一般	同意	非常同意
		1	2	3	4	5
绿色创业导向	16.本企业投入资金控制自身经营对环境的影响					
	17.本企业认为人类与自然应该和谐共处					
	绿色创业导向——绿色创新					
	18.本企业绿色新产品（服务）的开发程度较大					
	19.本企业对现有产品（服务）线的绿色改造力度较大					
	20.本企业强调　绿色产品创新、技术领先和研究开发程度较突出					
	绿色创业导向——绿色风险承担					
	21.本企业参与开发具有高风险、高回报的绿色项目的程度					
	22.本企业通常采取大胆的、迅速的行动来达到企业目标的程度					
	23.本企业倾向于采取更大胆和积极的态度来把握潜在绿色机会的程度					
绿色智力资本	**绿色智力资本——绿色人力资本**					
	24.本企业员工积极参与生产并为生态环境保护做出贡献					
	25.本企业员工有足够的生态保护能力					
	26.本企业在生态保护方面团队合作程度很高					
	27.本企业管理者可以全力支持员工完成生态保护工作					
	绿色智力资本——绿色关系资本					
	28.本企业根据环境要求设计产品或服务					
	29.本企业与生态环保战略合作伙伴合作关系是稳定的					

题项		非常不同意	不同意	一般	同意	非常同意
		1	2	3	4	5
	30.本企业与供应链在生态环境保护方面的关系是稳定了					
	31.本企业与客户在生态环境保护方面的合作关系是稳定的					
	绿色智力资本——绿色结构资本					
	32.本企业具有完善的生态环境保护管理体系					
	33.本企业在生态环境保护设施上投入了足够的资金					
	34.本企业面向生态环境保护的整体运作流程是有效的					
	35.本企业的知识管理体系有利于环境知识的积累和共享					
绿色供应链管理	**绿色供应链管理——内部环境管理**					
	36.本企业高级管理人员对绿色供应链管理的承诺					
	37.本企业中层管理人员对绿色供应链管理的支持					
	38.本企业的跨职能合作能促进环境改善					
	39.本企业运用全面质量环境管理					
	绿色供应链管理——绿色采购					
	40.产品的生态标签					
	41.本企业与供应商合作实现环保目标					
	42.本企业对供应商内部管理进行环境审核					
	43.二级供应商环保实践评估					
	绿色供应链管理——与客户合作					
	44.本企业与客户合作进行生态设计					
	45.本企业与客户合作实现清洁生产					

题项		非常不同意	不同意	一般	同意	非常同意
		1	2	3	4	5
	46.本企业与客户合作打造绿色包装					
	绿色供应链管理——生态设计					
	47.本企业设计减少材料/能源消耗的产品					
	48.本企业设计再利用、再循环、回收材料和零部件的产品					
	49.本企业设计产品以避免或减少使用危险产品和/或其制造过程					
	绿色供应链管理——投资回收					
	50.本企业多余存货/材料的投资回收（销售）					
	51.本企业出售废料和旧材料					
	52.本企业出售多余的资本设备					
环境不确定	**环境不确定——需求不确定**					
	53.本企业很难精确评估客户对环保产品的需求					
	54.本企业预测对环境产品的需求往往是不准确的					
	55.本企业很难预测客户对环境产品的未来偏好					
	环境不确定——技术不确定					
	56.本企业所处行业的技术正在迅速变化					
	57.很难预测3-5年后我国的技术水平					
	58.技术变革为本企业提供了巨大机会					

本调查问卷到此结束，再次感谢您的支持与配合!祝您工作愉快!

APPENDIX C

IOC Invitation

ที่ อว 0649.06/ 8735

คณะบริหารธุรกิจ
มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี
ตำบลคลองหก อำเภอคลองหลวง
จังหวัดปทุมธานี 12110

20 ธันวาคม 2566

เรื่อง ขอความอนุเคราะห์ตรวจสอบความถูกต้องเชิงเนื้อหาของแบบสอบถาม

เรียน ผู้ช่วยศาสตราจารย์ ดร.อภิสิทธิ์ ตั้งเกียรติศิลป์

สิ่งที่ส่งมาด้วย แบบสอบถามดุษฎีนิพนธ์

ด้วยคณะบริหารธุรกิจ มหาวิทยาเทคโนโลยีราชมงคลธัญบุรี ได้เปิดสอนระดับปริญญาเอก หลักสูตรปรัชญาดุษฎีบัณฑิต สาขาบริหารธุรกิจ ตั้งแต่ปีการศึกษา 2551 แล้วนั้น

เพื่อเป็นประโยชน์สำหรับนักศึกษา จึงใคร่ขอความอนุเคราะห์ตรวจสอบความถูกต้องเชิงเนื้อหาของแบบสอบถาม สำหรับนักศึกษา ราย Miss Wenli Hu รหัสนักศึกษา 126490501007-1 เป็นนักศึกษาหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาบริหารธุรกิจ วิชาเอกการจัดการ เป็นผู้จัดทำดุษฎีนิพนธ์เรื่อง The Impact of Green Entrepreneurial Orientation on Sustainable Performance โดยมี ผู้ช่วยศาตราจารย์ ดร.ธีทัต ตรีศิริโชติ เป็นที่ปรึกษาดุษฎีนิพนธ์

จึงเรียนมาเพื่อขอความอนุเคราะห์ตรวจสอบความถูกต้องเชิงเนื้อหาของแบบสอบถาม จักเป็นพระคุณยิ่ง

ขอแสดงความนับถือ

(รองศาสตราจารย์ ดร.กล้าหาญ ณ น่าน)
คณบดีคณะบริหารธุรกิจ

โครงการปริญญาเอก
โทร.02-5494819 โทรสาร.02-5494818, 02-5493243

ที่ อว 0649.06/ 8739

คณะบริหารธุรกิจ
มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี
ตำบลคลองหก อำเภอคลองหลวง
จังหวัดปทุมธานี 12110

20 ธันวาคม 2566

เรื่อง ขอความอนุเคราะห์ตรวจสอบความถูกต้องเชิงเนื้อหาของแบบสอบถาม

เรียน ดร.อาทิตย์ บุญญาภิสังขาร

สิ่งที่ส่งมาด้วย แบบสอบถามดุษฎีนิพนธ์

ด้วยคณะบริหารธุรกิจ มหาวิทยาเทคโนโลยีราชมงคลธัญบุรี ได้เปิดสอนระดับปริญญาเอก หลักสูตรปรัชญาดุษฎีบัณฑิต สาขาบริหารธุรกิจ ตั้งแต่ปีการศึกษา 2551 แล้วนั้น

เพื่อเป็นประโยชน์สำหรับนักศึกษา จึงใคร่ขอความอนุเคราะห์ตรวจสอบความถูกต้องเชิงเนื้อหาของแบบสอบถาม สำหรับนักศึกษา ราย Miss Wenli Hu รหัสนักศึกษา 126490501007-1 เป็นนักศึกษาหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาบริหารธุรกิจ วิชาเอกการจัดการ เป็นผู้จัดทำดุษฎีนิพนธ์เรื่อง The Impact of Green Entrepreneurial Orientation on Sustainable Performance โดยมี ผู้ช่วยศาตราจารย์ ดร.ธีทัต ตรีศิริโชติ เป็นที่ปรึกษาดุษฎีนิพนธ์

จึงเรียนมาเพื่อขอความอนุเคราะห์ตรวจสอบความถูกต้องเชิงเนื้อหาของแบบสอบถาม จักเป็นพระคุณยิ่ง

ขอแสดงความนับถือ

(รองศาสตราจารย์ ดร.กล้าหาญ ณ น่าน)
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ที่ อว 0649.06/ 8754

คณะบริหารธุรกิจ
มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี
ตำบลคลองหก อำเภอคลองหลวง
จังหวัดปทุมธานี 12110

20 ธันวาคม 2566

เรื่อง ขอความอนุเคราะห์ตรวจสอบความถูกต้องเชิงเนื้อหาของแบบสอบถาม

เรียน ดร.ณัฐปภัสษ์ จุ้ยเจริญ

สิ่งที่ส่งมาด้วย แบบสอบถามดุษฎีนิพนธ์

ด้วยคณะบริหารธุรกิจ มหาวิทยาเทคโนโลยีราชมงคลธัญบุรี ได้เปิดสอนระดับปริญญาเอก หลักสูตรปรัชญาดุษฎีบัณฑิต สาขาบริหารธุรกิจ ตั้งแต่ปีการศึกษา 2551 แล้วนั้น

เพื่อเป็นประโยชน์สำหรับนักศึกษา จึงใคร่ขอความอนุเคราะห์ตรวจสอบความถูกต้องเชิงเนื้อหาของแบบสอบถาม สำหรับนักศึกษา ราย Miss Wenli Hu รหัสนักศึกษา 126490501007-1 เป็นนักศึกษาหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาบริหารธุรกิจ วิชาเอกการจัดการ เป็นผู้จัดทำดุษฎีนิพนธ์เรื่อง The Impact of Green Entrepreneurial Orientation on Sustainable Performance โดยมี ผู้ช่วยศาตราจารย์ ดร.ธีทัต ตรีศิริโชติ เป็นที่ปรึกษาดุษฎีนิพนธ์

จึงเรียนมาเพื่อขอความอนุเคราะห์ตรวจสอบความถูกต้องเชิงเนื้อหาของแบบสอบถาม จักเป็นพระคุณยิ่ง

ขอแสดงความนับถือ

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