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Green Innovation and Environmental Performance: The Moderating Role of Innovation Orientation

By

Stella Mabel Tawiah

(BSc Management with Computing)

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DECLARATION

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma at Kwame Nkrumah University of Science and Technology, Kumasi or any other educational institution, except where due acknowledgment is made in the thesis.

STELLA MABEL TAWIAH …….. ..…….

PG7277321 Signature Date

Certified by:

DR. LISTOWEL OWUSU APPIAH …… ……

(Supervisor) Signature Date

Certified by:

PROF DAVID ASAMOAH …..……. …….

(Head, SCIS Department) Signature Date

DEDICATION

This thesis is dedicated to my loving parents, whose unwavering support, encouragement, and belief in me have been the foundation of my academic journey. Their guidance, wisdom, and selfless sacrifices have made it possible for me to reach this milestone. I also dedicate this work to my dear brother, Eric Foster Tawiah, whose friendship, inspiration, and enthusiasm have played a significant role in my life. Your endless optimism and genuine kindness have been a constant source of motivation and strength throughout this journey.

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ABSTRACT

Adopting green practices is a critical factor for today's businesses. However, green innovation, like all forms of innovation, bears inherent risk. There are instances where these efforts fail to achieve the desired environmental performance due to various reasons such as high cost, lack of acceptance, technology failures, or unforeseen adverse environmental impacts. Such risks may deter firms from investing in green innovations or limit their effectiveness in enhancing environmental performance. This study thus investigates the moderating role of innovation orientation in the relationship between green innovation and environmental performance. Grounded in the contingency natural resource based view theory, the research focuses on manufacturing firms in the Greater Accra region of Ghana. A quantitative research approach was employed, utilizing a sample of 200 firms and collecting data through a survey. The results show that both green innovation and innovation orientation positively impact environmental

performance. However, the interaction effect between green innovation and innovation orientation was not significant. The research contributes to the theoretical understanding of green innovation and innovation orientation in enhancing environmental performance and offers practical implications for firms seeking to improve their environmental performance. This study therefore recommends that the adoption of green practices, fostering a culture of innovation, and integrating innovation and sustainability strategies should be prioritized. Despite the limitations of focusing on the Greater Accra region and relying on self-reported data, the study provides valuable insights into the relationship between green innovation, innovation orientation, and environmental performance, with the potential for future research to expand the scope and explore the mediating role of innovation orientation.

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LIST OF ABBREVIATIONS

IO	Innovation orientation
RBV	Resource based view
OLR	Ordinary Least Regression
GI	Green Innovation
EFA	Exploratory Factor Analysis

CHAPTER ONE INTRODUCTION

1.1 Background to the Study

Adopting green practices is a critical factor for today's businesses. The demand for a more balanced approach to economic development and environmental sustainability is driven by resource constraints, more savvy customers, cultural pressures, and regulatory rules (Soewarno *et al.*, 2019). Over the last two decades, the management literature has developed an interest in green innovation and associated ideas (such as eco-innovation, sustainable innovation, and environmental innovation) (Zhao *et al.*, 2021). Product and process innovation are both components of green innovation. It includes advancements in product design and manufacturing techniques that conserve energy, minimise pollution, reduce waste, and lessen a company's negative environmental effect (Zhang *et al.*, 2020)

Environmental performance refers to corporate actions beyond basic compliance with laws and regulations to meet and surpass social expectations about the natural environment (Singh *et al.*, 2020). It includes the environmental consequences of organisational operations, products, and resource use per legal and environmental standards (Zailani *et al.*, 2015). Studies indicate that the quality of environmentally friendly goods influences environmental performance, green process and product innovation, and the inclusion of environmental sustainability issues into company operations and product development (Du *et al.*, 2019; Weng *et al.*, 2015).

Empirical research has generally acknowledged a positive association between green innovation and environmental performance. Several studies demonstrate that firms that prioritize green innovation tend to showcase superior environmental performance. For example, Chen et al. (2017) found that green process and product innovations can significantly decrease emissions and waste. Similarly, Wang et al. (2019) showed that green innovation

contributes to enhanced environmental performance by fostering energy efficiency and reducing resource consumption.

However, green innovation, like all forms of innovation, bears inherent risk. There are instances where these efforts fail to achieve the desired environmental performance due to various reasons such as high cost, lack of acceptance, technology failures, or unforeseen adverse environmental impacts. Such risks may deter firms from investing in green innovations or limit their effectiveness in enhancing environmental performance.

Hence, it can be posited that the relationship between green innovation and environmental performance may not be direct or straightforward. It is plausible to argue that this relationship could be influenced or moderated by other organizational factors. Innovation orientation is one such key factor.

The extent to which the adoption and implementation of green innovation are effective is dependent on varying levels of the firm's innovation orientation (IO). IO is critical in outperforming rivals and improving an organisation's capacity to implement new goods, services, systems, and processes (Tong and Rahman, 2022). Employees will be motivated and encouraged to engage in creative behaviour in organisations that have a new innovative environment and management (Iriyanto *et al.*, 2021)

Therefore, this research employs the Resource-based view theory to investigate the moderating effect of innovation orientation on the link between green innovation and environmental performance. The focus of this study is Greater Accra-based manufacturing companies.

1.2 Statement of the Problem

A lot of research has been done on the link between green innovation and performance results such as environmental performance, competitive advantage, financial performance, firm performance, green finances, and environmental quality (Andonova and Losada-Otálora, 2020; Iriyanto et al., 2021). However, the relationship between these concepts remains unclear. While some studies have documented positive effects of green innovation on various performance outcomes (Singh *et al.*, 2020; Soewarno *et al.*, 2019; Yu *et al.*, 2021; Zhang *et al.*, 2020; Zhao *et al.*, 2021), others (Wang *et al.*, 2021; Zailani *et al.*, 2015) have reported no relationship between the variables. Yet still, other studies (Abbas and Sağsan, 2019; Zhang *et al.*, 2020) have reported an indirect effect of green innovation on performance outcomes. Researchers have linked green innovation to different types of performance, such as environmental performance, competitive advantage, financial performance, firm performance, green finances, and environmental quality, which can lead to different results. Furthermore, in the green innovation literature, numerous researchers have reiterated that although an essential concept in driving performance outcomes, effective and efficient green innovation relies on other variables such as managerial concerns, environmental regulation, environmental strategy, green transformational leadership and green human resource management (Hsu *et al.*, 2021; Rehman *et al.*, 2021; Singh *et al.*, 2020)

To date, however, not much attention has been paid to understanding the relationship between green innovation, innovation orientation, and environmental performance. As a result, there are gaps in the literature. This study looks at how innovation orientation affects the relationship between green innovation and environmental performance. This is done to fill in some of the gaps that have been found.

1.3 Research Objectives

The study examines the moderating role of innovation orientation in the relationship between green innovation and environmental performance. Specifically, the study seeks:

1. To examine the relationship between green innovation and environmental performance.
2. To examine relationship between innovation orientation on environmental performance.
3. To examine the moderating role of innovation orientation on the relationship between green innovation and environmental performance.

1.4 Research Questions

1. What relationship exist between environmental performance and green innovation?
2. What relationship exist between environmental performance and innovation orientation?
3. What effect does innovation orientation have in moderating the relationship between environmental performance and green innovation?

1.5 Significance of the study

The study's findings will bear substantial relevance to the industrial sector, particularly to firms seeking to integrate green innovation into their business practices. As sustainability becomes an essential business strategy, understanding the role of innovation orientation can guide firms to effectively manage and implement green innovation. This could be the key to enhancing environmental performance and gaining a competitive advantage in the eco-friendly market space. Moreover, organizations can learn from this study how to mitigate the risks associated with green innovation by cultivating an appropriate innovation orientation.

From an academic perspective, this study contributes significantly to the theoretical understanding of green innovation. While previous studies have explored this relationship, the introduction of innovation orientation as a moderating factor offers a novel perspective. It enriches the Contingent Natural Resource-Based View (Contingent NRBV) by providing empirical evidence about the role of contingency factors in the effectiveness of environmental strategies. Moreover, it paves the way for future research exploring other potential moderating factors in this relationship.

For the Ghanaian economy, the study's significance is multifold. Ghana, like many developing nations, is at a critical juncture where it is seeking to balance economic growth with environmental sustainability. This study can inform policymakers on how to incentivize green innovation within industries and how to foster an innovation-oriented culture that enhances the success of these initiatives. This is particularly important given the significant role of small and medium-sized enterprises (SMEs) in Ghana, which may not traditionally have a strong innovation orientation. Successful implementation of green innovation can also improve the country's environmental performance, aligning with Ghana's commitments under international environmental agreements and contributing to the achievement of Sustainable Development Goals (SDGs). Moreover, the enhanced environmental performance of industries can stimulate green growth and create sustainable jobs, contributing to economic development in an environmentally friendly manner.

1.6 Summary of Methodology

The research design for this study is the explanatory design. The research strategy for this study is a survey focusing on manufacturing firms in Ghana. The research approach is quantitative: developing and testing hypotheses. The sample size for this study is two hundred (200), drawn from the target population using convenient sampling, a non-probability sampling technique. Ordinary Least Squares (OLS) regression and Macro PROCESS are used to test the model for the study.

1.7 Scope of the Study

The scope of the study is grouped into three categories: contextual, geographical, and conceptual. Geographically, this study targets firms operating within Ghana. Contextually, this study targets firms operating in different industries such as manufacturing, retail, and construction. Conceptually, in examining the moderating role of innovation orientation on the relationship between green innovation and environmental performance, this study adopts nine (9) items from Zhang et al. (2020), five (5) items from Tong and Rahman (2022), and five (5) items from Singh et al. (2020) to measure green innovation, innovation orientation and environmental performance, respectively. For the purpose of this study, the following definitions were adopted;

Green innovation: "a process that contributes to the creation of new production and technologies with the aim of reducing environmental risks, like pollution and negative consequences of resource exploitation" (Castellacci and Lie, 2017).

Environmental performance: "the magnitude of ecological impacts of economic activities (production and consumption) in a given period and within a particular economic area (country, region, or a firm)" (Andrade et al., 2022).

Innovation orientation: “a learning philosophy, strategic direction, and transfunctional beliefs within an organization that define and direct the organizational strategies and actions toward specific innovation-enabling competencies and processes” (Siguaw et al., 2006).

1.8 Limitations of the Study

The study's focus is restricted to the Greater Accra Region. This hampers the generalisation of the study's results since they may not apply to firms operating in different regions with different industrial characteristics. Regarding delimitation, the researcher limited the study's model to examine the direct relationship between green innovation and environmental performance and the moderating role of innovation orientation. However, this research may have examined the mediating impact of innovation orientation in the link between green innovation and environmental performance using a more complicated model.

1.9 Organization of the Thesis

The study consists of five chapters. The first chapter is the introduction, which includes the study's background, motivation, statement of the problem, objective, significance, methodology, and organisational structure. The second chapter provides a literature review applicable to the research. The second chapter is divided into four major sections: conceptual review, theoretical review, empirical review, and conceptual framework. The third chapter describes the methodology of the investigation. It describes the study design, population and sampling methodologies, method of data collecting, data processing, tests of reliability and validity, and ethical considerations. The fourth chapter shows and examines the data analysis and outcomes. It includes the Response rate, descriptive statistics, a test of validity and reliability, inferential statistics, and a findings discussion. The fifth chapter provides a summary of the study's results, along with recommendations, conclusions, and proposals for further research.

CHAPTER TWO LITERATURE REVIEW

2.1 Introduction

Green innovation, as a concept, represents a critical frontier in modern economic and environmental studies. It focuses on the development and application of products, processes, and technologies that not only foster economic growth but also minimize ecological damage. The chapter that follows delves into an in-depth exploration of green innovation and its relationship with environmental performance. The section on conceptual review outlines the underlying principles and definitions that shape the concept of green innovation. It examines various types and forms of green innovations, distinguishing between them, and analysing how they integrate economic and environmental goals. This part lays the foundation for understanding the multifaceted nature of green innovation and how it applies across different sectors and contexts. Following the conceptual review, the theoretical review section delves into existing theories and models that explain the dynamics of green innovation. It explores various theoretical frameworks that scholars have used to study the phenomenon, including its drivers, barriers, and implications. This section helps to bridge the gap between abstract concepts and real-world applications, offering a structured approach to understanding the mechanisms through which green innovation impacts environmental performance. The empirical review section builds on the theoretical foundations by examining real-world examples and research studies that have investigated green innovation. It synthesizes findings from different contexts and industries, providing empirical evidence of how green innovation has been implemented and what results have been achieved. This section adds a practical dimension to the discussion, highlighting the successes and challenges faced in realizing the promises of green innovation.

Lastly, the section on the conceptual framework provides a synthesized model of how green innovation interacts with environmental performance. It delineates the key variables,

constructs, and relationships that encapsulate the complex interaction between innovation orientation and environmental outcomes. This part serves as a roadmap for the rest of the study, presenting a coherent and comprehensive perspective on the subject matter.

2.2 Conceptual Review

The conceptual review section lays the foundation for the understanding of green innovation and its interplay with environmental performance. This part of the chapter serves to elucidate the core concepts, definitions, and classifications that underpin the broader subject of green innovation. The exploration is divided into specific sections that cater to different facets of green innovation, thereby providing a detailed yet coherent picture of this multifaceted phenomenon. Through this section, readers will gain insights into the various types and forms of green innovations and how they integrate with economic and environmental goals. The clarity of concepts presented here will guide the further exploration of theoretical, empirical, and practical aspects, and aid in the comprehension of the moderating role of innovation orientation within the context of environmental performance.

2.2.1 Green Innovation (GI)

Green innovation (GI) is an integral pillar in today's pursuit of environmental sustainability within the business landscape. It emerges as a robust and proactive countermeasure to the mounting worries relating to environmental degradation, resource exhaustion, and augmenting pressures from regulatory bodies. GI represents a paradigm shift, where environmentally responsive strategies are interwoven with conventional supply chain practices. The amalgamation of these two spheres sets the stage for a twin-track approach to business operations, paving the way for both environmental preservation and competitive advantage (Xie *et al.*, 2019). At its core, GI is a systemic transformation that transcends the traditional notions of supply chain management. In a conventional supply chain, the focus remains largely

on cost-efficiency, lead time reduction, and quality control. However, in a world grappling with climate change, pollution, deforestation, and biodiversity loss, this narrow perspective is no longer viable (Song and Yu, 2018). GI signifies a holistic change in this outlook, prioritising ecological integrity alongside economic gain. It embodies a shift from mere compliance with environmental regulations to proactive involvement in ecological conservation. It calls for innovative changes in the supply chain processes and product designs, aiming to reduce environmental footprint while maintaining, or even enhancing, operational efficiency and product quality (Soewarno *et al.*, 2019). In essence, GI brings forth an evolved model of supply chain management. It signifies the integration of environmental consciousness into every link of the supply chain - from raw material procurement to product design, manufacturing, distribution, consumption, and even end-of-life disposal or recycling. It encourages organisations to view their supply chains not just as a means to an end, but as a strategic tool to achieve environmental stewardliness, social responsibility, and sustainable competitive advantage (Tang *et al.*, 2018). Through its systemic approach, GI enables businesses to make significant strides towards sustainability goals. It allows them to reduce emissions, minimize waste, conserve resources, and promote circular economy principles. Simultaneously, it enhances operational efficiency, builds brand reputation, satisfies regulatory requirements, and opens up new market opportunities. This unique blend of environmental responsibility and business competitiveness marks GI as a compelling, forward-thinking strategy in the modern business world (Du, Li, *et al.*, 2019). Hence, Green innovation signifies more than a mere procedural change. It marks a philosophical shift, integrating environmental preservation into the very fabric of business operations, thereby setting the stage for a sustainable, ecologically responsible, and competitive future.

The landscape of GI has seen a surge in transformative trends and confronting issues over recent years. The overarching trend sees businesses transitioning from traditional, linear supply chains

towards circular and sustainable models. This evolution marks a shift from wasteproducing processes to waste-valorising ones, which reduce the environmental impact while adding value to businesses (Amore and Bennedsen, 2016). However, this green revolution is not without its issues. GI demands substantial investment, both financial and human, and requires technological proficiency and a paradigm shift in business operations, which many firms grapple with (Arfi et al., 2018).

Several scholars have posited their definitions of GI, highlighting its multifaceted nature. Guo et al. (2021) defined GI as a set of actions aimed at improving environmental performance through innovative changes in the supply chain processes and product designs. El-Kassar and Singh (2019) viewed it as the amalgamation of green purchasing, green manufacturing, green marketing, and reverse logistics to enhance both business and environmental outcomes. They argue for GSCI as an innovative, sustainable redesign of traditional supply chains. Gürlek and Koseoglu (2021) postulated GI as a strategic approach that introduces innovative environmental technologies and processes to improve environmental performance and achieve a competitive advantage. Meanwhile, Gupta and Barua (2017) emphasised the role of GI in reducing environmental risk, improving resource utilisation, and creating new market opportunities through eco-design, green purchasing, and green manufacturing. Singh et al. (2020) highlighted the importance of cooperation with customers and suppliers to promote green innovation. Synthesising these definitions, GI in this study is conceptualised as the integration of environmentally friendly, innovative practices throughout the supply chain operations to optimise environmental performance and achieve business competitiveness.

Green innovation (GI) is underpinned by various key practices that collectively steer businesses towards sustainable operations. These practices are entrenched within the entire lifecycle of products and services, making them crucial strategies in a company's green journey.

Green purchasing, the first key practice, involves the sourcing of environmentally friendly materials and the selection of suppliers who demonstrate stringent environmental standards. It promotes responsible sourcing, which ensures that materials are harvested sustainably and without causing harm to the environment (Chiou *et al.*, 2011). Green purchasing also necessitates the evaluation of suppliers' environmental credentials, which includes an examination of their environmental policies, waste management strategies, energy usage, emissions, and more. This practice ensures that the initial stage of the supply chain contributes positively towards the firm's overall environmental performance (Chiou *et al.*, 2011).

Green manufacturing, the next element of GI, concentrates on minimising waste, reducing emissions, and decreasing energy consumption within production processes. It introduces innovative technologies and techniques to create environmentally conscious manufacturing processes. For instance, using renewable energy sources, implementing energy-efficient machinery, and leveraging waste reduction strategies such as lean manufacturing. Green manufacturing, hence, involves a significant shift from traditional manufacturing practices, focusing on environmental stewardship while maintaining operational efficiency and product quality (Weng *et al.*, 2015).

Reverse logistics signifies another important practice within GSCI. Instead of following a linear 'take-make-dispose' model, reverse logistics emphasises the recovery, recycling, and waste management of products post-consumption. It encourages the return of products after their use, enabling their refurbishment, remanufacturing, or recycling, thus reducing landfill waste and promoting the efficient use of resources. This practice further propels the transition from a linear to a circular economy, emphasising resource optimisation and waste minimisation (Weng *et al.*, 2015).

Eco-design, the final key practice within GI, focuses on the design of products with minimum environmental impact throughout their lifecycle. This involves careful selection of materials, design for easy disassembly, reduction of energy and water usage during the product's life, and consideration for end-of-life recycling or disposal. Eco-design ensures that environmental considerations are integrated right from the product design stage, thereby minimising the product's overall environmental footprint (Du, Liu, *et al.*, 2019).

Together, these practices shape the essence of Green innovation. By interweaving these principles within their supply chain operations, companies can promote environmental sustainability while retaining, and often enhancing, their competitive advantage in the business realm.

The importance of GI is undeniable, both for its environmental benefits and for its contribution to the competitive edge of organisations. Adopting green practices can enhance brand image, meet regulatory requirements, reduce costs, and open up new market opportunities (Dabić *et al.*, 2019). However, implementing GSCI presents various challenges. It necessitates substantial investment, requires technological advancement, and demands organisational and cultural changes, which can strain resources and disrupt established processes. Notwithstanding these challenges, GSCI remains an essential path for organisations navigating the intricacies of the modern, environmentally conscious business world (Du, Liu, *et al.*, 2019).

2.2.2 Innovation Orientation

Pantano et al. (2017) defined innovation orientation as the total of an organization's innovation programs. According to the authors, this form of orientation is important since it provides businesses with a fresh perspective to markets. Andonova and Losada-Otálora (2020) conceptualized innovation orientation as a multi-component construct including the

introduction of new goods, research & development expenditures, and market entrance order. Moreover, according to Dobni and Klassen (2015), innovation orientation refers to businesses that focus their efforts to developing and improving better goods. This conceptualization encompasses both openness to innovation and innovation capabilities approaches to innovation orientation.

Tong and Rahman (2022) also defined "innovation orientation" as the connection between product modularity and a company's overarching strategic objective of creating and selling new goods or expanding into new markets. Innovation orientation, according to Iriyanto et al. (2021), is a three-part framework comprised of a firm's approach to knowledge acquisition, its strategic goals, and its trans-functional values. With this framework in place, businesses can foster an environment conducive to creative problem-solving and innovation at every level of operation, from individual employees to the top brass.

Innovation orientation was also characterized by Issau et al. (2021), but not as a normative set of behaviours, as a collection of attitudes about innovation that are embedded in the framework of firm knowledge and drive organizational activities. An organization with an innovation orientation welcomes new suggestions and is always looking for better ways to do things. As reported by (Weng et al., 2015)

2.2.3 Environmental Performance

The concept of performance in the organisational context has traditionally been linked to economic and financial outcomes, reflecting how effectively a company utilises its resources to generate profits. However, with the escalating environmental challenges and the mounting pressure from stakeholders, there has been a profound shift in the way organisational performance is evaluated (Aguilera-Caracuel and Ortiz-de-Mandojana, 2013). This has led to

the emergence of the concept of environmental performance, which encapsulates the impact of an organisation's activities on the environment and its commitment towards environmental sustainability (Tang *et al.*, 2018).

Trends and issues in environmental performance have been shaped by the growing environmental consciousness among stakeholders, stricter environmental regulations, and an increasing recognition of the strategic significance of environmental performance for business success. Companies are now striving to improve their environmental performance not just to comply with regulations and avoid penalties but also to bolster their corporate reputation, gain competitive advantage, and cater to the demands of environmentally conscious consumers (Zhang *et al.*, 2019). Nonetheless, issues such as the lack of standardised measures for environmental performance, difficulties in quantifying and reporting environmental impact, and the cost implications of environmental initiatives pose significant challenges (Huang and Li, 2017).

Environmental performance has been defined in several ways. Wijethilake (2017) defines it as the measurable results of a country or an organisation's management of its environmental affairs. Xie et al. (2019) considers it as an organisation's impacts on living and non-living natural systems, including ecosystems, land, air, and water. Hsu et al. (2021), defines it as a quantitative basis for comparing, analysing, and understanding countries' environmental performance. Rehman et al. (2021) views it as the results of an organisation's efforts to manage and reduce its environmental impact. Finally, Chan et al. (2016) depicts it as a measure of the environmental aspects and impacts of the activities, products, and services of an organisation. In this study, environmental performance is conceptualised as the degree to which an organisation's activities adhere to environmental norms and regulations, minimise environmental harm, and contribute to environmental preservation. Environmental

performance refers to actions undertaken by an organization to meet and surpass public expectations about the natural environment, going beyond simply compliance with laws and regulations (Hsu et al., 2021). It involves the environmental consequences of an organization's procedures, products, and resource usage in accordance with legal and environmental standards (Soewarno et al., 2019) The environmental performance also evaluates the accomplishments of national governments in relation to specific environmental quality and resource use efficiency targets (Issau et al., 2021). The environmental performance of a company is measured by how objectively it evaluates the results of its environmental policies. (Tong and Rahman, 2022). The environmental performance also evaluates the track record of national governments in relation to predetermined goals of environmental quality and resource use effectiveness (Andonova and Losos-Otálora, 2020).

The importance of environmental performance is increasingly being recognised. It not only ensures regulatory compliance and risk mitigation but also enhances stakeholder relations, corporate reputation, and market competitiveness (Wang *et al.*, 2021). However, the challenges lie in accurately measuring and reporting environmental performance, balancing environmental and economic objectives, and managing the costs and complexities associated with implementing environmental initiatives. Despite these challenges, improving environmental performance is now deemed a business imperative, integral to an organisation's sustainability agenda and its long-term viability in an environmentally sensitive business landscape (Zhao *et al.*, 2021).

2.3 Theoretical Review

2.3.1 Natural Resource-Based View

The Contingent Natural Resource-Based View (Contingent NRBV) is a business management theory that complements the Natural Resource-Based View (NRBV) theory by adding a contingency perspective. This theoretical framework argues that the strategies and benefits of

environmental sustainability differ significantly among firms based on specific contingency factors. It posits that not all companies achieve similar results or competitive advantage from the same green innovations or environmental practices because of variations in these contextual or contingency factors (Aragón-Correa and Sharma, 2003)

Contingent NRBV builds upon the three paths to competitive advantage as proposed by the NRBV: pollution prevention, product stewardship, and sustainable development. Pollution prevention refers to strategies aimed at reducing waste and emissions. Product stewardship involves reducing environmental impacts across the full life cycle of a product, and sustainable development seeks to create business models and strategies that have a positive impact on both the firm and the environment in the long run (Aragón-Correa and Sharma, 2003).

While the NRBV sees these paths as direct routes to advantage, the Contingent NRBV suggests that the effectiveness of these paths is dependent on certain contingency factors. These factors could include company size, industry type, geographic location, stakeholder pressure, regulatory context, and technological capabilities (Aragón-Correa and Sharma, 2003)

The "innovation orientation" of a firm can be seen as a key contingency factor in this context. That is, the extent to which a firm is inclined towards adopting and driving innovations could potentially influence the impact of its green innovations on environmental performance. For instance, a firm with a strong innovation orientation may be better positioned to effectively implement green innovations, yielding better environmental outcomes.

Furthermore, the study may uncover that certain green innovations only lead to enhanced environmental performance when matched with a certain level of innovation orientation.

Hence, the Contingent NRBV provides a comprehensive perspective on the complex interplay between green innovation, environmental performance, and innovation orientation.

2.4 Empirical Review

This section reviews prior literature on green innovation and innovation orientation. Table 2.1 below summarises some of the key studies focusing on the authors, objectives of the study, theoretical background, key constructs, findings and future directions.

2.4.1 Green Product Innovation

GI in the literature on innovation is addressed with its four dimensions: product innovation, process innovation, marketing and managerial innovation (Zhao *et al.*, 2021). "Green product innovation" is exemplified by the creation of a new product with no harmful consequences on the environment. The phrase "green process innovation" describes the creation of industrial processes that lead to more environmentally friendly products and services (Guo et al., 2021). Innovation is the introduction to the market of a new or considerably improved item or service. According to Gürlek and Koseoglu (2020), this calls for considerable advancements in technical specifications, materials, integrated software, user friendliness, or other functional aspects.

2.4.2 Green Process Innovation

Green process innovation is defined by Abbas and Sasan (2019) as the upgrade of present production processes and the application of environmentally friendly technologies to produce goods and provide services with no or little negative environmental impact. The introduction of a new or significantly improved method of manufacturing or distribution constitutes process innovation. Modifications to methods, hardware, and/or software are included (Sellitto et al., 2020).

2.4.3 Market Innovation

According to Rehman et al. (2021), market innovation entails satisfying the purchasing desires of clients via the proper market mix and market selection. According to the authors, businesses should participate in constant market innovation since technologically-driven market trends make it feasible for their clients to be easily swept away by rival businesses. Thus, market innovation might be seen as a crucial business activity, since it enables businesses to react to market possibilities and requirements (Huang and Li, 2017). Weng et al. (2015) argued that addressing the requirements and wants of consumers should be the motivation for businesses to implement market innovation. From the above, it can be concluded that market innovation is crucial to the success of the organization.

2.4.4 Market Innovation

Managerial innovation may be described as the adoption of managerial, organizational, and operational approaches, as well as new modes, with the intention of enhancing the performance of an organization (Du et al., 2019). Wang et al. (2021) also described managerial innovations as a considerable divergence from established management concepts, methods, and practices or from conventional organizational structures that dramatically affect how management is carried out.

2.4.5 Performance Outcomes of Green Innovation

Various performance outcomes have been linked to green innovation in the literature. Weng et al. (2015) discovered a correlation between green innovation, environmental performance, and corporate performance. Kücükolu and Pnar (2015) also connected green innovation to a competitive advantage in environmental performance. Tang et al. (2018) and Wang et al. (2021) discovered greater connections between green innovation and company success, and between green innovation and organisational and environmental performance, respectively. Zhang et al.

(2020) also linked green innovation to being ready for green innovation, business performance, and having an advantage over competitors. Yu et al. (2021) also found a link between green funding and green innovation.

Table 2.1: Empirical Review on Green Innovation and Innovation Orientation

AUTHOR(S)	OBJECTIVES	THEORETICAL BACKGROUND	FINDINGS	FUTURE DIRECTIONS
Küçükoğlu and Pınar (2015)	Analyse how eco-friendly innovations impact profits.	RBV	"The results of this study show that a company's environmental performance and competitive advantage may benefit greatly from green innovation efforts. Green process innovation is particularly illuminating when it comes to explaining shifts in environmental performance and competitive advantage.	Include moderating or mediating elements like environmental consciousness, dedication, and innovation orientation.
Tang et al. (2018)	To investigate how management concern (for environmental concerns) influences the link between green innovation and corporate performance.	Stakeholder theory	When managers don't care about the environment, corporate success is significantly (positively) correlated with green	It would be beneficial to do further study in other situations, using different data sources, or following businesses and their

			process innovation and green product innovation.	innovative efforts throughout time.
Wang et al. (2021)	The study's stated goal is to "examine the influence of stakeholders' viewpoints on green innovation (GI) practices, and their consequent effect on environmental and organizational performance (OP), with innovation orientation serving as a moderator."	Stakeholder theory	Positive and statistically significant correlations between stakeholder opinions and GI practices were found. It has been established that GI behaviours have a significant correlation with environmental and organizational results. A statistically substantial, although negative, moderating effect was discovered.	Other features of stakeholders' perspectives should be included in future research via the mediation of market innovation and managerial innovation.

Zhang et al. (2020)	The purpose of this study is to investigate the link between green innovation preparedness, firm performance, competitive advantage, and green innovation.	RBV	The findings reveal that the required and sufficient circumstances of all dimensions contribute significantly, although in somewhat different ways, to the success of green innovation.	In the future, researchers may try to collect data from a wide range of cultural backgrounds and different types of countries (e.g., western vs eastern).
Gürlek and Koseoglu (2021)	"This study aims to review the literature on green innovation (GI) in the hotel and tourist (H&T) industry, create a field map, and provide recommendations for future studies in this area.	RBV	"According to the numbers, "theory, model, and other theoretical ideas are used extensively in H&T GI research to describe the connections between structures."	Other materials on green innovation that are relevant should be added to widen the scope of the research.

Yu et al. (2021)	Using a sample of Chinese listed enterprises from 2001 to 2017, this research explores the impact of financial limitations on promoting green innovations.		"Green innovation aptitude is hampered when businesses confront more funding limitations, and privately held enterprises are more susceptible than state-owned enterprises. Although green finance regulations may successfully remove overall funding constraints on green	
			innovation, green credits are less likely to be offered to privately held businesses."	

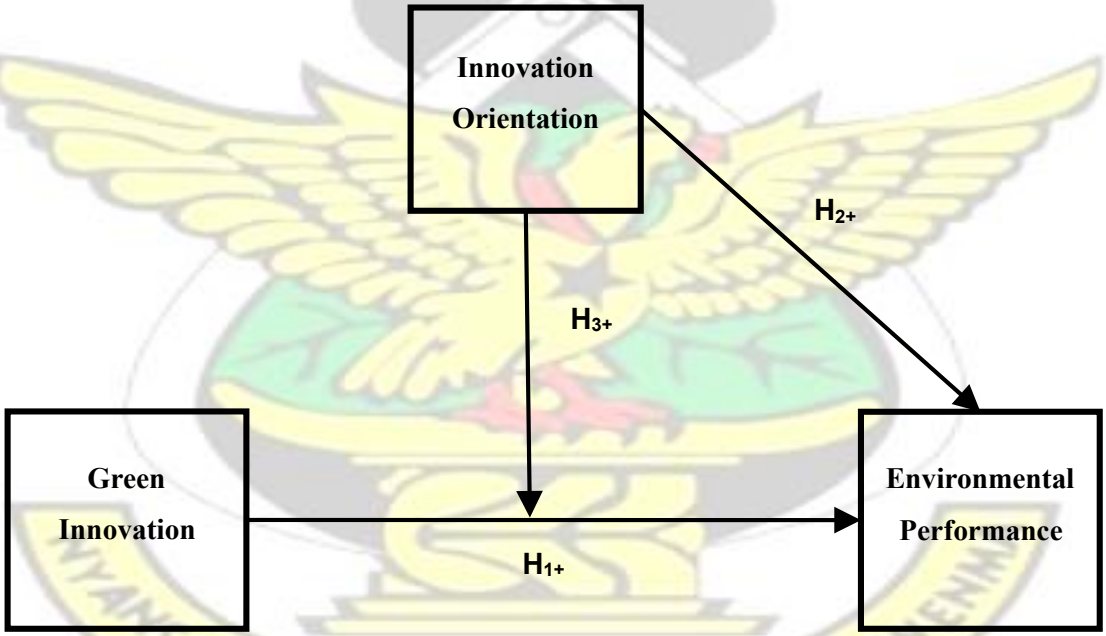
Zailani et al. (2015)	The purpose of this research is to look at the factors that influence green innovation uptake and how they affect company performance.	RBV	There are three main areas of sustainable performance that green innovation initiatives (GII) profit from: environmental regulations, market demand, and company internal activities (i.e., environmental, social, and economic).	To give exact data, a longitudinal research that investigates the connections across time should be conducted.
Huang and Li (2017)	this study "identifies the factors that drive green innovation and investigates the links between influencing variables, green innovation, and performance."	RBV and Dynamic capability theory	The results indicate that dynamic capacity, coordination competence, and social reciprocity play crucial roles in green innovation.	Future study might overcome this problem by using a longitudinal design that has been independently confirmed.
Guo et al. (2021)	Investigate the impact of green innovation on environmental quality.	RBV	The research found that the East Asian crises of 1997, the financial crises of 2007-	

			2008, and other significant structural breaches at the local, regional, and global levels are cointegrated with CO2 emissions, income, green innovation, renewable energy usage, and energy sector investment.	
Abbas and Sağsan (2019)	The present research investigates the function of knowledge management (KM) in green innovation and corporate sustainability development (CSD) operations.	RBV	Green innovation and CSD activities are greatly influenced by KM. Green innovation has also been shown to have a substantial beneficial influence on CSD.	Future scholars should add them to better investigate the problem

2.5 Conceptual Framework

A conceptual framework is a synthetization of interrelated components and variables which help in solving a real-world problem. It is the final lens used for viewing the deductive resolution of an identified issue (Imenda, 2014). The study, drawing on the Resource-based view theory, contends that green innovation positively and significantly impacts environmental performance. The study also posits a positive relationship between innovation orientation and environmental performance. The study's model also indicates a positive moderation effect of innovation orientation on the relationship between green innovation and environmental performance.

Figure 2.1: Conceptual Framework



Source: Researcher's construct (2022)

2.5.1 Green Innovation and Environmental Performance

According to the RBV, a unique set of resources owned by a firm, including the firm's capabilities, are expected to explain the variations in firm performance outcomes. The premise of RBV is that firms combine valuable, heterogeneous, imperfect and mobile resources to succeed (Barney, 2020). This study draws on the RBV to explain how a firm's green innovation as an internal core competency drives improvement in environmental performance (Singh *et al.*, 2020; Soewarno *et al.*, 2019; Yu *et al.*, 2021; Zhang *et al.*, 2020; Zhao *et al.*, 2021). Green innovation encompasses all areas of environmentally friendly goods and procedures, including energy conservation, pollution control, waste recycling, product design, and environmental management (Wang et al., 2021). Consequently, this demonstrates a direct and positive link between green innovation and environmental performance. Green innovation has a beneficial influence on the environment, reducing CO2, increasing biodiversity, and decreasing pollution. Green innovation boosts the company's productivity, grows its market share, generates an image that it cares about the environment, and increases its efficiency. The quality of ecofriendly products, green processes, and product innovation, as well as the incorporation of ecological sustainability issues into company operations and product development, have all been shown to have a direct impact on environmental performance (Soewarno et al., 2019; Yu et al., 2021; Zhang et al., 2020). Green innovation improves environmental performance, which in turn benefits from a well-developed environmental management plan (Zailani et al., 2015). Following from this, the study concludes:

H1: Green innovation is positively related to environmental performance

2.5.2 Innovation Orientation and Environmental Performance

The RBV also asserts that some of the organisational resources could be intangible whiles others are tangible. Innovation orientation, defined as a strategic orientation that disrupts organisations' innovation processes and serves as a guiding standard for developing strategy and implementing policies to boost an organisation's innovativeness (Pantano et al., 2017), is therefore considered in this study as an intangible organisational capability, that could drive improvements in a firm's environmental performance. The argument is that there is sufficient evidence in the literature to support the claim that innovation orientation relates positively to environmental performance (Dobni and Klassen, 2015; Pantano et al., 2017). The rationale behind this thinking is that a firm's approach and orientation to innovation would determine the level of commitment and willingness to invest in green innovation initiatives required to drive improvements.

H2: Innovation orientation is positively related to environmental performance

2.5.3 Moderating role of Innovation Orientation

The Resource-based view explains that some organisational resources could be tangible or intangible (innovation orientation). This study proposes innovation orientation as an important intangible resource that could enhance a firm's green innovation capability required to improve environmental performance. Strong evidence shows a relationship between green innovation and innovation orientation (Iriyanto *et al.*, 2021; Issau *et al.*, 2021; Tong and Rahman, 2022). This study further proposes that the effect of green innovation on environmental performance depends on varying levels of innovation orientation. Although several researchers have demonstrated that a firm's green innovation is related to its environmental performance (Singh

et al., 2020; Soewarno *et al.*, 2019; Yu *et al.*, 2021; Zhang *et al.*, 2020; Zhao *et al.*, 2021), the exact nature of the link between green innovation and environmental performance is not clear.

Furthermore, existing empirical studies on the green innovation-performance relationship have shown dichotomised findings that are inconclusive in the extant literature. The reason may be attributed to the factors that have largely been ignored and unaccounted for by researchers; therefore, there is the need to re-examine the relationship under different contingencies. Accordingly, several studies have proposed different mediation and moderation variables in the study of green innovation and environmental performance links (Guo *et al.*, 2021; Hsu *et al.*, 2021). This study suggests that the connections between green innovation and environmental performance can't be completely appreciated through direct association. The study argues that the relationship between green innovation and environmental performance should be positive when innovation orientation is high. The rationale is that a firm's innovation orientation could result in a higher commitment towards green innovation. Conversely, when innovation orientation is low, commitment and allocation of resources towards green innovation would be low. Accordingly, the study states the following:

H3: Innovation Orientation moderates the relationship between green innovation and environmental performance.

CHAPTER THREE RESEARCH METHODOLOGY

3.1 Introduction

The chapter covers the researcher's data collection techniques and processes to achieve the study's objectives. It covers research design, population, sample size and sampling techniques, data collecting methods, measurements, data analysis, reliability and validity, ethical considerations and industry profile.

3.2 Research Design

A research design is a plan for how you'll gather and analyse your data. Descriptive, exploratory and explanatory are all types of research designs in the research process. The explanatory design is adopted for this study. This study chose this design because the study seeks to examine the relationship between green innovation, innovation orientation, and environmental performance.

A research strategy is an in-depth plan for carrying out a study. It does, however, help with the planning, carrying out, and keeping tabs on of an experiment. There are two broad classes into which research methods may be placed. This is what a case study or survey is. Case studies are a kind of research that focuses on one individual, group, or event. An investigation takes a lot of time and effort to complete. In contrast, a survey is a research method that collects information from the general public or a sizable representative sample of the population to better understand how those people feel about the topic under investigation. In order to better understand the manufacturing sector in Greater Accra, the current study adopts a survey methodology.

From broad assumptions to concrete data collecting, analysis, and interpretation procedures, the study methodology encompasses it all (Cohen et al., 2017). Qualitative, quantitative, and mixed methods of research are the three primary approaches (Saunders et al., 2017). The

purpose of this quantitative study was to investigate the factors that contribute to green innovation's positive impact on environmental performance.

3.3 Population of the Study

A research population is generally a large collection of individuals or objects that focus on a scientific query. Thus, any collection of people who share a characteristic may constitute a population (Ritchie et al., 2013). The study's population consist of manufacturing firm operating within Ghana. There are more than 25,000 registered manufacturing firms operating in Ghana. Therefore, the study's target population included senior-level managers from these target firms.

3.4 Sample and Sampling Technique

Sampling is a method for estimating the characteristics of a population by picking a representative sample from that group. The researcher used a non-probability sampling method called "convenient sampling. The researcher adopted convenient sampling because it enabled the researcher to select proximity samples, reducing the cost and time associated with data collection. Firstly, obtaining a reliable sampling frame, especially in developing economies like Ghana, can be challenging due to a lack of comprehensive and up-to-date databases of firms. This makes it difficult to employ probability sampling methods that require a complete list of the population. In such scenarios, convenience sampling becomes a pragmatic choice as it allows for the selection of accessible samples without the need for a complete sampling frame. Secondly, in studies that involve surveying top managers or executives, there might be a high degree of non-response due to their busy schedules or reluctance to share information. Convenience sampling allows the researcher to approach those who are willing and readily available to participate, thereby increasing the response rate and ensuring the availability of sufficient data for the study. Convenience sampling was thus, employed by the researcher to select the 9 companies that were surveyed. The researcher then adopted the simple random

sampling technique to determine the sample size from the selected companies. The sample size for this study was two hundred (200) senior managers of manufacturing firms operating within Ghana. This is based on the Krejcie and Morgan (1970) sampling table which identifies that a sample population of 400 should have a sample size of 196 respondents.

3.5 Data Collection Method

In statistics, data collection is the gathering of information from all relevant sources in order to address a research problem. It assists in assessing the result of the situation. The data gathering techniques provide the conclusion of a response to the relevant inquiry. This section discusses the techniques used to collect the data for the research.

3.5.1 Data Type and Instrument

The research makes use of primary data sources. Primary data is produced by the researcher via the use of specifically planned questionnaires, interviews, and experiments for understanding and addressing the study issue at hand. This study's data collection tool is a questionnaire. The items used to assess the study's constructs are listed below.

Table 3.1 Summary of Measurement Items

Variables	No. of Items	Sources
GREEN INNOVATION		
Process Innovation	3	(Singh et al, 2020; Sellitto et al., 2020; Zhang et al., 2020)
Product Innovation	4	
Marketing Innovation	5	
Managerial Innovation	3	
INNOVATION ORIENTATION	5	Tong and Rahman (2022
ENVIRONMENTAL PERFORMANCE	5	(Wijethilake, 2017; Liao, 2017)

Source: Author's Construct (2022)

3.5.3 Collection procedure

The researcher created an online survey using Google Forms to gather data from responders. Online forms were less expensive to disseminate and collect answers because they removed geographical obstacles. Online surveys were also the handiest since respondents could complete them on their phones.

3.6 Data Analysis

The data gathered from the questionnaires were analysed using descriptive and differential analyses. Descriptive statistics involved using frequencies, means, standard deviations, kurtosis, and skewness to describe the demographical profile of respondents, the extent of green innovation, innovation orientation and environmental performance. The inferential analysis involved regression and correlation analyses in establishing the relationships between the study's independent, dependent, and moderating variables. All these analyses were conducted using IBM SPSS version 26.

3.7 Reliability and Validity

Reliability is concerned with the repeatability of the research outcomes and the consistency of the measurements used for each construct. In contrast, validity relates to the question of whether an indicator (or combination of indicators) developed to assess a notion accurately measures that concept. Cronbach's alpha was used to assess the reliability of each component. Each item's Cronbach's alpha was more than 0.70, the threshold for statistical significance. Exploratory factor analysis (EFA) was used to examine the reliability of the instruments. The factor loadings for every single item were more than 0.5.

3.8 Ethical Considerations

First, the questionnaire did not request respondents' names and sensitive information to ensure the study incorporates ethical principles. Secondly, all data sourced from relevant articles are

duly referenced. Lastly, no respondent was forced to take part in the study; their consent would be sought before the questionnaires were dispatched

3.9 Profile of the Manufacturing Industry

The Ghanaian economy is made up of three main sectors; they are agriculture, industry and services sectors. The unimpressive performance of the industrial sector (comprising manufacturing, mining and quarrying, utility services and construction) was reversed in 2017 with a growth rate of 19.3%. This surge is largely attributable to the deferral of the FPSO Turret Remediation Project to 2018 as well as the increase in revenue from new production from the Sankofa-Gye Nyame and the Tweneboa Enyenra Ntomme ("TEN") oil fields.

The manufacturing sector is a subsector of Industry. It covers 16 of the 33 sub-sectors in the international standard classification of industries (ISIC). Manufacturing Value Added (MVA) was 5.6313% of GDP in 2016. The sector has experienced a sustained decrease in its share of GDP throughout the past decade, losing more than 40% of its 2006 share of 10.2%. However, GDP from Manufacturing in Ghana averaged 2173.25 GHS million from 2006 until 2017, reaching an all-time high of 2543 GHS million in 2017. 'The One District One Factory' initiative by government brings exciting prospects for the industrialisation of the economy. This policy, among others would establish a factory in each of the 216 districts in Ghana and would build strong value chains around key industries such as automobiles and other high value products for exports. Ghana's most notable industrial sectors are electronics, electric cars, automotive, light, aluminum smelting, food processing, cement, and small commercial shipbuilding. The Tarkwa mining district also has a small glass production industry because to the excellent grade sand found there. External financing has increased in recent years. The bulk of production serves both local and international markets.

Heavy manufacturing is a sector that contributes immensely to the growth of the economy. Heavy industries often sell their products to other industries rather than to end users and consumers. Accordingly, when an economy begins to recover, heavy industry is often first to show signs of improvement. This makes the sector a leading economic indicator. Oil, mining, ship building, steel, chemicals, machinery manufacturing and similar industries are examples of heavy industry. They are very capital-intensive and as such require a lot of machinery and equipment to produce. Although an under-developed sector in Ghana, manufacturing is nevertheless an important contributor to the country's GDP.

Until recently, the sector was characterized by a narrow industrial base dominated by agro-industries, limited diversification, reliance on imported inputs of raw materials and intermediates, relatively under-developed industry linkages, prevalent use of obsolete technologies and production that is mainly focused on the domestic market. Government recognizes that significant transformation of the sector is vital. In order to achieve this, it is necessary to promote and stimulate a change process which will make the sector exhibit a diversified structure of production; undertake processing of more of the natural resources with which Ghana is endowed; and become export-oriented.

CHAPTER FOUR RESULTS AND DISCUSSIONS

4.1 Introduction

The results of the research are presented in this chapter. The information was gathered through a questionnaire that was given to organisations. To examine the data and test the study hypotheses, several statistical approaches were applied. The chapter contains sections on the response rate, respondent demographics, reliability and validity tests, descriptive statistics, model and hypothesis testing, and a discussion of the findings.

4.2 Response Rate

The study distributed 250 questionnaires to collect data on green innovation, innovation orientation, and environmental performance. 200 out of the 250 questionnaires were completed and returned, resulting in a response rate of 80%. This high response rate indicates a strong level of participation and engagement from the respondents, which enhances the reliability of the collected data for further analysis.

4.3 Demographic Characteristics of Respondents

In this section, the study presents an overview of the demographic characteristics of the firms and respondents participating in our study. These demographic factors play a crucial role in understanding the context in which green innovation, environmental performance, and innovation orientation are examined. By analysing the product type, ownership type, staff strength, educational level, firm age, respondents' position, and position experience, the study can better comprehend the diverse backgrounds and experiences that shape the firms' innovation and environmental performance. This comprehensive analysis of demographic characteristics will also allow the researcher to identify potential variations and trends within the sample, which may further inform the understanding of the relationships under investigation.

Table 4.2: Demographic Information of Respondents

Categories		Frequency	Percent (%)
Product Type	Industrial machinery	12	6
	Chemicals	14	7

	Plastics and rubber	10	5
	Food beverages and drinks	96	48
	Metals and metal working	12	6
	Pharmaceuticals	10	5
	Paper and packaging materials	3	1.5
	Engineering and construction	19	9.5
	Textiles and clothing	6	3
	Others	18	9
Ownership Type	Local private company	173	86.5
	Local public company	-	-
	Subsidiary of a foreign multination	5	2.5
	International joint venture	22	11
Number of Employees	1 - 100	190	95
	101 - 200	6	3
	Above 200	4	2
Educational Level of Respondents	Up to SHS level	15	7.5
	Up to Diploma level	56	28.1
	Up to 1st degree	106	53.3
	Up to second degree	22	11.1
Firm Age	1 – 10 years	40	20
	11 – 20 years	149	74.5
	Above 20 years	11	5.5
Position Experience	1 – 10 years	124	62
	11 – 20 years	76	38
	Above 20 years	-	-

Source: Field Data, 2023.

The table presents the demographic characteristics of the respondents in the study. There were 200 respondents in total, and their responses were categorized into six main groups: product type, ownership type, number of employees, educational level, firm age, and position experience.

Product Type: The majority of respondents (48%) were from the food beverages and drinks industry, followed by engineering and construction (9.5%), chemicals (7%), and industrial machinery and metals and metal working (both 6%). These results indicate that the study had

a diverse representation of industries, although the food and beverages industry was overrepresented. The implications of this for the study are that the results may be more applicable to the food and beverages industry than to other industries.

Ownership Type: The majority of respondents (86.5%) were from local private companies, while 11% were from international joint ventures. Only a small proportion of respondents (2.5%) were from subsidiary of a foreign multinational companies. These results suggest that the study was mainly focused on the perspective of local private companies, which may limit the generalizability of the findings to other ownership types.

Number of Employees: Most respondents (95%) were from companies with 1-100 employees, while only a small proportion (2%) were from companies with above 200 employees. These results suggest that the study was mainly focused on small and medium-sized enterprises, which may limit the generalizability of the findings to larger companies.

Educational Level of Respondents: Most respondents (53.3%) had up to a 1st degree, followed by up to a diploma level (28.1%), up to a second degree (11.1%), and up to SHS level (7.5%). These results suggest that the majority of the respondents had a good level of education, which may have implications for the analysis and interpretation of the results.

Firm Age: Most of the respondents (74.5%) were from companies that had been in operation for 11-20 years, while only a small proportion (5.5%) were from companies that had been in operation for above 20 years. These results suggest that the study was mainly focused on companies that had been in operation for a moderate amount of time, which may limit the generalizability of the findings to newer or more established companies.

Position Experience: Most respondents (62%) had 1-10 years of position experience, while 38% had 11-20 years of experience. No respondents had above 20 years of experience. These results suggest that the study was mainly focused on individuals with moderate levels of

experience, which may limit the generalizability of the findings to individuals with more or less experience.

4.4 Reliability and Validity Test

In this study, the reliability and validity of the measurement scales for the three main constructs—Green Innovation, Innovation Orientation, and Environmental Performance—are essential for ensuring the accuracy and robustness of the findings. To assess the reliability and validity of the measures, Cronbach's Alpha and exploratory factor analysis (EFA) are employed, respectively. Cronbach's Alpha evaluates the internal consistency of the items within each construct, while EFA examines the factor structure and convergent validity of the measures.

Table 4.3: Reliability Test – Alpha Cronbach

Variables	Number of items	Alpha Value
Green innovation	5	.740
Innovation Orientation	4	.785
Environmental Performance	6	.730

Source: Field Data, 2023.

Table 4.2 presents the results of a reliability test using Cronbach's alpha coefficient for three variables: Green Innovation, Innovation Orientation, and Environmental Performance. Cronbach's alpha is a measure of internal consistency, which assesses how closely related the items in a variable are to each other. The Green Innovation variable consists of 5 items, and the calculated Cronbach's alpha coefficient is 0.740. This indicates that the items in the Green Innovation variable have relatively good internal consistency, with a Cronbach's alpha value above the acceptable threshold of 0.70. The Innovation Orientation variable consists of 4 items, and the calculated Cronbach's alpha coefficient is 0.785. This suggests that the items in the

Innovation Orientation variable have a high level of internal consistency, with a Cronbach's alpha value above the acceptable threshold. This indicates that the items in this variable are closely related to each other. The Environmental Performance variable consists of 6 items, and the calculated Cronbach's alpha coefficient is 0.730. This indicates that the items in the Environmental Performance variable have moderate internal consistency, with a Cronbach's alpha value above the acceptable threshold of 0.70.

Table 4.4: Validity Test - Exploratory Factor Analysis (EFA)

Items	Variable		
	GI	IO	EP
Green Innovation			
ecolabels are a part of an official policy	0.588		
supports product recycling or exchanges	0.658		
worries about figuring out what kind of information consumers need to help the environment	0.748		
Cooperates with retailers in green issues	0.650		
Innovation Orientation			
My firm attaches great importance to innovation.		0.678	
My firm is willing to invest in innovation.		0.728	
My firm attaches importance to resource development and utilization.		0.590	
My firm attaches importance to management concept innovation.		0.522	
Environmental Performance			
Pick resources that can be restored or refilled as inputs.			0.670
Efforts made to lessen or remove environmentally harmful aspects of manufacturing			0.708
Activities in ecologically fragile areas have been scaled down.			0.659
Enhanced safety measures have decreased the incidence of environmental mishaps.			0.591
Reduced waste by streamlining processes			0.641
Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.765			
Bartlett's Test of Sphericity: $\chi 2 = 975.065$, df = 105, p < .01			

Source: Field Data (2023) Notes: Green Innovation (GI); Innovation Orientation (IO); Environmental Performance (EP)

Table 4.3 presents the results of the exploratory factor analysis (EFA) conducted to assess the validity of the measures used in the study for the three main constructs: Green Innovation (GI), Innovation Orientation (IO), and Environmental Performance (EP). Examining the factor loadings, it can be observed that all items but for GI13 and EP6 have factor loadings greater than 0.5 on their respective constructs, which is a generally accepted threshold for factor loadings. This indicates that the items are strongly related to their underlying constructs and supports the convergent validity of the measures. GI13 and EP6 were therefore eliminated from the study's regression analysis. In addition, the table provides the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, which is calculated as 0.765. This measure assesses the overall suitability of the data for factor analysis, with higher values indicating better sampling adequacy. Furthermore, Bartlett's Test of Sphericity is also reported in the table, with a chisquare value of 975.065, degrees of freedom (df) of 105, and a significance level (p) of less than 0.01. This test assesses whether the correlations among the variables are sufficiently different from zero to support conducting a factor analysis. The significant result ($p < 0.01$) indicates that the correlations among the variables are suitable for conducting a factor analysis.

4.5 Descriptive Statistics

In this section, the computed descriptive statistics for green innovation, innovation orientation and environmental performance are presented, exploring their implications in the context of the study. The mean helps to identify the central location of the data, providing an average value for each variable. The standard deviation measures the dispersion of the data points around the mean, highlighting the degree of variability within the data set. Skewness evaluates the symmetry of the data distribution, indicating any potential biases or asymmetries. Lastly, kurtosis assesses the "tailedness" of the distribution, shedding light on the prevalence of extreme values or outliers in the data.

4.5.1 Green Innovation

Five items were adopted from (Singh et al, 2020; Sellitto et al., 2020; Zhang et al., 2020) to operationalise green innovation, the predictor variable. The descriptive analysis for green innovation is detailed in the table below

Table 4.5: Descriptive Statistics Results for Green Innovation

Variables	Mean	SD	Skewness	Kurtosis
ecolabels are a part of an official policy	4.58	1.426	-0.426	-0.401
supports product recycling or exchanges	4.99	1.307	-0.636	0.305
worries about figuring out what kind of information consumers need to help the environment	4.44	1.536	-0.432	-0.592
Cooperates with retailers in green issues	4.17	1.659	-0.266	-0.831
establishing mechanisms for environmental monitoring and management.	2.83	1.387	0.774	0.451
OVERALL SCORE	**4.199**	**1.027**	**-0.710**	**0.667**

Source: Field Data (2023)

The table presents descriptive statistics for different variables related to green innovation. "Has a formal policy for ecolabels," "Has a reuse or return policy for items," "Has worries about identifying customer needs on green problems," "Cooperates with merchants on green issues," and "implements environment audit/control systems" are among the factors. The mean (average) and standard deviation (a measure of variability) are provided for each variable. Skewness (a measure of the asymmetry of the data distribution) and kurtosis (a measure of the peakness of the data distribution) are also reported. The results show that, on average, companies have relatively high scores for "Has a reuse or return policy for products" (mean = 4.99) and "Has concerns on identifying consumer requirements on green issues" (mean = 4.44), indicating that companies are actively engaged in these green innovation practices. "Has a

formal policy for ecolabels" also has a relatively high mean score of 4.58. On the other hand, "Cooperates with retailers in green issues" has a slightly lower mean score of 4.17, indicating that companies may have some room for improvement in this area. "Implementing environment audit/control systems" has the lowest mean score of 2.83, suggesting that companies may need to focus more on this aspect of green innovation. The standard deviations for most variables are moderate, indicating some variability in the data. Skewness values are close to zero for most variables, indicating that the data distributions are approximately symmetric. However, "implementing environment audit/control systems" has a positive skewness value of 0.774, indicating that the data may be slightly skewed to the right. Kurtosis values are generally close to zero, suggesting that the data distributions are approximately normal.

4.5.2 Innovation Orientation

Four items were adopted from Tong and Rahman (2022) to operationalise innovation orientation, the moderator variable. The descriptive analysis for Innovation Orientation is detailed in the table below

Table 4.6: Descriptive Statistics Results for Innovation Orientation

Variables	Mean	SD	Skewness	Kurtosis
My firm attaches great importance to innovation.	4.89	1.44	-0.541	0.089
My firm is willing to invest in innovation.	5.2	1.234	-0.249	-0.621
My firm attaches importance to resource development and utilization.	5.36	1.155	-0.663	0.635
My firm attaches importance to management concept innovation.	5.13	1.263	-0.452	-0.357
OVERALL SCORE	**5.1445**	**0.99566**	**-0.408**	**-0.532**

Source: Field Data (2023)

Table 4.5 presents the descriptive statistics results for innovation orientation. The overall mean score is 5.1445, which suggests that the sample companies have a relatively high level of innovation orientation on average. The standard deviation of 0.99566 indicates a moderate level of variability among the companies in their commitment to and prioritization of innovation. Analysing skewness and kurtosis, it appears that the distribution of the overall score is negatively skewed (-0.408) and has a kurtosis value of -0.532. The negative skewness reveals that the distribution of innovation orientation scores is slightly biased towards higher scores, implying that a majority of companies in the sample have a strong focus on innovation. The kurtosis value of -0.532 indicates that the overall distribution is relatively platykurtic, which means that extreme values or outliers are less frequent in the data. Looking at the individual variables, the highest mean score of 5.36 is observed for 'My firm attaches importance to resource development and utilization', indicating that this aspect of innovation orientation is most emphasized by the sample companies. On the other hand, the lowest mean score of 4.89 is found for 'My firm attaches great importance to innovation', suggesting that while companies acknowledge the significance of innovation, there might be some variation in the degree of importance they attach to it. In conclusion, the descriptive statistics results reveal that the sample companies have a relatively high level of innovation orientation, with a particular focus on resource development and utilization. However, there might be some variation in the extent to which companies emphasize innovation as a strategic priority.

4.5.3 Environmental Performance

Six items were adopted from (Wijethilake, 2017; Liao, 2017) to operationalise Environmental Performance, the outcome variable. The descriptive analysis for Environmental Performance is detailed in the table below.

Table 4.7: Descriptive statistics Results for Environmental Performance

Variables	Mean	SD	Skewness	Kurtosis
Pick resources that can be restored or refilled as inputs.	4.51	1.588	-0.393	-0.675
Efforts made to lessen or remove environmentally harmful aspects of manufacturing	4.47	1.389	-0.307	-0.225
Activities in ecologically fragile areas have been scaled down.	4.77	1.12	-0.056	-0.52
Enhanced safety measures have decreased the incidence of environmental mishaps.	4.97	1.128	-0.186	-0.127
Reduced waste by streamlining processes	5.04	0.994	-0.259	-0.302
has informed the public of the company's environmental consequences and dangers	5.1	1.07	-0.499	0.365
OVERALL SCORE	**4.810**	**0.801**	**-0.608**	**0.204**

Source: Field study (2023)

The table provides summary data for a number of environmental performance-related factors. Select inputs from sources that are rehabilitated or replenished," We have "eliminated or significantly reduced the use of environmentally damaging processes in production," "reduced operations in environmentally sensitive locations," "reduced the likelihood of environmental accidents through process improvements," "reduced waste by streamlining processes," and "communicated the firm's environmental impacts and risks to the public." There are measures of central tendency (the mean) and dispersion (the standard deviation) supplied for all variables. In addition to mean and standard deviation, we also present skewness and kurtosis to characterize the asymmetry and skewedness of the data distribution, respectively. According to the findings, most businesses get excellent marks in environmental performance practices. Companies are actively engaging in these activities to lessen their influence on the

environment, with the highest mean scores seen for "Communicated the firm's environmental impacts and hazards to the public" (mean = 5.10) and "Reduced waste by streamlining operations" (mean = 5.04). There are a number of other practices with high mean ratings, including "Reduced chance of environmental mishaps by process improvements" (mean = 4.97) and "Reduced activities in ecologically vulnerable sites" (mean = 4.77). With mean ratings of 4.51 and 4.47, respectively, "Chose inputs from sources that are remediated or refilled" and "Reduced environmental effects of production processes or eliminated ecologically destructive activities" still show rather excellent performance. The average score for all factors was 4.810, indicating that businesses generally do well in terms of environmental performance. Variability in the data is indicated by moderate standard deviations across most variables. The majority of the variables have skewness values close to zero, suggesting that the data distributions are almost symmetric. A negative skewness rating of -0.499 suggests that the data may be somewhat skewed to the left for the category "Communicated the firm's environmental effects and risks to the public." Distributions of the data are nearly normal if the Kurtosis values are close to zero, which they usually are. The descriptive data point to an encouraging general trend toward sustainability and environmental responsibility on the part of businesses, with average scores that are quite high across a range of environmental performance strategies.

4.6 Inferential Statistics

According to Sahu et al. (2015), inferential statistics use measurements from the sample of subjects in the experiment to compare the treatment groups and make generalizations about the larger population of subjects. There are many types of inferential statistics and each is appropriate for a specific research design and sample characteristics. This study employs regression analysis. The model for the study is tested in this section using Ordinary least regression and Macro Process.

4.6.1 Regression Analysis

In this section, regression analysis is used to investigate the relationship between green innovation and environmental performance, and to explore the moderating effect of innovation orientation on this relationship. The regression models allow us to test hypotheses and make predictions about the impact of these variables on environmental performance.

Table 4.8: Regression Analysis Results

Independent variable	**Dependent variable: Environmental Performance**		
	Unstandardized coefficients		
	Model 1	***Model 2***	***Model 3***
Constant	3.839**	3.704**	1.6449**
***Main effect*:**			
Green Innovation (GI)	.231 (4.371)**		
Innovation Orientation (IO)		.215 (3.879)**	
Interaction effect:			
GI × IO			-.0883 (-1.93)
R_2	8.8%	7.1%	13.5%
ΔR^2	.083	.66	
(Δ) F statistics	19.107**	15.047**	10.1588**
Degree of freedom	199	198	195

Source: Field Data (2023) **Notes**: *p < .05, **p < .01

Table 4.7 presents the results of a regression analysis exploring the relationship between environmental performance, green innovation (GI), and innovation orientation (IO), as well as the interaction effect of GI and IO. The results are presented across three models.

Model 1 solely considers the impact of green innovation on environmental performance. The unstandardized coefficient of .231 for GI indicates that, holding all else constant, a one-unit increase in green innovation is associated with a .231unit increase in environmental

performance. The coefficient is statistically significant at the 1% level, signifying a meaningful relationship between green innovation and environmental performance. However, the R^2 value of 8.8% suggests that only a relatively small portion of the variation in environmental performance is explained by green innovation in this model.

Model 2 shifts focus to the impact of innovation orientation on environmental performance, excluding green innovation. The unstandardized coefficient of .215 for IO suggests that a oneunit increase in innovation orientation corresponds to a .215-unit increase in environmental performance, holding all else constant. Similar to Model 1, the relationship is statistically significant at the 1% level, indicating a significant relationship. Yet, the R^2 value of 7.1% shows that innovation orientation, on its own, also explains only a small proportion of the variation in environmental performance.

Finally, Model 3 introduces the interaction effect between green innovation and innovation orientation. The unstandardized coefficient of -.0883 for the interaction term suggests a negative moderation effect. This implies that the positive impact of green innovation on environmental performance decreases when the level of innovation orientation is higher. Although the coefficient's sign is negative, it's important to note that it's statistically significant at a lower level ($p < .10$ as suggested by the absolute t-value of 1.93) compared to the coefficients in Models 1 and 2, indicating that the interaction effect is less robust.

However, the R^2 value in Model 3 increases to 13.5%, indicating that the model's explanatory power improves when the interaction effect is included. The increase in the (Δ) F statistics also suggests that the introduction of the interaction term significantly improves the model fit. In summary, the regression analysis suggests that both green innovation and innovation orientation have significant positive relationships with environmental performance when considered independently.

4.6.2 Hypotheses Testing

This section provides a brief summary of the outcomes from the regression analyses that were conducted to assess the hypotheses of our study. The regression models were utilized to investigate the connections between the independent variables and the dependent variable, which is environmental performance.

Table 4.9: Hypotheses Table

Hypothesis	Path Analysis	Expected effect	Results	Conclusion
H1	GI → EP	Positive	.231 ($p < 0.01$)	**Supported**
H2	IO → EP	Positive	.215 ($p < 0.01$)	**Supported**
H3	GI × IO → EP	Positive	-.0883 ($p >$ .05)	**Not Supported**

Source: Field Data (2023) Notes: Green Innovation (GI); Innovation Orientation (IO); Environmental Performance (EP)

4.7 Discussion of Results

Based on the study's hypotheses, the results of the regression analyses are discussed further

4.7.1 Green Innovation and Environmental Performance

The results from the regression analysis show a statistically significant positive relationship between green innovation and environmental performance ($\beta = 0.231$, $p < 0.01$), which supports our hypothesis (H1). These findings are consistent with previous studies that have emphasized the positive impact of green innovation on environmental performance (Singh et al., 2020; Soewarno et al., 2019; Yu et al., 2021; Zhang et al., 2020; Zhao et al., 2021). The positive relationship between green innovation and environmental performance is due to the fact that green innovation helps firms to reduce CO2 emissions, increase biodiversity, and manage pollution, while also improving productivity, expanding market share, and improving

efficiency. Overall, the findings support the argument that green innovation is a valuable resource for firms seeking to improve their environmental performance.

4.7.2 Innovation Orientation and Environmental Performance

The results from the regression analysis also demonstrate a statistically significant positive relationship between innovation orientation and environmental performance ($\beta = 0.215$, $p < 0.01$), which supports our hypothesis (H2). These results are in line with the literature on the positive relationship between innovation orientation and environmental performance (Dobni and Klassen, 2015; Pantano et al., 2017). The positive relationship between innovation orientation and environmental performance is attributed to the fact that a firm's approach and orientation to innovation affects the level of commitment and willingness to invest in green innovation initiatives required to drive improvements in environmental performance. The results suggest that firms with a strong innovation orientation are more likely to invest in green innovation initiatives, which in turn contributes to better environmental performance.

4.7.3 Moderation Effect of Innovation Orientation

The moderation analysis results indicate that the interaction effect between green innovation and innovation orientation on environmental performance is not statistically significant ($\beta = 0.0883$, $p > .05$), which does not support our hypothesis (H3). These findings are consistent with the idea that the link between green innovation and environmental performance cannot be fully explained by direct association alone (Guo et al., 2021; Hsu et al., 2021). However, the lack of significance in the interaction term should be interpreted with caution, as it may be due to the study's limitations, such as the sample size or the operationalization of the variables. Overall, the results suggest that while both green innovation and innovation orientation are valuable resources for firms seeking to improve their environmental performance, the interaction effect between the two variables requires further investigation to better understand the nature of their relationship.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

This section provides a synopsis of the study's results, conclusions, recommendations, and suggestions for future research.

This study was thus set out to examine the relationship between green innovation and environmental performance, examine relationship between innovation orientation on environmental performance, and examine the moderating role of innovation orientation on the relationship between green innovation and environmental performance.

5.2 Summary of Findings

The following sections outline and elucidate the primary discoveries of the study.

5.2.1 Green Innovation and Environmental Performance

The study found that green innovation has a significant positive effect on environmental performance, indicating that as firms invest more in green innovation, they are likely to achieve better environmental performance outcomes.

5.2.2 Innovation Orientation and Environmental Performance

Additionally, the study revealed a significant positive relationship between innovation orientation and environmental performance, suggesting that firms that prioritize innovation and view it as a core competency are more likely to invest in green innovation initiatives, leading to better environmental performance outcomes.

5.2.3 Moderation effect of Innovation Orientation

However, the study did not find support for the hypothesis that innovation orientation moderates the relationship between green innovation and environmental performance.

5.3 Conclusion

The study concludes that manufacturing companies have incorporated Green Innovation as a policy instrument in their operations although the study notes that these manufacturing companies have no established mechanisms for environmental monitoring and management. This is supported by results from the analysis conducted which indicates that companies have a relatively high level of innovation orientation, with a particular focus on resource development and utilization. However, there might be some variation in the extent to which companies emphasize innovation as a strategic priority.

The study further concludes that Innovation Orientation was a critical concept that was adopted by the manufacturing companies as they attach significant importance to it. And relative to environmental performance, data point to an encouraging general trend toward sustainability and environmental responsibility on the part of businesses, with average scores that are quite high across a range of environmental performance strategies.

Green innovation and innovation orientation were shown to have a beneficial influence on environmental performance in the research. However, the interaction effect of green innovation and innovation orientation on environmental performance was not significant. The findings of the study suggest that Green Innovation practices positively related to environmental performance. From the findings, it is also concluded that the moderation effect of Innovation Orientation was found statistically significant but with a negative coefficient value. The study also describes significant implications and suggestions to the managers and policymakers.

5.4 Recommendations

The recommendations section provides practical and actionable steps for supply chain managers based on the findings of the study. The recommendations aim to help supply chain managers improve environmental performance by emphasizing green innovation, fostering an innovative culture, and integrating innovation and sustainability strategies. By implementing these recommendations, supply chain managers can effectively manage their supply chain operations while also contributing to the broader goal of environmental sustainability.

5.4.1 Recommendations for Managers

The study found that green innovation has a positive effect on environmental performance. Therefore, supply chain managers should prioritize the adoption of green practices and seek out ways to improve their products, processes, and services to conserve energy, reduce waste, and minimize pollution. This can be achieved by adopting practices that conserve energy, minimize pollution, reduce waste, and lessen the firm's negative environmental impact. For example, firms can adopt renewable energy sources, implement circular economy principles, and design products with sustainable materials. Supply chain managers should also invest in research and development to identify new and innovative ways to improve environmental performance.

The study also found that innovation orientation has a positive effect on environmental performance. Therefore, supply chain managers should promote an innovative culture that encourages employees to generate new ideas, develop new skills, and use new technologies to enhance the firm's ability to innovate and improve environmental performance. This can be achieved by promoting knowledge-sharing, cross-functional collaboration, and a learning perspective that encourages continuous improvement. Supply chain managers should also provide resources and support to encourage employees to engage in creative behavior and take calculated risks to develop new products, services, and processes.

Although the interaction effect of green innovation and innovation orientation on environmental performance was not significant, supply chain managers should still integrate innovation and sustainability strategies to achieve optimal results. By combining innovation and sustainability, supply chain managers can develop new products, services, and processes that not only improve environmental performance but also provide competitive advantages in the market. This can be achieved by aligning innovation goals with sustainability objectives to develop new products, services, and processes that not only improve environmental performance but also provide competitive advantages in the market. Supply chain managers should also collaborate with suppliers, customers, and other stakeholders to identify opportunities for joint innovation and sustainability initiatives. Additionally, supply chain managers should monitor and track the environmental performance of their supply chain to ensure that their sustainability and innovation strategies are being effectively implemented and delivering the desired results.

5.4.2 Suggestions for Future Research

The future suggestions aim to provide directions for future research on the topic "Green Innovation and Environmental Performance: The Moderating Role of Innovation Orientation." The suggestions are based on the limitations identified in the study and provide practical ideas for future researchers to improve the understanding of the relationship between green innovation, innovation orientation, and environmental performance.

The study focuses on manufacturing firms operating within the Greater Accra region. This limits the generalization of the study's results since they may not apply to firms operating in different regions with different industrial characteristics. Future studies are encouraged to Conduct a multi-region study to examine the relationship between green innovation, innovation orientation, and environmental performance in various industrial sectors across different

regions. This will provide a more comprehensive understanding of the relationship between the variables and help to identify region-specific differences in the adoption of green innovation and innovation orientation.

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APPENDIX A

SURVEY QUESTIONNAIRE

My name is Stella, a postgraduate student at the Kwame Nkrumah University of Science and Technology, Kumasi, Department of Supply Chain and Information Systems. This survey instrument has been designed to enable me carry out research on the topic: **"Green Innovation and Environmental performance: The moderating role of innovation orientation**. Any information provided will be used for academic purposes ONLY. There are no risks associated with your participation, and your responses will remain confidential and anonymous.

SECTION A: RESPONDENT'S BIOGRAPHY AND COMPANY PROFILE

When completing this questionnaire, please tick **[√]** in the applicable box or provide an answer as applicable.

1. Gender: [ ] Male [ ] Female

2. Age: [ ] 23 years and below [ ] 24–29 years [ ] 30–35 years

[ ] 36–40 years [ ] 41 years and above

3. Educational Background:

[ ] No formal education [ ] Basic/Primary [ ] Secondary [ ] Bachelor's Degree [ ] Master's Degree [ ] Ph.D./Doctorate

4. Number of years the firm has been in operation:

[ ] Less than 1 year [ ] 1-5 years [ ] 6-10 years
[ ] 11-15 years [ ] 16-20 years [ ] 21 years & above

5. Number of employees in the firm:

[ ] Less than 6 employees [ ] 6-9 employees [ ] 10-29 employees
[ ] 30-50 employees [ ] More than 50 employees

6. Type of ownership:

[ ] Fully locally owned [ ] Fully foreign owned [ ] Jointly Ghanaian & foreign owned

7. Firm's annual revenue (in Ghana Cedis)?

[ ] Less than 500,000 [ ] 500,000 – 1,000,000 [ ] Above 1,000,000

SECTION B: GREEN INNOVATION (Singh et al, 2020; Sellitto et al., 2020; Zhang et al., 2020)

Indicate the extent to which you agree or disagree with each statement by checking the appropriate number from 1 to 7, using the following scale:

1 = Strongly Disagree		***2 = Disagree***		***3 = Somewhat Disagree***		***5 = Somewhat Agree***		
4 = Indifferent/Not Sure						***6 = Agree***		
7 = Strongly Agree								
Process Innovation								
Item	**Statement**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
The manufacturing processes of my company effectively reduces……..								
GPI1	hazardous substance or waste.							
GPI2	consumption of coal, oil, electricity or water.							
GPI3	use of raw materials.							
Product Innovation								
Item	**Statement**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
My company uses materials that……..								
GPI1	produce least pollution.							
GPI2	consumes less energy and resources.							
GPI3	to design environment friendly product.							
GP14	are easy to recycle, reuse, and decompose.							
Marketing Innovation								
Item	**Statement**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
My company……..								
GMI1	Uses the packaging for eco-information							
GMI2	Has a formal policy for ecolabels							
GMI3	Has a reuse or return policy for products							
GMI4	Has concerns on identifying consumer requirements on green issues							
GMI5	Cooperates with retailers in green issues							
Managerial Innovation								
Item	**Statement**				**1**	**2**	**3**	**4**	**5**	**6**	**7**
Top management is committed to……..								

GMI1	implementing environment audit/control systems.							
GMI2	establishing green supply chain management.							
GMI3	adopting environmental management standards (e.g., ISO 14000).							

SECTION C: Innovation orientation (Tong and Rahman, 2022)

Indicate the extent to which you agree or disagree with each statement by checking the appropriate number from 1 to 7 using the following scale:

1 = Strongly Disagree	***2 = Disagree***	***3 = Somewhat Disagree***
4 = Indifferent/Not Sure	***5 = Somewhat Agree***	***6 = Agree***
7 = Strongly Agree		

Item	**Statement**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
IO1	My firm attaches great importance to innovation.							
IO2	My firm is willing to invest in innovation.							
IO3	My firm attaches importance to resource development and utilization.							
IO4	My firm attaches importance to management concept innovation.							
IO5	My firm supports product service or service technology innovation.							

SECTION D: Performance (Wijethilake, 2017; Liao, 2017)

Indicate the extent to which you agree or disagree with each statement by checking the appropriate number from 1 to 7 using the following scale:

1 = Strongly Disagree	***2 = Disagree***	***3 = Somewhat Disagree***
4 = Indifferent/Not Sure	***5 = Somewhat Agree***	***6 = Agree***
7 = Strongly Agree		

Environmental Performance								
Item	**Statement**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
My firm……								
EP1	Chose inputs from sources that are remediated or replenished							

EP2	Reduced environmental impacts of production processes or eliminated environmentally damaging processes							
EP3	Reduced operations in environmentally sensitive locations							
EP4	Reduced likelihood of environmental accidents through process improvements							
EP5	Reduced waste by streamlining processes							
Social Performance								
Item	**Statement**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
My firm……								
SP1	Considered interests of stakeholders in investments by creating a formal dialogue							
SP2	Communicated the firm's environmental impacts and risks to the public							
SP3	Improved employee or community health and safety							
SP4	Protected claims and rights of local community							
SP5	Showed concern for the visual aspects of the firm's facilities and operations							
Economic Performance								
Item	**Statement**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
My firm……								
EP1	Reduced costs of inputs for same level of outputs							
EP2	Created spin-off technologies that could be profitably applied to other areas of the business							
EP3	Worked with government officials to protect the company's interests							
EP4	Sold waste product for revenue							
Competitive Advantage								
Item	**Statement**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
CA1	My company can provide prices as low or lower than our competitors							
CA2	My company provides reliable products and services							
CA3	My company guarantees to provide the market demand for the product or service.							
CA4	My company can adapt according to different needs of customers to provide customized products.							
CA5	My company has rapid product or services delivery.							

SECTION E: Institutional Pressures (Wang et al., 2018)

Indicate the extent to which you agree or disagree with each statement by checking the appropriate number from 1 to 7 using the following scale:

1 = Strongly Disagree		***2 = Disagree***		***3 = Somewhat Disagree***				
4 = Indifferent/Not Sure		***5 = Somewhat Agree***		***6 = Agree***				
7 = Strongly Agree								
Normative pressures								
Item	**Statement**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
NP1	The increasing environmental consciousnesses of consumers have spurred our firm to implement environmental management practices							
NP2	Being environmentally responsible is a basic requirement for our firm to be part of this industry.							
NP3	Non-governmental organizations around our firm expect all firms in the industry to be environmentally responsible.							
NP4	Community stakeholders may not support our firm if our firm releases toxic substances and emissions.							
Regulatory pressures								
RP1	Our firm tries to reduce the threat from the environmental regulations by implementing environmental management practices							
RP2	Environmental regulations are important for our firm to implement environmental management practices.							
RP3	The local government has set strict environmental standards which our firm needs to comply with.							
RP4	Several penalties have been imposed on firms which violate environmental standards and regulations.							

Thank you for participating in the survey.