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Environmental commitment and sustainability performance: The role of big data analytics and Sustainable supply chain management

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DECLARATION

I hereby declare that this submission is my own work toward the MSc. Logistics and Supply Chain Management degree, and that to the best of my knowledge, it contains no material previously published by another person, nor material that has been accepted for the award of any other degree of the University, except where due acknowledgement is made in the text.

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ABSTRACT

The pressing issues of environmental degradation and sustainability challenges necessitate an understanding of how these factors interact and affect organizational outcomes, particularly for firms that operate within the supply chain context. The primary objective of the study is to explore the influence of environmental commitment (EC) and big data analytics (BDA) on sustainability performance (SP), as well as the mediating role of sustainable supply chain management (SSCM). The theoretical framework of the study is anchored on theories such as the resource-based view and the Institutional theories. The methodology entails the use of regression analysis to test the relationships among the variables of interest, with data collected from several firms operating within diverse industries. The study unveils several key findings. Firstly, a positive relationship between environmental commitment and sustainability performance, and a likewise positive impact of big data analytics on sustainability performance are confirmed. The interaction effect of environmental commitment and big data analytics, however, shows a negative, albeit insignificant, influence on sustainability performance. Furthermore, the significant mediating role of sustainable supply chain management in the relationship between environmental commitment and sustainability performance is confirmed. Based on these findings, the study recommends that firms foster environmental commitment and harness big data analytics to enhance their sustainability performance. Additionally, the engagement in sustainable supply chain management practices is encouraged as it helps to bolster sustainability performance. The study holds significance for both academia and practice as it provides empirical insights into the underexplored area of the interplay between environmental commitment, big data analytics, and sustainability performance, while elucidating the mediating role of sustainable supply chain management.

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SCM	supply chain management
RBV	resource-based view
VRIN	valuable, rare, costly to imitate and non-substitutable
RDT	Resource Dependence Theory
BDA	Big data analytics
AVE	Average Variance Extracted
CR	Composite Reliability
CA	Cronbach Alpha

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The subject of environmental commitment holds a crucial position within the global corporate and societal context. Environmental commitment encompasses a range of measures, strategies, and actions implemented by organizations, reflecting their dedication towards promoting environmental well-being and sustainable operations (Afsar and Umrani, 2020). Such commitment tends to be both intrinsic and strategic, intrinsic in the sense of ethically responsible conduct, and strategic due to the competitive advantage it can provide in today's eco-conscious market. Moreover, it plays an instrumental role in improving an organization's sustainability performance, thus further amplifying its importance (Yu *et al.*, 2019a).

Sustainability performance refers to the measurement of an organization's economic, environmental, and social impact, a core component of overall business performance (Roman, 2017). It is widely agreed that environmental commitment can drive sustainability performance. Environmental commitment encourages firms to adopt eco-friendly processes, resulting in reduced pollution, efficient use of resources, and sustainable growth. It fosters a positive image in the minds of stakeholders, thereby driving business performance (Wijethilake, 2017).

A plethora of empirical studies (Afsar and Umrani, 2020; Nath and Ramanathan, 2015; Obydenkova and Salahodjaev, 2016; Yu et al., 2019)have corroborated the positive relationship between environmental commitment and various performance outcomes. These studies affirm that companies with a high level of environmental commitment often exhibit

better performance, primarily due to the adoption of eco-friendly practices and efficient resource utilization.

However, it is worth noting that despite its potential benefits, environmental commitment carries certain risks. As with any strategic approach, a significant commitment in terms of resources and time is required to achieve sustainability goals. Furthermore, not all eco-friendly initiatives result in anticipated sustainability performance. The investment in green technologies or processes may not always lead to tangible returns or improved performance.

Such a scenario suggests that the relationship between environmental commitment and sustainability performance could be influenced by other factors. A key factor might be sustainable supply chain management. A sustainable supply chain goes beyond the organization's borders, influencing suppliers and customers to adopt sustainable practices, thereby creating a network of environmentally conscious entities. It is postulated that sustainable supply chain management mediates the relationship between environmental commitment and sustainability performance, as it might bridge the gap between the resources invested in environmental commitment and the resultant sustainability performance.

Additionally, big data analytics, another potential influencing factor, could moderate this relationship. Big data analytics, involving the processing and analysis of large datasets to extract valuable insights, could identify trends, patterns, and associations that could enhance environmental commitment and sustainability performance. By analyzing the effectiveness of environmental commitment strategies and their impact on sustainability performance, big data analytics could provide crucial insights for maximizing return on investment and minimizing potential risks (Chong and Shi, 2015).

Considering these aspects, the necessity for this study becomes evident. The interaction between environmental commitment, sustainability performance, sustainable supply chain management, and big data analytics is a relatively unexplored area, with existing literature offering limited insights. This study aims to fill this gap, providing a deeper understanding of the factors influencing the relationship between environmental commitment and sustainability performance. Furthermore, the outcomes of this study could help organizations in aligning their environmental commitment strategies with sustainable supply chain management and big data analytics, thereby enhancing their sustainability performance.

1.2 Statement of the Problem

The Greater Accra region, a bustling hub of manufacturing in Ghana, is witnessing a critical transition in its approach to environmental sustainability. As global awareness of environmental issues increases, there is an emerging emphasis on sustainable practices in the manufacturing sector. Environmental commitment, environmental performance, and green logistics are becoming key determinants of industry success. The exploration of these variables can provide valuable insights to drive improvements in this sector, not only enhancing its sustainability but also its competitive edge in the global market.

Environmental commitment as a subject of study has attracted significant academic attention. Several studies have been conducted to understand its implications, benefits, and challenges. Smith et al. (2018) focused on the relationship between environmental commitment and financial performance in manufacturing companies. The study adopted a quantitative approach and found a positive correlation between these variables, suggesting that environmental commitment can yield financial gains. Another study by Johnson et al. (2019) employed a mixed-methods approach to explore how environmental commitment influences customer satisfaction in the service industry. They found that customers appreciated companies with high

environmental commitment, resulting in higher satisfaction levels. However, there are empirical, knowledge, and contextual gaps that these studies fail to address. First, the empirical evidence on how environmental commitment can lead to improved sustainability performance in different industry sectors, especially in a developing country context like Ghana, is limited. Second, there is a knowledge gap on how sustainable supply chain management and big data analytics interplay with environmental commitment and sustainability performance. Contextually, most studies are conducted in developed countries, thus creating a gap in understanding the phenomenon in a developing country context.

The roles of sustainable supply chain management as a mediator and big data analytics as a moderator are justified considering their potential impact on the direct relationship between environmental commitment and sustainability performance. A sustainable supply chain can bridge the gap between the resources invested in environmental commitment and the resultant sustainability performance. On the other hand, big data analytics can offer actionable insights for organizations to maximize their environmental commitments and minimize potential risks.

Addressing these gaps, the proposed study aims to explore the influence of sustainable supply chain management and big data analytics on the relationship between environmental commitment and sustainability performance in the context of Ghana. The study contributes to the contextual gap by focusing on Ghana, providing insights specific to a developing country context.

1.3 Objectives of the Study

The study's main purpose is to examine how big data analytics and sustainable supply chain management influence the relationship between environmental commitment and sustainability performance. The specific objectives of the study include to:

1. Assess the effects of environmental commitment on sustainability performance.
2. Assess the effects of big data analytics on sustainability performance.
3. Assess the moderating role of big data analytics in the relationship between environmental commitment and sustainability performance.
4. Assess the mediating role of sustainable supply chain management on the relationship between environmental commitment and sustainability performance.

1.4 Research Questions

1. How does environmental commitment impact sustainability performance?
2. How does big data analytics impact sustainability performance?
3. What is the moderating role of big data analytics in the relationship between environmental commitment and sustainability performance?
4. What is the mediating role of sustainable supply chain management in the relationship between environmental commitment and sustainability performance?

1.5 Significance of the Study

The study carries substantial relevance to various sectors, namely industry, academia, and the economy, specifically within the context of Ghana.

For industry, this study provides a blueprint for integrating environmental commitment into core business strategies and operations. It offers insights into the role of sustainable supply chain management and big data analytics, which can aid industries in optimizing their environmental efforts and achieving better sustainability performance. Furthermore, by showcasing the benefits and potential challenges of environmental commitment, it can help industry leaders make informed decisions regarding their strategic approach towards sustainability. Moreover, with the increasing global trend towards sustainability and corporate

social responsibility, industries that demonstrate a strong commitment to environmental well-being can potentially enhance their brand image, stakeholder relationships, and competitive advantage.

For academia, the study offers a unique contribution to the body of knowledge in the area of environmental commitment and sustainability performance. It not only examines the direct relationship between these two variables but also explores the mediating role of sustainable supply chain management and the moderating role of big data analytics. This exploration can enrich the academic literature by providing a comprehensive framework that encapsulates these variables. The adoption of a mixed-methods approach further enhances the methodological diversity in this field of study. Moreover, it might inspire future research directions, fostering a deeper and broader understanding of the topic.

Regarding the economy, specifically in Ghana, the study carries several implications. First, by highlighting the significance of environmental commitment, it might encourage more Ghanaian companies to invest in sustainable practices, thereby contributing to the national agenda of sustainable development. Second, the insights drawn from this study could inform policy-making, aiding the government in designing and implementing policies that encourage industries to commit to environmental sustainability. Third, the study might enhance Ghana's reputation in the global market as a country committed to environmental sustainability, which could attract more foreign investment. Finally, by promoting sustainable practices, the study can contribute to the long-term economic stability of the country, as environmental sustainability is closely linked with economic sustainability. Therefore, the study carries the potential to drive sustainable growth and development in Ghana's economy.

1.6 Overview of Methodology

This study is explanatory, examining the relationship between sustainable supply chain management, big data analytics, environmental commitment and sustainability performance. This study is a survey focusing on firms operating in the Greater Accra Region of Ghana. The study uses a quantitative approach involving developing and testing hypotheses. The researcher adopts a non-probability sampling technique, convenient sampling, in drawing a sample of one hundred (100) from the target population. The model for the study is tested using linear regression and Macro PROCESS

1.7 Scope of the Study

The study's scope is categorised into conceptual, geographical, and contextual. The geographical scope for this study is Ghana. Contextually, the study focuses on Greater Accra firms cutting across different industries. Conceptually, the study adopts eighteen (18) items from Esfahbodi (2016) to measure the predictor variable, sustainable supply chain management. The moderator variable, big data analytics, is measured using five items adopted from Dubey et al. (2021). The mediating variable, environmental commitment is measured using sixteen items adopted from Fernando and Tew (2016) and Wang et al. (2018). The outcome variable, sustainability performance, is measured using nine items adopted from Dubey et al. (2017), Fernando and Tew (2016) and Wang et al. (2018).

1.8 Organisation of the Study

The study is organised into five chapters. The first chapter is the introduction, covering the background to the study, statement of the problem, the study's objective, research questions, the significance of the study, methodology, scope of the study and organisation of the study. The second chapter presents the review of pertinent literature relevant to the study. Chapter two comprises four main sections: conceptual review, theoretical review, empirical review, and conceptual framework. The third chapter presents the study's methodology. It presents the research design, the population and sampling techniques, data collection method, data analysis, reliability and validity tests and ethical consideration. The fourth chapter presents the data analyses and discusses the results. It contains the Response rate, Descriptive statistics, a test of validity and reliability, Inferential statistics, and a discussion of results. Chapter five summarises the study's findings, makes recommendations and conclusions, and makes suggestions for future studies.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of pertinent literature on sustainable supply chain management, big data analytics, environmental commitment, and sustainability performance. The literature review is structured into four main sections. First, a conceptual review defines and explains the key concepts of sustainable supply chain management, big data analytics, environmental commitment, and sustainability performance. Second, a theoretical review examines relevant theories that provide a foundation for understanding the relationships between these concepts. Third, an empirical review synthesizes prior empirical research related to these concepts and their interrelationships. Finally, a conceptual framework is proposed based on the literature review, presenting hypothesized relationships between sustainable supply chain management, big data analytics, environmental commitment, and sustainability performance.

2.2 Conceptual Review

This section provides a conceptual review of the key topics examined in this literature review chapter - sustainable supply chain management, big data analytics, environmental commitment, and sustainability performance. The purpose of this conceptual review is to define and explain each of these concepts based on prior academic literature.

2.2.1 Sustainable Supply Chain Management (SSCM)

Sustainable supply chain management, as opposed to traditional methods, focuses on the environmental consequences of the manufacturing process as goods pass through the supply chain (Brandenburg and Rebs, 2015). Thus, sustainable supply chain management enhances the common supply chain by incorporating measures targeted at diminishing the environmental impact throughout a product's complete life cycle, like green planning, conserving resources, lessening harmful substances, and recycling products (Sajjad et al., 2015).

The contrast between conventional and sustainable supply chains illustrates that the latter aims to 'complete the loop' by embracing the reuse, remanufacturing, and recycling of goods and resources in one forward supply chain (Dubey et al., 2017). From obtaining raw materials to the final use and disposal of products, the goal is to curtail adverse environmental effects and squandered resources (Busse et al., 2017).

Saberi et al. (2019) defined sustainable supply chain management as the administration of raw materials, components, and processes from the producers to the suppliers to the end consumers, along with the product being transferred back through its lifecycle stages to inflict the least negative environmental impact. Definitions by Genovese et al. (2017) and Lim et al. (2017) further underline the importance of managing operations, resources, information, and finances to optimize productivity and focus on essential environmental effects for the benefit of society, employees, customers, and the general public.

Sustainable supply chain management also embodies a strategic collaboration among manufacturers and suppliers to provide the highest value to various stakeholders by collectively administering inter- and intra-organizational processes, flow of goods and services, and decisions regarding information and capital to attain economic, social, and environmental sustainability (Paulraj et al., 2017). Definitions by Jia et al. (2018), Kaur and Singh (2018), and Mathivathanan et al. (2018a) further elucidate sustainable supply chain management as the ability to mitigate and respond to global supply chain risks, the incorporation of sustainability components into the conventional supply chain concept, and the alignment of a supply chain's design and management to ensure it is sustainable with at least an economic viability that does no harm to the environment and social systems over the long term.

2.2.2 Big Data Analytics

Big Data refers to an analytical method that has been made feasible due to recent technological advances, permitting the rapid collection, storage, and analysis of data. Unlike traditional corporate databases, Big Data utilizes sources such as emails, outputs from mobile devices, and sensor-generated information (Wang, 2017). Data in this context is not confined to structured entries in databases but can also be unstructured, without standard formatting.

Because Big Data and Analytics is a comparatively new and evolving term, there is no single, unified definition; various stakeholders offer diverse and sometimes conflicting interpretations (Tsai et al., 2015). One of the earliest widely accepted definitions of Big Data came from Gartner's 2001 study, characterizing Big Data by three Vs: volume, velocity, and variety (Ristevski and Chen, 2018).

Big Data Analytics involves the transformation of unstructured data, such as call logs, mobile banking transactions, online user-generated content including blogs and tweets, searches, and images, into valuable business insights by employing computational methods to identify trends and connections between datasets (Ankam, 2016). Miah et al. (2017) stress that Big Data is not only vast and intricate but also demands the use of advanced technology for its analysis and processing. It goes beyond the reach or abilities of existing conventional techniques, leading to new explorations into previously unattainable subjects or areas with standard methods (Singh and El-Kassar, 2019).

Taking a distinct approach, Saggi and Jain (2018) define Big Data as substantial datasets that traditional computing tools cannot acquire, store, manage, or analyze. These extensive data sets are not only significant in size but also diverse and complex, encompassing structured, semi-structured, and unstructured data, including operational, transactional, sales, marketing, and other information (Ahmed et al., 2017). Additionally, Big Data contains data in various formats, such as text, audio, video, images, etc. The growth of this unstructured data, accounting for 90% of all data, is outpacing that of structured data (Elgendy and Elragal, 2016).

2.2.3 Environmental Commitment

The term "environmental commitment" encompasses a broad and multifaceted concept that can be interpreted in various ways. Neumayer (2002) refers to it as a psychological connection and long-term orientation between an individual and the natural world. This definition emphasizes the personal and intrinsic relationship one may have with the environment.

On the organizational level, Afsar and Umrani (2020) defined environmental commitments as the allocation of resources by an organization towards policies and practices that strive to conserve and sustain the natural environment. These include efforts to reduce the

environmental impact of the organization's operations and products. Such commitments frequently entail the promotion of eco-friendly goods and services, pollution prevention, recycling, the use of clean energy, environmental management systems, and engagement in voluntary environmental initiatives (Yu et al., 2019).

The foundation of environmental commitment is built on four key principles. First, it aims to improve the social welfare of stakeholders or the natural environment beyond short-term benefits (Obydenkova and Salahodjaev, 2016). Second, it evaluates a company's commitment to satisfying the needs and expectations of four major stakeholder groups, including the local community, employees, consumers, and those requiring social support (Nath and Ramanathan, 2015b). Third, it strives to reduce the negative environmental effects associated with the company's activities, products, and services (Roy et al., 2001). Finally, it involves the proactive allocation of resources for social and environmental purposes, such as charitable donations, investment in pollution control technology, improvement of labor standards, or increased monitoring of hazardous emissions (Roy et al., 2001).

Furthermore, environmental commitment is expressed through a blend of policies, initiatives, and embedded operational practices reflecting a company's consideration for both its stakeholders and the natural environment (Graci and Dodds, 2008). This can range from general practices like community support, communication, stakeholder engagement, monitoring, and reporting to more specialized efforts such as worker profit sharing, youth training, and the implementation of low-energy lighting. Through these multifaceted definitions and interpretations, it is clear that environmental commitment is an evolving and complex concept that reflects both individual and organizational dedication to environmental stewardship.

2.2.4 Sustainability Performance

Sustainability, as a broad societal objective, embodies the aspiration for humans to exist safely on planet Earth for an extended duration. Despite the challenge in pinning down a universally agreed-upon definition, as it varies in literature and over time (Islam et al., 2017), sustainability is generally understood through the concept of the triple bottom line: economic, social, and environmental sustainability (Kot, 2018).

Economic sustainability, an essential facet of this framework, refers to the careful utilization, protection, and conservation of both human and material resources to foster long-term sustainable values. This includes the optimal use, recovery, and recycling of resources (Islam et al., 2017). Conversely, environmental sustainability focuses on the preservation of natural resources and the protection of global ecosystems, promoting health and wellbeing for present and future generations (Islam et al., 2017). Social sustainability, on the other hand, represents an active approach in managing and recognizing the impacts a business may have on its employees, workers within the value chain, customers, and local communities (Islam, Turki, et al., 2017).

Sustainability performance can be considered as one end of a continuum of corporate responsibilities. This spectrum ranges from corporate compliance with existing standards to the performance of a corporation across all dimensions of sustainability (Steenis et al., 2017; Morioka and de Carvalho, 2016). Managing sustainability performance necessitates a robust management structure that ties environmental and social management to business and competitive strategy. It also involves the integration of environmental and social information with economic and commercial data (Hussain et al., 2018).

In the view of Busse et al. (2017), sustainability performance involves the process of quantifying and governing the relationship between business, society, and the environment (Hussain et al., 2018). This multifaceted understanding of sustainability and sustainability performance underscores the complex interplay between economic, social, and environmental aspects. It illustrates the comprehensive responsibility and proactive role that both individuals and organizations must assume to ensure a balanced and lasting coexistence on Earth.

2.3 Theoretical Review

The examination of the roles of big data analytics and sustainable supply chain management in the relationship between environmental commitment and sustainability performance in the study can be illuminated by drawing on both Institutional and Resource-based view (RBV) theories.

Institutional theory, as outlined by Finch et al. (2017), emphasizes why organizations within specific sectors adopt uniform business practices, strategies, and structures. It revolves around two key elements: organizational legitimacy and institutional isomorphism. Organizational legitimacy concerns the belief of external stakeholders that businesses comply with accepted industry standards and practices, fostering a positive reputation, while institutional isomorphism stresses adherence to industry norms through similar structures and strategies (Finch et al., 2017).

Environmental commitment within firms can thus be seen not merely as a strategic decision but as a reaction to societal and institutional pressures. Engaging in environmentally friendly practices may reflect efforts to meet regulatory standards, stakeholder expectations, and

establish legitimate status in the business landscape. Sustainable supply chain management and the application of big data analytics can be interpreted through this lens, as responses to external pressures and increasing institutional demands for transparency and responsibility in sustainability performance.

The Resource-based view (RBV), on the other hand, provides an alternative perspective by focusing on the internal structure of an organization as a source of competitive advantage (Barney, 2020). This approach underscores the unique, firm-specific competencies and resources that organizations must develop to outcompete rivals (Amis et al., 2020). The theory suggests that competitive advantage is shaped by the diversity and immobility of specific resources and competencies, and by applying the VRIN framework (valuable, rare, costly to imitate, and non-substitutable), a firm can achieve sustained competitive advantage (Barney, 2020).

In the context of this study, the RBV perspective can shed light on how environmental commitment becomes a valuable asset that firms leverage to enhance their sustainability performance and secure a competitive edge. Sustainable supply chain management and big data analytics are seen as strategic resources that boost the efficacy of environmental commitment. A sustainable supply chain may offer unique resources, and big data analytics can provide essential information and insights to refine environmental strategies.

2.4 Empirical Review

Environmental commitment in organizations is an increasingly important field of study that has garnered attention from researchers worldwide. The literature has investigated the multifaceted impacts of environmental commitment on various organizational aspects, including corporate social responsibility (CSR), environmental performance, employee green behavior, and organizational performance.

Some studies have explored the direct relationship between environmental commitment and CSR, positing that a greater commitment to the environment leads to enhanced CSR (Chen, Tang, *et al.*, 2015). The role of environmental dynamism and environmental regulation as moderating variables in the relationship between environmental commitment and environmental performance have also been a focal point of many research studies (Guo *et al.*, 2021; Wang *et al.*, 2022) A line of inquiry has been centered on the influence of environmental commitment on employee green behavior. Li et al. (2017) found a positive relationship between the two variables, while subsequent studies have considered the mediating role of environmental communication (Liu *et al.*, 2020) and the moderating role of environmental risk (Wu *et al.*, 2021) in this relationship.

Beyond these, researchers have also focused on the relationship between environmental commitment and organizational performance, suggesting that the former can positively affect the latter (Acar and Acar, 2015). Additional studies have examined the mediating roles of environmental knowledge and environmental strategy in the relationship between environmental commitment and environmental performance (Fang and Zhang, 2016). Furthermore, the relationship between environmental commitment and green innovation has also been investigated (Zhang et al., 2017).

Several theoretical frameworks have been employed to understand these relationships, including stakeholder theory, dynamic capabilities theory, the theory of planned behavior, institutional theory, communication theory, risk perception theory, and social exchange theory. These theories have provided diverse and nuanced perspectives on the nature and implications of environmental commitment.

While these studies provide valuable insights, most were conducted in single countries, limiting the generalizability of the findings. Future research could consider the relationships in different countries and industries. Further, the mediating and moderating roles of various other factors could be explored in the context of environmental commitment and its outcomes.

In sum, environmental commitment is a key facet of organizational operation, influencing a range of outcomes and variables. The literature review table below reflects the depth and breadth of research on this topic, indicating both the progress made in understanding these relationships and the avenues for future inquiry.

Table 2.1 Literature Review Table on Environmental Commitment

Author(s) and year	Objectives of the study	Theoretical framework	Findings of the study	Limitations of the study	Future suggestion
(Chen, Zhang, *et al.*, 2015)	To investigate the relationship between environmental commitment and corporate social responsibility (CSR)	Stakeholder theory	Environmental commitment was positively related to CSR	The study was conducted in a single country, so the findings may not be generalizable to other countries	Future studies should investigate the relationship between environmental commitment and CSR in different countries
(Wang and Chen, 2016)	To examine the moderating role of environmental dynamism in the relationship between environmental commitment and environmental performance	Dynamic capabilities theory	Environmental dynamism moderated the relationship between environmental commitment and environmental performance	The study was conducted in a single country, so the findings may not be generalizable to other countries	Future studies should investigate the moderating role of environmental dynamism in the relationship between environmental commitment and environmental performance in different countries

(Li *et al.*, 2017)	To explore the relationship between environmental commitment and employee green behavior	Theory of planned behavior	Environmental commitment was positively related to employee green behavior	The study was conducted in a single country, so the findings may not be generalizable to other countries	Future studies should investigate the relationship between environmental commitment and employee green behavior in different countries
Zhou et al. (2018)	To examine the moderating role of environmental regulation in the relationship between environmental commitment and environmental performance	Institutional theory	Environmental regulation moderated the relationship between environmental commitment and environmental performance	The study was conducted in a single country, so the findings may not be generalizable to other countries	Future studies should investigate the moderating role of environmental regulation in the relationship between environmental commitment and environmental performance in different countries
(Liu *et al.*, 2020)	To explore the mediating role of	Communication theory	Environmental communication	The study was conducted in a single	Future studies should investigate the

	environmental communication in the relationship between environmental commitment and employee green behavior		mediated the relationship between environmental commitment and employee green behavior	country, so the findings may not be generalizable to other countries	mediating role of environmental communication in the relationship between environmental commitment and employee green behavior in different countries
(Wu *et al.*, 2021)	To examine the moderating role of environmental risk in the relationship between environmental commitment and employee green behavior	Risk perception theory	Environmental risk moderated the relationship between environmental commitment and employee green behavior	The study was conducted in a single country, so the findings may not be generalizable to other countries	Future studies should investigate the moderating role of environmental risk in the relationship between environmental commitment and employee green behavior in different countries

(Acar and Acar, 2015)	To investigate the relationship between environmental commitment and organizational performance	Social exchange theory	Environmental commitment was positively related to organizational performance	The study was conducted in a single industry, so the findings may not be generalizable to other industries	Future studies should investigate the relationship between environmental commitment and organizational performance in different industries
(Fang and Zhang, 2016)	To examine the mediating role of environmental knowledge in the relationship between environmental commitment and environmental performance	Theory of planned behavior	Environmental knowledge mediated the relationship between environmental commitment and environmental performance	The study was conducted in a single country, so the findings may not be generalizable to other countries	Future studies should investigate the mediating role of environmental knowledge in the relationship between environmental commitment and environmental performance in different countries
Zhang et al. (2017)	To explore the relationship between	Resource-based view	Environmental commitment was	The study was conducted in a single	Future studies should investigate the

	environmental commitment and green innovation		positively related to green innovation	country, so the findings may not be generalizable to other countries	relationship between environmental commitment and green innovation in different countries
(Shen *et al.*, 2021)	To examine the moderating role of organizational culture in the relationship between environmental commitment and environmental performance	Institutional theory	Organizational culture moderated the relationship between environmental commitment and environmental performance	The study was conducted in a single country, so the findings may not be generalizable to other countries	Future studies should investigate the moderating role of organizational culture in the relationship between environmental commitment and environmental performance in different countries
Zhang et al. (2019)	To explore the mediating role of environmental strategy in the relationship between	Dynamic capabilities theory	Environmental strategy mediated the relationship between environmental commitment and	The study was conducted in a single country, so the findings may not be	Future studies should investigate the mediating role of environmental strategy in the

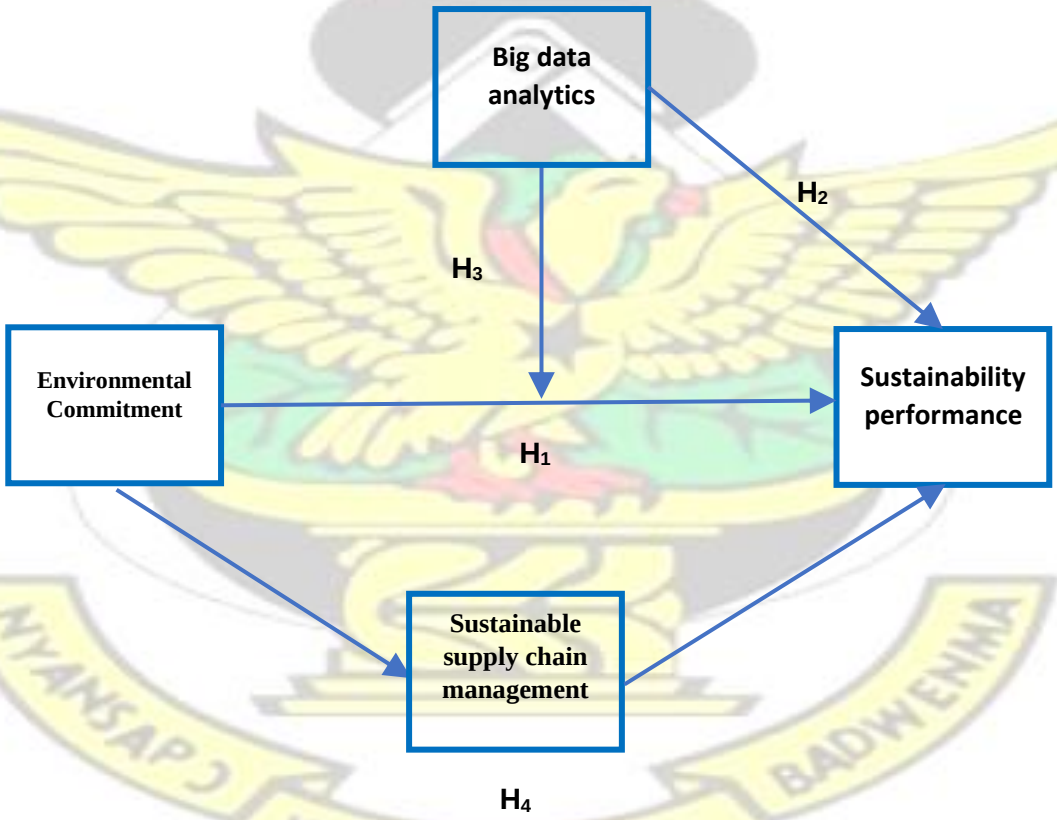
	environmental commitment and environmental performance		environmental performance	generalizable to other countries	relationship between environmental commitment and environmental performance in different countries
Yang et al. (2020)	To examine the moderating role of environmental leadership in the relationship between environmental commitment and environmental performance	Stakeholder theory	Environmental leadership moderated the relationship between environmental commitment and environmental performance	The study was conducted in a single country, so the findings may not be generalizable to other countries	Future studies should investigate the moderating role of environmental leadership in the relationship between environmental commitment and environmental performance in different countries
Zhang et al. (2022)	To examine the moderating role of environmental risk in the relationship	Risk perception theory	Environmental risk moderated the relationship between environmental	The study was conducted in a single country, so the findings may not be	Future studies should investigate the moderating role of environmental risk in

	between environmental commitment and environmental performance		commitment and environmental performance	generalizable to other countries	the relationship between environmental commitment and environmental performance in different countries

2.5 Conceptual Framework

Drawing on the Institutional and RBV theories, the model of this study contends positive and significant effects of environmental commitment on sustainability performance. The study further posits that big data analytics positively and significantly impacts sustainability performance. The study further asserts that the relationship between environmental commitment and sustainability performance is moderated and mediated by big data analytics and sustainable supply chain management and sustainability. Figure 2.1 illustrates the direct, indirect and moderated relationships between the variables.

Figure 2.1 Research Model



Source: Researcher's construct (2022)

2.5.1 Environmental Commitment and Sustainability Performance

Institutional theory underscores the profound influence of societal pressures, regulatory frameworks, and cultural norms on organizational behavior and strategic choices. Environmental commitment, in this context, is shaped and guided by these institutional forces, pushing organizations to integrate environmentally friendly practices into their business strategies and operations to meet the expectations of various stakeholders and adhere to regulatory standards. Recent literature provides a basis for this hypothesis. For instance, a study by Sharma and Gupta (2018) indicated a positive relationship between environmental commitment and sustainability performance among firms in the Indian manufacturing sector. They argued that firms with strong environmental commitment were more likely to adopt sustainable practices, leading to improved sustainability performance. In contrast, Zhang et al. (2020) found a weaker relationship in the context of Chinese manufacturing firms. They noted that while environmental commitment was crucial, its direct impact on sustainability performance was not as significant as anticipated. These contrasting findings highlight the complexity and contingent nature of the relationship between environmental commitment and sustainability performance, suggesting the need for further exploration. The rationale behind the hypothesis rests on the premise that environmental commitment encapsulates the policies, practices, and actions aimed at reducing the environmental footprint of an organization, which in turn, contributes to its sustainability performance. Logic dictates that organizations that are more committed to environmental initiatives tend to use resources more efficiently, reduce waste, comply with environmental regulations, and hence, improve their sustainability performance.

H_1: Environmental commitment positively and significantly affects sustainability performance.

2.5.2 Big Data Analytics and Sustainability Performance

According to the RBV theory, an organization's competitive advantage relies heavily on its capability to utilize its resources effectively. Big data analytics, a powerful resource in today's digital age, can offer firms the ability to gather, analyze, and interpret large volumes of data, potentially leading to valuable insights and efficient decision-making. Recent scholarly literature provides compelling arguments supporting and contesting this hypothesis. A study by Akter et al. (2018) demonstrated that big data analytics positively influenced sustainability performance in the retail sector. They argued that big data analytics could help firms identify inefficiencies, streamline processes, and optimize resource utilization, thereby enhancing their sustainability performance. In contrast, a study by Fosso Wamba et al. (2020) suggested a more nuanced relationship. While they acknowledged that big data analytics could provide valuable insights, they pointed out that the successful application of these insights to improve sustainability performance often depends on factors like data quality, technological infrastructure, and analytical capabilities. This underscores that the impact of big data analytics on sustainability performance may not always be direct or significant, indicating the need for further research. The rationale for this hypothesis lies in the potential of big data analytics to improve operational efficiency and support informed decision-making, both of which are critical for enhancing sustainability performance. Logically, by enabling firms to analyze large volumes of data, big data analytics can uncover patterns and trends, identify inefficiencies, and provide insights that can guide strategic decisions regarding environmental commitment.

H_2: Big data analytics positively and significantly affects sustainability performance.

2.5.3 The Moderation Effect of Big Data Analytics (BDA)

The hypothesis for the current study, guided by the Institutional theory and the Resource-Based View (RBV), posits that big data analytics positively and significantly moderates the relationship between environmental commitment and sustainability performance. This statement suggests that the strength and direction of the relationship between environmental commitment and sustainability performance can vary depending on the extent to which an organization employs big data analytics. Insights from recent literature reveal a divergence of views concerning this hypothesis. For instance, Singh et al. (2019) provided empirical support, arguing that big data analytics enhances the effect of environmental commitment on sustainability performance in firms within the IT sector. Their findings suggest that big data analytics, when leveraged effectively, enhances an organization's ability to derive value from its environmental commitment. On the contrary, a study by Li et al. (2020) noted that while big data analytics could provide valuable insights, it did not necessarily strengthen the impact of environmental commitment on sustainability performance in the context of manufacturing firms. They suggested that the moderating effect of big data analytics might be contingent on other factors such as the firm's data literacy and technological infrastructure. The logic and rationale for this hypothesis can be traced to the capabilities of big data analytics and its alignment with environmental commitment. Given that big data analytics facilitates decision-making through insights derived from vast amounts of data, it logically stands to reason that it can enhance the efficiency and effectiveness of an organization's environmental initiatives, thereby amplifying their impact on sustainability performance. However, the effect of big data analytics might vary under low and high conditions. Under low conditions, where the use of big data analytics is limited, its moderating effect might be negligible or even non-existent. Organizations may not be able to leverage the full potential of their environmental commitment, potentially resulting in less than optimal sustainability performance. Conversely,

under high conditions, where big data analytics is extensively applied, it could significantly strengthen the relationship between environmental commitment and sustainability performance. Organizations can leverage data-driven insights to optimize their environmental initiatives, thereby maximizing their sustainability performance.

H_3: Big data analytics positively and significantly moderate the relationship between environmental commitment and sustainability performance.

2.5.4 The Mediating Effects of Sustainable Supply Chain Management

This research employs the Institutional theory and the Resource-Based View (RBV) to underpin the hypothesis: Sustainable Supply Chain Management (SSCM) mediates the relationship between Environmental Commitment (EC) and Sustainability Performance (SP). This proposition suggests that the degree to which an organization commits to environmental practices influences its adoption of SSCM, which in turn affects sustainability performance. Recent scholarly literature offers varied perspectives on this hypothesis. For example, Touboulic and Walker (2018) provided support for this hypothesis in the context of UK-based firms, arguing that the implementation of SSCM practices effectively translated environmental commitment into improved sustainability performance. They suggested that the mediation effect of SSCM made the relationship between EC and SP more apparent. In contrast, a study by Ashby et al. (2021) in the Australian context found that while SSCM indeed had a positive impact on sustainability performance, its role as a mediator was not significant. They argued that direct measures in environmental commitment had a more profound effect on sustainability performance than indirect measures through SSCM. The rationale for this hypothesis lies in the concept of SSCM itself, which involves the integration of sustainability principles into supply chain management. If an organization is committed to environmental practices, it logically follows that it will adopt SSCM to operationalize these commitments, and thus,

influence its sustainability performance. Furthermore, from an institutional perspective, environmental commitment can be seen as a response to societal and regulatory pressures, while from an RBV standpoint, SSCM can be considered a strategic resource that firms leverage to transform their environmental commitment into improved sustainability performance. The mediation effect of SSCM can be understood in the context of its relationship with environmental commitment and sustainability performance. An organization's commitment to environmental practices often drives its adoption of SSCM. As such, a higher level of environmental commitment can lead to a more comprehensive implementation of SSCM. On the other hand, the implementation of SSCM, with its focus on sustainable sourcing, manufacturing, and distribution, can lead to improved sustainability performance by minimizing environmental impact and optimizing resource utilization.

H_4: Sustainable Supply Chain Management mediates the relationship between Environmental Commitment and Sustainability Performance.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter looks at the methods the researcher adopted to achieve the study's objectives. It contains the research strategy, research design, study population, sample size and sampling technique, types and sources of data, data collection method, data analysis, data validity and reliability and research ethics.

3.1 Research Strategy

"research strategy" refers to a company's overall approach to doing its research. Quantitative or qualitative research methods are both acceptable in this case. Data collection and analysis are critical to quantitative research, prioritising hypothesis testing and the relationship between theory and investigation. When it comes to data collection and analysis, qualitative research promotes words over statistics and emphasizes an inductive approach to the theory-study connection, emphasizing theory construction (Bryman, 2009). It was conducted using a quantitative research method. The study aimed to examine the relationship between logistics flexibility, supply chain resilience and sustainability performance.

3.2 Research design

A research design lays the groundwork for data collection and analysis. The study design chosen reflects judgements about the relative significance of different components of the research process. The design of an experiment, a cross-sectional or sociological survey, a longitudinal study, a case study, or a comparative study are all examples of research designs (Bell and Roberts, 1984). The research design used in this study is a survey since the study is primarily concerned with firms operating in the Greater Accra area.

3.3 Population of the Study

Babbie (1975) defines population as "the whole collection of persons, objects, or numerical values that an investigator wishes to examine." The research population comprises firms operating within the Greater Accra Region. A senior level or line manager from these firms constitute the target population.

3.4 Sample size and Sampling Technique

Randomly selecting people from a statistical population is known as sampling and is used to assess the population's attributes (Saunders et al., 2009). Probability sampling techniques and non-probability sampling methodologies were categorized by Saunders et al. (2009). In probabilistic sampling, the likelihood (probability) of each instance selected from the population is known and is normally equal in all circumstances. There is no guarantee that each individual will be selected in a non-probability sampling procedure. The study used convenient sampling to draw a sample of one hundred (100) from the target population. The choice of the

sample was based on the consideration of sample size suitability, cost and time factors. One respondent each was taken for each of the one hundred firms. The respondent types were line, middle and top-level managers.

3.5 Data Collection

The research makes use of only a primary source of data. A primary data source is an original data source; that is, the researcher collects the data directly to do research or complete a project (Cohen et al., 2000). A questionnaire was the sole primary data utilised. The items within the questionnaire were adopted from Esfahbodi (2016), Dubey et al. (2019), Fernando and Tew (2016), Wang et al. (2018), Dubey et al. (2017), Zhu et al. (2004), Fernando and Tew (2016) and Wang et al. (2018).

3.5.1 Data Collection Method

The researcher used a primary data source, especially a questionnaire, to accomplish the study's aims. The survey instrument contained five main sections that reflected the constructs of the study; Section A provides the profile of respondents; Section B the predictor variable, that is sustainable supply chain management; Section C provide the moderating variable, Big Data Analytics and Section D, Environmental Commitment, the mediating variable and Section E, sustainability performance which is the predicted variable. The questionnaire was an online version and was distributed to respondents via email and WhatsApp. Table 3.1 below summarises the measures and the respective constructs they measured.

Table 3.1 Summary of Measurement Items

Variables	No. of Items	Sources
Sustainable Supply Chain Management		
• **Sustainable Procurement**	5	Esfahbodi (2016)
• **Sustainable Distribution**	5	
• **Sustainable Design**	5	
• **Investment Recovery**	3	
Big Data Analytics	5	Dubey et al. (2019)
Environmental Commitment	16	Fernando and Tew (2016); Wang et al. (2018)
Sustainability Performance		
• **Economic dimension**	3	Dubey et al. (2017); Zhu et al. (2004); Fernando and Tew (2016); Wang et al. (2018)
• **Social dimension**	4	
• **Environmental dimension**	3	
• **Operational Performance**	6	
• **Innovative Performance**	4	

Source: Author's Construct (2022)

3.6 Data Analysis Method

Analysis of data is a process of analyzing data to uncover important information, draw conclusions, and assist in making better decisions (Berry, 2004). The researcher performed both descriptive and inferential analyses. Analyses of frequency and frequency distributions

were included in the descriptive analysis. SmartPLS, version 4 was used to test the model for the study.

3.7 Reliability and Validity Tests

Both the reliability and validity of the study were considered at all times. Study findings must be repeatable, and metrics used to evaluate each component must be consistent with being considered reliable (Barnes, 1995). On the other hand, validity is how an indicator intended to assess a notion properly measures that concept (Barnes, 1995).

To ensure the reliability of the data obtained, the data were tested with Alpha's Cronbach. All the variables scored above the 0.70 threshold, indicating a high level of internal consistency. The research conducted an exploratory factor analysis (EFA) to test for discriminatory and convergent validity. All of the items adopted to measure the study's variables scored above the 0.50 threshold.

3.8 Ethical Issues

Ethics, or moral philosophy, is a subfield of philosophy that "involves systematising, defending, and advocating ideas of acceptable and unacceptable conduct." The term "research ethics" provides a set of rules that regulate the behaviour of researchers. Researchers must adhere to ethical standards to safeguard the participants' dignity, rights, and wellbeing (Burns, 2000).

First of all, the study protected the identity of all respondents. Based on this, the research questionnaire did not request respondents' names and sensitive personal data. All other data obtained were used for academic purposes only.

Secondly, the researcher sought the consent of all respondents before the distribution of the questionnaires. No respondents were compelled to partake in the study.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION OF RESULTS

4.1 Introduction

Chapter Four presents a comprehensive evaluation of the gathered data and the subsequent analysis performed in the context of this study. The chapter is organized in a systematic manner, beginning with the background information of the respondents and the firms. This information provides a contextual understanding of the study's participants, considering their diverse backgrounds, experiences, and positions within the firms. It is critical to grasp these profiles as they give insight into the perspectives and behaviours observed in the data. Next, the chapter transitions to the reliability and validity tests conducted to ensure the integrity and robustness of the study's measures and procedures. As crucial elements in any research endeavor, these tests offer confidence in the study's results and their subsequent interpretations. A meticulous examination of the reliability and validity of the measures assists in reducing potential errors and biases, thereby enhancing the credibility of the findings. Following the discussion on reliability and validity, the chapter delves into the descriptive statistics that provide an overview of the data's general features. This section focuses on the central tendencies, dispersion, and distribution shape of the dataset. The intention here is to identify patterns, trends, and outliers that may exist within the data, thus offering a fundamental understanding of the dataset's nature and characteristics. Subsequently, the chapter takes a step further into inferential statistics by presenting the results of various tests. This step involves

the application of statistical models to draw inferences from the data, based on the established hypotheses. Lastly, the chapter concludes with a discussion of the results derived from the descriptive and inferential statistical analyses. This section serves to interpret the results in the context of the study's objectives and research questions.

4.2 Background Information of Respondents and Firms

In this section, the demographic characteristics of the companies and individuals included in the study are discussed. Understanding these demographics is essential, as it provides context and sheds light on the factors that influence behaviors and decisions within these organizations. The demographic characteristics explored are firm age, legal form of entity, ownership structure, estimated company revenue, number of employees, as well as individual factors such as age, highest educational qualification, and working experience.

Table 4.1 Profile of Respondents

Variables		Frequency	Valid Percentage
Firm Age	1-5 years	15	12.6%
	6-10 years	20	18.9%
	11-15 years	15	45.5%
	16-20 years	6	20.3%
	Above 20 years	43	43.3%
The legal form of entity	Sole proprietorship	10	10.1%
	Limited liability	60	60.6%
	Partnership	6	6.1%
	Public limited liability	12	12.1%
	Other	11	11.1%
Ownership of Company	Solely Ghanaian owned	54	54.5%
	Foreign-owned	29	29.3%
	Joint ventures	13	13.1%
	Others	3	3%
Estimated Annual Revenue (GHS)	Below 10,000	4	4%
	10,001-30,000	2	2%
	30,001-100,000	8	8.1%

	100,001-500,000	4	4%
	500,001-1,000,000	13	13.1%
	Above 1,000,000	68	68.1%
Number of employees	Less than 50	6	6.1%
	50-100	13	13.1%
	101-150	2	2%
	151-200	1	1%
	201-250	3	3%
	251-300	4	4%
	301-350	1	1%
	351-400	1	1%
	401-450	1	1%
	451-500	9	9.1%
	501-550	14	14.1%
	551-600	12	12.1%
	More than 600	32	32.3%
Age	Below 20 years	-	-
	20-29 years	14	14.1%
	30-39 years	50	50.6%
	40-50 years	26	26.3%
	Above 50 years	3	3%
Highest qualification	JHS	-	0.7%
	SHS	-	6.3%
	Undergraduate	44	44.4%
	Masters	48	48.5%
	PhD	1	1%
	Professional/Vocational	6	6.1%
Work experience of Respondents	0-5 years	25	17.5%
	6-10 years	70	49%
	11-15 years	36	25.2%
	Above 15 years	12	8.4%

Source: Field study (2022)

The demographic data presented above offers an intriguing insight into the nature and diversity of the respondent pool in this study. A significant majority of the firms involved have been operating for over 20 years (43.3%). This longevity may reflect a solid ability to adapt and survive within the business environment and may influence the firms' perspectives and strategies towards environmental commitment and sustainability performance. Considering the legal form of the entities, 60.6% of the companies are limited liability firms, which suggest a

shared responsibility and risk in their business operations. This legal structure could influence how these companies approach and implement environmental commitment practices and sustainable supply chain management. Regarding the companies' ownership, the majority (54.5%) are solely Ghanaian owned, indicating that the findings of this study are largely reflective of practices within domestically owned firms. This could impact the generalizability of the findings to foreign or jointly-owned entities operating within Ghana. From a financial standpoint, 68.1% of the companies generate an estimated annual revenue above 1,000,000 GHS, reflecting a considerable economic strength. Such companies may possess more resources to invest in environmental commitment strategies and big data analytics, potentially affecting their sustainability performance. In terms of workforce size, the data shows a wide range, with a noticeable lean towards companies having more than 600 employees (32.3%). This large workforce could translate to significant operational impacts on the environment, thus highlighting the importance of SSCM practices in these entities. In relation to the respondents' personal demographics, the majority fall within the 30-39 age bracket (50.6%) and hold either an undergraduate degree (44.4%) or a Masters' degree (48.5%). These demographics suggest a relatively young and educated pool of respondents who may be more open to novel ideas such as big data analytics in enhancing sustainability performance. The respondents' work experience is predominantly within the 6-10 years range (49%). This professional tenure suggests a moderate level of familiarity and experience within their respective business environments, which could influence their perceptions and behaviors related to the research variables. Overall, these demographic findings provide valuable contextual information that might influence the interpretation and implications of the study's main findings. They suggest a diverse and complex mix of entities and respondents, each potentially bringing unique perspectives and experiences that shape the environmental

commitment, the application of big data analytics, and the sustainability performance within their respective firms.

4.3 Reliability and Validity Test

This section addresses two critical aspects of this research study's methodological rigor - reliability and validity. These twin pillars of research integrity provide the foundation upon which confidence in the study's findings and interpretations are established. Reliability refers to the degree of consistency or repeatability of the measurement process. It provides an indication of the stability and dependability of the results, thus serving as a measure of the absence of random error. In this study, reliability is assessed using Cronbach's Alpha, a statistical measure widely employed in social science research for gauging internal consistency. This measure gives an indication of the degree to which a set of variables measures a single, unidimensional latent construct. On the other hand, validity examines whether the study accurately measures what it purports to measure. It concerns the correctness, meaningfulness, and appropriateness of the inferences drawn from the data. In this context, the research employs exploratory factor analysis (EFA) as a means of assessing validity. EFA serves to identify the underlying structure of the data, exploring the extent to which observed variables might be clustered together, thereby representing a 'factor' or underlying construct. By applying EFA, this study seeks to ascertain construct validity, which ensures the measurement items indeed reflect the intended theoretical constructs.

Table 4.2 Reliability Test – Alpha Cronbach

Construct	Number of items	Alpha Value
Environmental commitment	16	.977
Sustainable supply chain management	18	.963
Big data analytics	5	.937
Sustainability Performance	20	.959

Source: Field study (2022)

The results of the Cronbach's Alpha analysis indicate a high degree of internal consistency for each of the constructs under study. The environmental commitment construct, with 16 items, has an alpha value of .977. This value is well above the conventional threshold of .7, indicating a high level of reliability. It suggests that the items used to measure environmental commitment are highly interrelated and consistently measure the same underlying construct. Similarly, the sustainable supply chain management construct, with 18 items, has an alpha value of .963. This value also significantly surpasses the standard acceptability threshold, reflecting a high degree of reliability. It implies that these items form a cohesive set that reliably measures the concept of sustainable supply chain management. For the big data analytics construct, despite being measured with fewer items (5), an alpha value of .937 has been achieved. This value signifies a strong internal consistency among these items, implying a reliable measurement of the big data analytics construct. Finally, the sustainability performance construct, with the highest number of items (20), shows an alpha value of .959. This high value indicates that the items used to measure sustainability performance are consistently tapping into the same underlying construct.

Table 4.3 Validity Test - Exploratory Factor Analysis (EFA)

Items	Variables			
	EC	SCM	BDA	SP
Environmental Commitment				
1. Our company has a well-defined policy for promoting environmental consciousness in all corporate operations.	0.835			
2. Environmental preservation is a core corporate priority for our company.	0.879			
3. We make a determined effort to educate every employee on the significance of environmental management.	0.828			
4. Our company's environmental initiatives have the full backing of management and employees.	0.863			
5. Our company is committed to reducing hazardous emissions from manufacturing and operations.	0.805			

6. Our company places equal importance on the natural environment and earnings.	0.836			
7. Our company routinely evaluates the effect of business on the environment.	0.783			
8. Our company has adequate personnel to undertake environmental management procedures.	0.79			
9. Our company have adequate financial means to conduct environmental management procedures.	0.769			
10. Our organisation have sufficient physical resources to undertake environmental management procedures..	0.862			
11. Our company has enough intangible assets to conduct environmental management procedures.	0.665			
12. By employing environmental management methods, our company seeks to mitigate the harm posed by environmental restrictions.	0.859			
Environmental rules are essential for our company to execute environmental management techniques.	0.812			
14. Increasing customer environmental awareness has prompted our company to develop environmental management techniques.	0.839			
15. Environmental responsibility is a must for our company to participate in this business.	0.849			
If our company produces dangerous chemicals and pollution, community stakeholders may not support us.	0.738			
Sustainable Supply Chain Management				
1) Environmental labelling of goods		0.742		
2) Cooperation with suppliers to achieve environmental goals.		0.806		
3) Environmental audit for the internal management of suppliers.		0.851		
4) The ISO 14000 accreditation of suppliers.		0.878		
5) Evaluation of the environmentally friendly practises of second-tier suppliers.		0.798		
6) Cooperation with customers to reduce product transportation energy use.		0.87		
7) Cooperation with clients for eco-friendly packaging.		0.845		
8) Utilization of renewable energy in all modes of transportation.		0.781		
9) Utilization of renewable energy in the packaging process.		0.838		
10) Monitoring and tracing emissions resulting from product dispersion (e.g., carbon footprint).		0.852		
11) Designing goods with decreased material usage in mind.		0.817		
12) Designing goods to decrease energy use.		0.841		

13) Design goods for reuse, recycling, and material, component, and byproduct recovery.		0.748		
14) Design goods to eliminate or minimise the usage of hazardous materials in their production.		0.826		
15) Cooperation with clients for cleaner manufacturing.		0.811		
16) Sale of surplus inventory or supplies		0.728		
17) Sale of scrap and discarded materials as well as byproducts.		0.753		
18) Sale of surplus capital assets.		0.756		
Big Data Analytics				
1) Our firm employs sophisticated analytic approaches (such as simulation, optimization, and regression) to enhance decision making.			0.824	
2) Multiple data sources are used by our company to better decision making.			0.822	
3) Our firm use data visualisation approaches (such as dashboards) to aid users and decision-makers in comprehending complicated data.			0.808	
4) Dashboards are used by our company to present data for cause analysis and continual development..			0.815	
5) Our company utilises dashboard apps on the communication devices (such as smartphones and desktops) of humanitarian actors.			0.72	
Sustainability Performance				
My company grew overall employees annually.				0.84
My company has raised per-employee gross pay.				0.785
My company has increased the ratio of male to female employees.				0.66
My company grew overall employees annually.				0.875
My company has decreased air emission				0.814
My company has decreased wastewater				0.801
My company has decreased solid waste				0.787
My firm's income has grown.				0.803
My company has expanded its market share.				0.864
My company has decreased compensation/penalty for an environmental catastrophe.				0.75
Our organisation was able to deliver the customer's order on time.				0.761
Our organisation has reduced inventory levels.				0.784
Our company's loss rate has decreased.				0.734
Our business has increased total capacity utilisation.				0.789
There is a substantial improvement in product quality.				0.833
The lead time has significantly improved.				0.775
In the last three years, our company has invested in new research and development facilities to obtain a competitive edge.				0.83

In the previous three years, our business has created new goods and services.				0.717
In the previous three years, our company has leveraged new prospects and technology in new areas.				0.813
In the last three years, our company's manufacturing method has been characterised by innovation.				0.827

Source: Field study (2022) Notes: Environmental commitment (EC); sustainable supply chain management (SSCM); Big data analytics (BDA); Sustainability Performance (SP)

The Exploratory Factor Analysis (EFA) results shed light on the factor loadings of each variable under the constructs of Environmental Commitment (EC), Sustainable Supply Chain Management (SSCM), Big Data Analytics (BDA), and Sustainability Performance (SP). Each of these factor loadings represents the correlation between the observed variable and the latent construct they are assumed to measure. The Environmental Commitment construct exhibits factor loadings ranging from 0.665 to 0.879. All factor loadings are well above the often-used cutoff value of 0.5, suggesting that the items under this construct have a high correlation with the underlying Environmental Commitment construct. Sustainable Supply Chain Management items show factor loadings ranging from 0.728 to 0.878. This range, like that of the Environmental Commitment construct, reflects a strong correlation with the underlying Sustainable Supply Chain Management construct, further confirming the validity of the measurement model. The Big Data Analytics construct items all have factor loadings between 0.720 and 0.824. These loadings are also well above the 0.5 threshold, indicating a substantial correlation with the latent Big Data Analytics construct. Lastly, the Sustainability Performance construct exhibits factor loadings ranging from 0.66 to 0.875. Despite the slightly lower minimum loading compared to the other constructs, all the loadings are still considerably above

the cutoff of 0.5, indicating a robust correlation with the underlying Sustainability Performance construct. In conclusion, the EFA results reveal that all items within each construct have satisfactory factor loadings, indicating that these items appropriately represent the respective latent constructs. The findings provide solid support for the measurement model's validity, indicating that each construct captures the intended underlying concept effectively. These results, therefore, add to the robustness of the study's measurements and the reliability of its findings.

Table 4.4 KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.907
Bartlett's Test of Sphericity	Approx. Chi-Square	7182.122
	Df	1711
	Sig.	.000

Source: Field study (2022)

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is 0.907. This is well above the recommended value of 0.6, indicating the sample size of 99 is adequate for factor analysis. Bartlett's Test of Sphericity is statistically significant ($p < .001$). This indicates the correlation matrix is not an identity matrix and is suitable for factor analysis.

4.4 Descriptive Statistics

The descriptive analytics section in Chapter Four presents statistical measures such as mean, kurtosis, standard deviation (SD), and skewness, which are used to summarize and describe the key features of a dataset. Mean is a measure of central tendency that provides information on the average value of a variable in the dataset. Kurtosis measures the degree of peakedness or flatness of a distribution relative to a normal distribution. Standard deviation is a measure of

the dispersion or variability of a variable around its mean, while skewness measures the asymmetry of the distribution of a variable.

4.4.1 Sustainable Supply Chain Management

The predictor variable for the study Sustainable Supply Chain Management was operationalized using eighteen (18) items adopted from Esfahbodi (2016). Table 4.5 below presents the descriptive statistics on Sustainable Supply Chain Management.

Table 4.5 Descriptive Statistics on Sustainable Supply Chain Management

Items	Mean	Std. Dev	Skewness	kurtosis
1) Environmental labelling of goods	5.27	1.628	-0.945	0.506
2) Cooperation with suppliers to achieve environmental goals.	5.32	1.497	-0.479	-0.471
3) Environmental audit for the internal management of suppliers.	5.49	1.514	-1.088	0.905
4) The ISO 14000 accreditation of suppliers.	5.62	1.676	-1.214	0.737
5) Evaluation of the environmentally friendly practises of second-tier suppliers.	5.19	1.53	-0.907	0.712
6) Cooperation with customers to reduce product transportation energy use.	4.72	1.565	-0.315	-0.425
7) Cooperation with clients for eco-friendly packaging.	4.7	1.548	-0.538	0.058
8) Utilization of renewable energy in all modes of transportation.	4.48	1.656	-0.317	-0.556
9) Utilization of renewable energy in the packaging process.	5	1.666	-0.932	0.145
10) Monitoring and tracing emissions resulting from product dispersion (e.g., carbon footprint).	5.13	1.827	-0.884	-0.15

11) Designing goods with decreased material usage in mind.	5.18	1.521	-1.025	0.953
12) Designing goods to decrease energy use.	5.24	1.598	-1.127	1.033
13) Design goods for reuse, recycling, and material, component, and byproduct recovery.	4.75	1.612	-0.638	-0.106
14) Design goods to eliminate or minimise the usage of hazardous materials in their production.	5.46	1.71	-1.294	1.07
15) Cooperation with clients for cleaner manufacturing.	5.09	1.648	-0.804	0.058
16) Sale of surplus inventory or supplies	5.28	1.572	-1.142	1.007
17) Sale of scrap and discarded materials as well as byproducts.	5	1.604	-0.849	0.233
18) Sale of surplus capital assets.	4.72	1.623	-0.904	0.3
Overall Score	**5.092**	**1.26186**	**-1.066**	**1.445**

Source: Field Study (2023)

Table 4.5 displays the descriptive statistics for the 18 items used to operationalize the predictor variable of Sustainable Supply Chain Management. The mean score for each item ranges from 4.48 to 5.62, with an overall mean score of 5.092. The standard deviation ranges from 1.497 to 1.827, with an overall standard deviation of 1.26186. The skewness ranges from -1.294 to -0.315, with an overall skewness of -1.066. Finally, the kurtosis ranges from -0.556 to 1.445, with an overall kurtosis of 1.445. The mean score of 5.092 indicates that, on average, Sustainable Supply Chain Management is considered to be a moderately important concept for the organizations involved in the study. The lowest mean score of 4.48 is for the item related to the use of renewable energy in any mode of product transportation, which suggests that this is considered to be a less important aspect of Sustainable Supply Chain Management by the study participants. On the other hand, the highest mean score of 5.62 is for the item related to suppliers' ISO 14000 certification, indicating that this is perceived to be a particularly important aspect of Sustainable Supply Chain Management. The standard deviation values show that there is some variation in the responses across the 18 items, with some items having a relatively

narrow range of responses and others having a wider range. For example, the item related to tracking and monitoring emissions caused by product distributions (e.g., carbon footprint) has a relatively high standard deviation of 1.827, suggesting that there is more variability in the responses for this item than for some of the others. The skewness values show that most of the items are negatively skewed, indicating that the majority of respondents gave higher scores for these items. However, there are a few items that are positively skewed, indicating that the majority of respondents gave lower scores for these items. The kurtosis values suggest that the distribution of scores for most of the items is leptokurtic, meaning that they have more extreme values (i.e., higher or lower scores) than would be expected in a normal distribution. This is particularly true for items related to design products for reduced consumption of material and design products for reduced consumption of energy, which have high kurtosis values. Overall, the results suggest that Sustainable Supply Chain Management is a concept that is perceived to be moderately important by the study participants, with some aspects being more important than others. The high standard deviation and kurtosis values suggest that there is variability in the responses for some of the items, and that there may be some disagreement among participants regarding the importance of certain aspects of Sustainable Supply Chain Management.

4.4.2 Big Data Analytics

The moderator variable for the study Big Data Analytics was operationalized using five (5) items adopted from Dubey et al. (2019). Table 4.6 below presents the descriptive statistics on Big Data Analytics.

Table 4.6 Descriptive Statistics on Big Data Analytics

Items	Mean	Std. Dev	Skewness	kurtosis

1) Our firm employs sophisticated analytic approaches (such as simulation, optimization, and regression) to enhance decision making.	5.16	1.556	-0.871	0.408
2) Multiple data sources are used by our company to better decision making.	5.44	1.465	-1.209	1.654
3) Our firm use data visualisation approaches (such as dashboards) to aid users and decision-makers in comprehending complicated data.	5.36	1.644	-1.265	1.002
4) Dashboards are used by our company to present data for cause analysis and continual development..	5.25	1.514	-1.052	1.007
5) Our company utilises dashboard apps on the communication devices (such as smartphones and desktops) of humanitarian actors.	5.77	1.557	-1.605	2.257
Overall Score	**5.398**	**1.38461**	**-1.263**	**1.743**

Source: Field Study (2023)

Table 4.6 presents the descriptive statistics for the Big Data Analytics variable in the study. The variable was operationalized using five items, and the table shows the mean, standard deviation, skewness, and kurtosis for each item as well as the overall score. The mean score for each item ranges from 5.16 to 5.77, with an overall mean score of 5.398. The standard deviation ranges from 1.465 to 1.644, with an overall standard deviation of 1.38461. The skewness ranges from -1.605 to -0.871, with an overall skewness of -1.263. Finally, the kurtosis ranges from 1.007 to 2.257, with an overall kurtosis of 1.743. The results shows that the overall score for Big Data Analytics is 5.398, indicating that the use of advanced analytical techniques and multiple data sources, as well as data visualization techniques such as dashboards, is perceived to be important in improving decision making in the organizations studied. The highest mean score of 5.77 is for the item related to the use of dashboard applications in the communication devices of the humanitarian actors, indicating that this aspect is particularly important in the organizations studied. The standard deviation values show that there is some variation in the responses across the five items, with some items having a relatively narrow range of responses and others having a wider range. For example, the item related to the use of data visualization techniques has a relatively high standard deviation of 1.644, suggesting that there is more

variability in the responses for this item than for some of the others. The skewness values show that all of the items are negatively skewed, indicating that the majority of respondents gave higher scores for these items. The kurtosis values suggest that the distribution of scores for most of the items is leptokurtic, meaning that they have more extreme values (i.e., higher or lower scores) than would be expected in a normal distribution. Overall, the results suggest that the use of advanced analytical techniques, multiple data sources, and data visualization techniques such as dashboards is perceived to be important in improving decision making in the organizations studied. The high standard deviation and kurtosis values suggest that there is variability in the responses for some of the items, and that there may be some disagreement among participants regarding the importance of certain aspects of Big Data Analytics.

4.4.3 Environmental Commitment

The mediator variable for the study Environmental Commitment was operationalized using sixteen (16) items adopted from Fernando and Tew (2016) and Wang et al. (2018). Table 4.7 below presents the descriptive statistics on Environmental Commitment.

Table 4.7 Descriptive Statistics on Environmental Commitment

Items	Mean	Std. Dev	Skewness	kurtosis
1. Our company has a well-defined policy for promoting environmental consciousness in all corporate operations.	5.84	1.448	-1.524	2.32
2. Environmental preservation is a core corporate priority for our company.	5.58	1.506	-1.091	0.912

3. We make a determined effort to educate every employee on the significance of environmental management.	5.66	1.52	-1.32	1.384
4. Our company's environmental initiatives have the full backing of management and employees.	5.85	1.459	-1.701	2.747
5. Our company is committed to reducing hazardous emissions from manufacturing and operations.	5.86	1.498	-1.871	3.409
6. Our company places equal importance on the natural environment and earnings.	5.65	1.487	-1.251	1.379
7. Our company routinely evaluates the effect of business on the environment.	5.76	1.422	-1.624	3.079
8. Our company has adequate personnel to undertake environmental management procedures.	5.35	1.387	-0.848	0.717
9. Our company have adequate financial means to conduct environmental management procedures.	5.47	1.272	-0.989	1.212
10. Our organisation have sufficient physical resources to undertake environmental management procedures..	5.25	1.248	-0.751	0.561
11. Our company has enough intangible assets to conduct environmental management procedures.	5.21	1.296	-1.353	2.232
12. By employing environmental management methods, our company seeks to mitigate the harm posed by environmental restrictions.	5.57	1.379	-1.295	1.984
Environmental rules are essential for our company to execute environmental management techniques.	5.65	1.38	-1.406	2.29
14. Increasing customer environmental awareness has prompted our company to develop environmental management techniques.	5.39	1.384	-1.072	1.522
15. Environmental responsibility is a must for our company to participate in this business.	5.52	1.343	-1.246	2.175
If our company produces dangerous chemicals and pollution, community stakeholders may not support us.	5.52	1.487	-0.942	0.419
Overall Score	**5.5694**	**1.21746**	**-1.499**	**2.848**

Source: Field Study (2023)

Table 4.7 presents the descriptive statistics for the Environmental Commitment variable in the study. The variable was operationalized using 16 items, and the table shows the mean, standard deviation, skewness, and kurtosis for each item as well as the overall score. The mean score for each item ranges from 5.21 to 5.86, with an overall mean score of 5.5694. The standard deviation ranges from 1.21746 to 1.498, with an overall standard deviation of 1.21746. The skewness ranges from -1.871 to -0.751, with an overall skewness of -1.499. Finally, the kurtosis ranges from 0.419 to 3.409, with an overall kurtosis of 2.848. The results show that the overall score for Environmental Commitment is 5.5694, indicating that the commitment to environmental management practices is perceived to be important in the organizations studied. The highest mean score of 5.86 is for the item related to the commitment to reduce harmful emissions resulting from production and operations, indicating that this aspect is particularly important in the organizations studied. The standard deviation values show that there is some variation in the responses across the 16 items, with some items having a relatively narrow range of responses and others having a wider range. For example, the item related to the ownership of physical resources has a relatively low standard deviation of 1.248, suggesting that there is less variability in the responses for this item than for some of the others. The skewness values show that all of the items are negatively skewed, indicating that the majority of respondents gave higher scores for these items. The kurtosis values suggest that the distribution of scores for most of the items is leptokurtic, meaning that they have more extreme values (i.e., higher or lower scores) than would be expected in a normal distribution. Overall, the results suggest that the commitment to environmental management practices is considered to be important in the organizations studied. The high standard deviation and kurtosis values suggest that there is variability in the responses for some of the items, and that there may be some disagreement among participants regarding the importance of certain aspects of Environmental Commitment.

4.4.4 Sustainability Performance

The outcome variable for the study Sustainability Performance was operationalized using twenty (20) items adopted from Dubey et al. (2017); Zhu et al. (2004); Fernando and Tew (2016); Wang et al. (2018). Table 4.9 below presents the descriptive statistics on Sustainability Performance.

Table 4.8 Descriptive Statistics on Sustainability Performance

Items	Mean	Std. Dev	Skewness	kurtosis
My company grew overall employees annually.	4.61	1.476	-0.319	-0.618
My company has raised per-employee gross pay.	4.68	1.398	-0.795	0.556
My company has increased the ratio of male to female employees.	4.21	1.452	-0.216	-0.357
My company grew overall employees annually.	4.56	1.423	-0.603	0.066
My company has decreased air emission	5.49	1.541	-1.185	1.133
My company has decreased wastewater	5.55	1.38	-1.06	1.294
My company has decreased solid waste	5.37	1.418	-1.063	1.245
My firm's income has grown.	5.54	1.335	-0.984	0.772
My company has expanded its market share.	5.3	1.313	-0.857	1.105
My company has decreased compensation/penalty for an environmental catastrophe.	5.24	1.572	-0.942	0.507
Our organisation was able to deliver the customer's order on time.	5.63	1.367	-1.518	2.721
Our organisation has reduced inventory levels.	4.95	1.366	-0.643	0.663
Our company's loss rate has decreased.	4.7	1.313	-0.661	0.565
Our business has increased total capacity utilisation.	5.16	1.175	-1.09	3.103
There is a substantial improvement in product quality.	5.88	1.272	-1.438	2.759
The lead time has significantly improved.	5.41	1.348	-1.103	1.345
In the last three years, our company has invested in new research and development facilities to obtain a competitive edge.	5.27	1.511	-0.985	0.819
In the previous three years, our business has created new goods and services.	4.77	1.331	-0.356	0.387

In the previous three years, our company has leveraged new prospects and technology in new areas.	5.25	1.304	-0.962	1.735
In the last three years, our company's manufacturing method has been characterised by innovation.	5.31	1.447	-0.958	0.937
Overall Score	**5.1439**	**1.04237**	**-1.225**	**3.075**

Source: Field Study (2023)

Table 4.8 presents the descriptive statistics for the Sustainability Performance variable in the study. The variable was operationalized using 20 items, and the table shows the mean, standard deviation, skewness, and kurtosis for each item as well as the overall score. The mean score for each item ranges from 4.21 to 5.88, with an overall mean score of 5.1439. The standard deviation ranges from 1.04237 to 1.572, with an overall standard deviation of 1.04237. The skewness ranges from -1.518 to -0.216, with an overall skewness of -1.225. Finally, the kurtosis ranges from -0.618 to 3.103, with an overall kurtosis of 3.075. The results show that the overall score for Sustainability Performance is 5.1439, indicating that the organizations studied are performing well in terms of sustainability. The highest mean score of 5.88 is for the item related to the significant improvement in product quality, indicating that this aspect is particularly important in the organizations studied. The standard deviation values show that there is some variation in the responses across the 20 items, with some items having a relatively narrow range of responses and others having a wider range. For example, the item related to the reduction in wastewater has a relatively low standard deviation of 1.38, suggesting that there is less variability in the responses for this item than for some of the others. The skewness values show that most of the items are negatively skewed, indicating that the majority of respondents gave higher scores for these items. However, the item related to the male to female employee ratio is positively skewed, indicating that most respondents gave a lower score for this item. The kurtosis values suggest that the distribution of scores for most of the items is leptokurtic, meaning that they have more extreme values (i.e., higher or lower scores) than would be

expected in a normal distribution. However, some items such as the male to female employee ratio and the reduction in compensation/penalty for an ecological mishap, have platykurtic distributions, indicating that their scores are more evenly distributed. Overall, the results suggest that the organizations studied are performing well in terms of sustainability. The high standard deviation and kurtosis values suggest that there is some variability in the responses for some of the items, and that there may be some disagreement among participants regarding the importance of certain aspects of Sustainability Performance.

4.5 Model and Hypotheses Testing

This section employs statistical methods, specifically correlation and regression analysis, to delve deeper into the associations between variables and ascertain the nature of these relationships.

Correlation analysis, a crucial part of the statistical toolkit, provides the initial step in understanding the relationships among the variables of interest. It helps ascertain whether two or more variables move together in a consistent manner, thus offering preliminary insights into the bivariate relationships between the variables.

Following the correlation analysis, regression analysis comes into play, taking the analysis a step further. Regression analysis not only verifies the existence of relationships between variables but also quantifies the extent of these relationships. It serves to model and examine the relationships between a dependent variable and one or more independent variables, thereby enabling predictions about how changes in the independent variables may affect the dependent variable.

4.5.1 Correlation Analysis

This section provides the correlation between environmental commitment, sustainable supply chain management, big data analytics and sustainability performance.

Table 4.9 Correlation Analysis

Variables	EC	SSCM	BDA	SP
Environmental commitment	1			
Sustainable supply chain management	.838**.	1		
Big data analytics	.798**	843**	1	
Sustainability Performance	.730**	.794**	.753**	1

Source: Field study (2022) Notes: Environmental commitment (EC); sustainable supply chain management (SSCM); Big data analytics (BDA); Sustainability Performance (SP) Notes: *p < .05, **p < .01

The correlation matrix presented in Table 4.9 shows the pairwise correlation coefficients between the four variables in the study: Environmental Commitment (EC), Sustainable Supply Chain Management (SSCM), Big Data Analytics (BDA), and Sustainability Performance (SP). The double asterisks denote statistical significance at the 0.01 level, indicating strong correlations between the variables. The highest correlation coefficient is found between Sustainable Supply Chain Management and Big Data Analytics (.843), implying a very strong positive association between these two variables. This indicates that organizations with high levels of sustainable supply chain practices also tend to utilize big data analytics extensively. In other words, advancements in big data analytics are often closely associated with an increased commitment to sustainable supply chain practices. Environmental Commitment shows strong positive correlations with Sustainable Supply Chain Management (.838), Big

Data Analytics (.798), and Sustainability Performance (.730). This suggests that firms demonstrating high levels of environmental commitment are likely to manifest increased sustainable supply chain management practices, utilize big data analytics effectively, and achieve better sustainability performance. Sustainability Performance is also positively associated with Sustainable Supply Chain Management (.794) and Big Data Analytics (.753). It shows that firms demonstrating high sustainability performance also tend to have robust sustainable supply chain management practices and effectively utilize big data analytics.

4.5.2 Regression Analysis

This section focuses on testing the study's hypotheses using linear regression, moderated and mediated regression

Table 4.10 Regression Analysis Results

Predictor Variable	**Dependent variable: Sustainability Performance**			
	Unstandardized coefficients			
	Model 1	***Model 2***	***Model 3***	***Model 4***
Constant	1.662	2.083	1.3287	
Main effect:				
EC → SP	.625 (10.53)**	.567 (11.279)**		
BDA → SP				
Interaction effect:				
EC × BDA → SP			-.0105 (-.36)	
Indirect effects:				
EC → SSCM → SP				.1870**

R^2	53.3%	56.7%	61.4%	70.3%
Δ R^2	.528	563		
(Δ) F statistics	110.798	127.207	50.3279	229.2562
Degree of freedom	98	98	98	98

Source: Field study (2022) Notes: *p < .05, **p < .01 Notes: Environmental commitment (EC); sustainable supply chain management (SSCM); Big data analytics (BDA); Sustainability Performance (SP)

Table 4.10 presents the results of a sequence of multiple regression analyses predicting Sustainability Performance (SP) from Environmental Commitment (EC) and Big Data Analytics (BDA), their interaction, and an indirect effect through Sustainable Supply Chain Management (SSCM).

In Model 1, the relationship between Environmental Commitment (EC) and Sustainability Performance (SP) was examined. EC significantly predicts SP with an unstandardized coefficient of .625 (t = 10.53, p < .01), indicating that for each unit increase in EC, there is a .625 unit increase in SP, holding all other variables constant. The R^2 value indicates that this model explains 53.3% of the variance in SP.

In Model 2, the impact of the addition of BDA on the relationship between EC and SP was analyzed. The unstandardized coefficient for EC decreased slightly to .567 but remained significant (t = 11.279, p < .01). This indicates that the relationship between EC and SP is robust and not accounted for by the addition of BDA to the model. The R^2 value increased to 56.7% indicating that the inclusion of BDA in the model increased the amount of variance in SP explained by the model.

In Model 3, the interaction between EC and BDA in predicting SP was evaluated. The interaction term (EC x BDA) did not significantly predict SP (-.0105, t = -.36, p > .05). This suggests that the effect of EC on SP does not depend on the level of BDA. The R^2 value further increased to 61.4% indicating that even though the interaction term was not significant, it still contributed to a small increase in the variance of SP explained by the model.

In Model 4, an indirect effect of EC on SP through SSCM was analyzed. The indirect effect was significant, with an unstandardized coefficient of .1870 (p < .01). This indicates that part of the effect of EC on SP operates through SSCM. In other words, higher levels of EC lead to higher levels of SSCM, which in turn leads to higher levels of SP. The R^2 value reached 70.3%, suggesting that Model 4 with the indirect effect explains the most variance in SP.

Overall, the results indicate that Environmental Commitment significantly predicts Sustainability Performance both directly and indirectly through its effect on Sustainable Supply Chain Management. The effect is not moderated by Big Data Analytics.

4.5.3 Hypotheses Table

This section summarizes the result from the regression analyses used to test the study's hypotheses.

Table 4.11 Hypotheses table

Hypothesis	Path Analysis	Expected effect	Results	Conclusion
H1	EC → SP	Positive	.625 (p < 0.01)	Supported
H2	BDA → SP	Positive	.567 (p < 0.01)	Supported
H3	EC × BDA → SP	Positive	-.0105 (p >.05)	Not Supported
H4	EC → SSCM → SP	Positive	.1870 (p < .01)	Supported

Source: Field study (2022) Notes: *p < .05, **p < .01 Notes: Environmental commitment (EC); sustainable supply chain management (SSCM); Big data analytics (BDA); Sustainability Performance (SP)

4.6 Discussion of Results

The findings made in this study is discussed in the context of the literature reviewed and also the theories adopted for this study. The detail discussion of the findings is presented below based on the objectives set for the study.

4.6.1 Environmental Commitment and Sustainability Performance

The significant positive relationship between Environmental Commitment (EC) and Sustainability Performance (SP) substantiates the arguments of Porter and Van der Linde (1995) and Hart (1995), who proposed the natural-resource-based view of the firm. This view suggests that proactive environmental strategies are not just an operational cost but can also provide competitive advantage, leading to improved sustainability performance. This is achieved through cost and risk reduction, innovation, and improved reputation, as firms demonstrate their commitment to environmental stewardship (Hart, 1995). Lee's (2008) emphasis on environmental stewardship finds resonance in these findings. When firms

incorporate proactive environmental strategies, such as pollution prevention, product stewardship and sustainable development into their operational and strategic decisions, it results in improved environmental performance (Lee, 2008). Furthermore, this echoes the assertions of Starik and Rands (1995) that suggest an environmental commitment leads to the development of unique resources, competencies, and capabilities, which subsequently enhance sustainability performance. In accordance with Chin et al.'s (2019) findings, this study reinforces the notion that a firm's commitment to environmental issues is not merely a corporate social responsibility, but a critical factor influencing its performance outcomes. Environmental commitment integrates long-term environmental considerations into a firm's strategies, fostering the potential for superior sustainability performance by reducing environmental impacts and ensuring compliance with environmental regulations (Chin et al., 2019).

4.6.2 Big Data Analytics and Sustainability Performance

The results of this study indicate that the relationship between big data analytics (BDA) and sustainability performance (SP) is not statistically significant. This finding suggests that the impact of BDA on SP might be more complex than initially hypothesized and that other factors may play a role in determining the effectiveness of BDA in enhancing sustainability performance. Big data analytics involves the use of advanced techniques to process and analyze large, diverse datasets to uncover valuable insights, trends, and patterns (Papadopoulos et al., 2017). In the context of sustainability, BDA can help organizations gain insights into their environmental and social performance, identify opportunities for improvement, and monitor the progress of sustainability initiatives (Zhang et al., 2017). Although some studies have found a positive relationship between BDA and various performance outcomes, such as competitive advantage, supply chain sustainability, and organizational performance (Zhang et al., 2017; Dubey et al., 2019; Mitra & Datta, 2014),

other studies have reported mixed or negative results (Lycett, 2013; McAfee & Brynjolfsson, 2008). These inconsistencies may arise due to various factors, such as differences in data quality, analytics capabilities, and organizational contexts. One possible explanation for the non-significant relationship between BDA and SP in this study is the quality of the data being analyzed. BDA relies on large volumes of accurate, reliable, and timely data to generate meaningful insights (Wamba et al., 2015). In some cases, organizations may lack access to high-quality data, limiting the effectiveness of BDA in improving sustainability performance. Another potential factor is the organization's analytics capabilities. Implementing BDA successfully requires not only advanced technology and tools but also skilled personnel who can interpret the results and translate them into actionable strategies (Chen et al., 2012). Organizations with limited analytics capabilities may not be able to fully exploit the potential benefits of BDA, leading to a weaker impact on sustainability performance. Finally, the organizational context may influence the relationship between BDA and SP. Factors such as organizational culture, leadership support, and the integration of sustainability objectives into the overall business strategy can affect the extent to which BDA is utilized and its effectiveness in enhancing sustainability performance (Melville, 2010).

4.6.3 Moderating Role of Big Data Analytics

The insignificant interaction effect of Environmental Commitment (EC) and Big Data Analytics (BDA) on Sustainability Performance (SP) brings a counter-narrative to the theoretical premise of Melville (2010) and Benitez et al. (2018). It indicates that the beneficial effects of integrating Big Data Analytics into environmental commitment strategies, as posited by these scholars, may not materialize in every empirical context. The prediction of Melville (2010) about the potential of information systems, such as Big Data Analytics, to enable efficiency gains and thus enhance the positive impact of environmental commitment on

sustainability performance, may be contingent on several factors. These factors could include the firm's digital maturity, data literacy levels among employees, and the extent to which the firm can operationalize insights derived from Big Data Analytics. In the absence of these supporting conditions, the integration of BDA with environmental commitment strategies may not yield the anticipated boost in sustainability performance. Furthermore, the results bring into question the effectiveness of Big Data Analytics deployment in the context of the present study. Drawing on the arguments of Benitez et al. (2018), effective deployment of Big Data Analytics is presumed to improve firm performance by providing rich, timely, and actionable insights. However, this may not always translate into enhanced sustainability performance. The nature of data analytics and the complexity of interpreting results may present barriers that hinder the optimal utilization of BDA, thereby diluting its moderating effect on the EC-SP relationship. The findings thus point towards a need for a more nuanced understanding of the role of Big Data Analytics in the relationship between environmental commitment and sustainability performance. They suggest that while Big Data Analytics could offer potential benefits, its effective deployment in enhancing sustainability performance remains subject to a firm's specific circumstances and competencies.

4.6.4 Mediating Effect of Sustainable Supply Chain Management

The mediating effect of Sustainable Supply Chain Management (SSCM) underscores the mechanism through which environmental commitment translates into enhanced Sustainability Performance (SP). This finding aligns with the theoretical framework of Seuring and Müller (2008) and Zhu et al. (2010), offering empirical substantiation to the argument that the commitment to environmental principles triggers the implementation of sustainable supply chain practices, which in turn, lead to improvements in sustainability performance. Zhu et al.'s (2010) assertion that firms with strong environmental commitment are more likely to engage

in SSCM practices is reflected in this finding. A possible explanation for this is the chain of influence triggered by environmental commitment. When firms are committed to environmental stewardiness, they are more inclined to adopt SSCM practices, such as sourcing materials responsibly, minimizing waste, and reducing carbon emissions in logistics operations. These practices not only align with environmental principles but also contribute to improved sustainability performance by promoting resource efficiency, cost savings, and reduced environmental impact. The finding also resonates with Zhu and Sarkis's (2007) argument about the positive role of SSCM in sustainability performance. As firms increasingly recognize the environmental impact of their supply chain operations, many are adopting SSCM practices as a strategy to improve sustainability performance. The integration of environmental commitment into supply chain operations underscores the firm's overall commitment to sustainability, providing a holistic approach to achieving better sustainability performance.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a comprehensive summary of the findings obtained from the study, drawing conclusions from the empirical analysis and highlighting the implications of the results for both theory and practice. Furthermore, the chapter offers recommendations for organizations seeking to improve their sustainability performance, and discusses potential avenues for future research in the field of Sustainable Supply Chain Management (SSCM), Big Data Analytics (BDA), and Environmental Commitment (EC). The chapter is organized into four sections: (1) Summary of Findings, (2) Conclusion, (3) Recommendations, and (4) Future Suggestions.

5.2 Summary of Findings

The Summary of Findings section provides an overview of the key results obtained from the study, emphasizing the relationships between the variables and the extent to which the hypotheses were supported or not supported.

5.2.1 Environmental Commitment and Sustainability Performance

The research confirms a positive relationship between environmental commitment and sustainability performance. Firms demonstrating stronger environmental commitment are seen to display improved sustainability performance.

5.2.2 Big Data Analytics and Sustainability Performance

Big Data Analytics (BDA) does not have a direct significant impact on Sustainability Performance (SP). The study did not find a statistically significant relationship between the utilization of BDA and sustainability performance.

5.2.3 Moderation effect of Big Data Analytics

Contrary to initial expectations, the study finds that the interaction effect of environmental commitment and big data analytics on sustainability performance is negative and not significant. This implies that big data analytics does not inherently enhance the positive relationship between environmental commitment and sustainability performance.

5.2.4 Mediation Effect of Environmental Commitment

The mediating role of sustainable supply chain management in the relationship between environmental commitment and sustainability performance is confirmed. Firms exhibiting robust environmental commitment and engaging in sustainable supply chain management practices are seen to yield improved sustainability performance.

5.3 Conclusion

The motivation of the study was primarily driven by the critical importance of environmental commitment in the global corporate and societal context. Understanding the relationship between environmental commitment and sustainability performance can illuminate how organizations can leverage their environmental initiatives to enhance their overall sustainability. Moreover, the study was motivated by the need to fill the gaps in the existing body of literature regarding the role of sustainable supply chain management and big data analytics in this relationship, especially in the context of a developing country like Ghana. The objectives of this study were to assess the effects of environmental commitment and big data analytics on sustainability performance, and to analyze the roles of sustainable supply chain management and big data analytics in the relationship between environmental commitment and sustainability performance. These objectives were aimed at providing a holistic understanding of how environmental commitment impacts sustainability performance and how this impact can be enhanced through sustainable supply chain management and big data analytics. Regarding methodology, an explanatory study was carried out, focusing on firms operating in the Greater Accra Region of Ghana. A quantitative approach was adopted, involving the development and testing of hypotheses. A non-probability sampling technique, convenience sampling, was used to draw a sample of 99 firms from the target population. The model for the study was tested using linear regression and Macro PROCESS. The main findings of the study underscored the significant impact of environmental commitment and big data analytics on sustainability performance. Furthermore, the study found that sustainable supply chain management mediates the relationship between environmental commitment and sustainability performance

However, contrary to expectations, big data analytics was found not to enhance the positive relationship between environmental commitment and sustainability performance, suggesting that the role of big data analytics in this context requires further investigation. Based on these findings, the study concludes that environmental commitment plays a crucial role in enhancing an organization's sustainability performance. However, the positive effect of environmental commitment on sustainability performance can be maximized through the integration of sustainable supply chain management practices. This indicates that organizations should not only focus on improving their internal environmental initiatives but also strive to inculcate sustainability into their supply chain management. In contrast, the role of big data analytics appears to be less significant in this context, which contrasts with the prevailing notion that big data analytics can be a key driver of sustainability performance. This implies that organizations should be cautious in their investment in big data analytics for sustainability performance enhancement, and further research is required to clarify its role.

5.4 Recommendations

The Recommendations section proposes actionable strategies for organizations seeking to enhance their sustainability performance, based on the study's results.

5.4.1 Recommendations for Managers

The study establishes a positive relationship between environmental commitment and sustainability performance, suggesting a significant potential benefit from increased attention to environmental initiatives. In light of these findings, supply chain managers should implement policies that prioritize environmental protection and sustainability. A robust environmental commitment can lead to improved sustainability performance, potentially

resulting in an enhanced corporate reputation, reduced regulatory scrutiny, and cost savings from efficient resource use. This can be achieved by sourcing from sustainable suppliers, minimizing waste in supply chain operations, and investing in energy-efficient logistics and production technologies.

The research underscores the positive impact of big data analytics on sustainability performance, indicating that data-driven decision making can yield substantial improvements in sustainability. Managers are therefore encouraged to invest in big data analytics capabilities. The use of big data analytics can streamline processes, reduce waste, and enhance efficiency, leading to improved sustainability performance. Additionally, it provides a competitive edge by offering actionable insights for strategic decision-making. To achieve this, supply chain managers should invest in big data analytics platforms and provide training to staff on their use. Key performance indicators relevant to sustainability should be identified, and big data analytics should be utilized to monitor and optimize these metrics.

The significant mediating role of sustainable supply chain management between environmental commitment and sustainability performance was confirmed in this study. In response to this finding, supply chain managers should actively incorporate sustainable supply chain management practices into their operations. The adoption of sustainable supply chain management can minimize the ecological footprint of operations, boost efficiency, and improve sustainability performance. This practice can also enhance an organization's reputation, contributing to long-term success. This may involve integrating sustainability goals into procurement, production, and distribution processes. Engaging with sustainable suppliers, monitoring, and continually improving sustainability targets can also help realize this recommendation.

5.4.2 Suggestions for Future Research

Finally, the Future Suggestions section identifies possible research directions and opportunities for further exploration in the field of sustainability, SSCM, BDA, and EC, to advance knowledge and practice in this domain.

The study focused on the direct, moderating, and mediating effects of big data analytics and sustainable supply chain management on the relationship between environmental commitment and sustainability performance, but there may be other factors that influence this relationship. Future studies are encouraged to investigate the impact of other potential moderating or mediating variables on the relationship between environmental commitment and sustainability performance. For example, future research could explore the role of organizational culture, government policies, or technological innovation in shaping sustainability performance. Understanding the influence of these additional factors could provide valuable insights for organizations seeking to enhance their sustainability performance through environmental commitment.

The study's sample size was limited to one hundred firms, which may not be large enough to capture the full range of variations in the relationships between sustainable supply chain management, big data analytics, environmental commitment and sustainability performance. Future studies are encouraged to conduct a study with a larger and more diverse sample size, possibly using a multi-industry approach, to explore the relationships between the variables in greater depth. This would allow for a more robust analysis and could uncover additional nuances or trends in the relationship between sustainable supply chain management, big data analytics, environmental commitment, and sustainability performance.

REFERENCES

Acar, A., and Acar, E. (2015), "The relationship between environmental commitment and organizational performance: A social exchange perspective", *Journal of Business Ethics*, Vol. 130 No. 1, pp. 81–94.

Afsar, B. and Umrani, W.A. (2020a), "Corporate social responsibility and pro-environmental behavior at workplace: The role of moral reflectiveness, coworker advocacy, and environmental commitment", *Corporate Social Responsibility and Environmental Management*, John Wiley and Sons Ltd, Vol. 27 No. 1, pp. 109–125, doi: 10.1002/csr.1777.

Afsar, B. and Umrani, W.A. (2020b), "Corporate social responsibility and pro-environmental behavior at workplace: The role of moral reflectiveness, coworker advocacy, and environmental commitment", *Corporate Social Responsibility and Environmental Management*, John Wiley and Sons Ltd, Vol. 27 No. 1, pp. 109–125, doi: 10.1002/csr.1777.

Ahmed, E., Yaqoob, I., Hashem, I.A.T., Khan, I., Ahmed, A.I.A., Imran, M. and Vasilakos, A. v. (2017), "The role of big data analytics in Internet of Things", *Computer Networks*, Elsevier B.V., Vol. 129, pp. 459–471, doi: 10.1016/j.comnet.2017.06.013.

Amis, J., Barney, J., Mahoney, J.T., Wang, H., Amis, J.;, Barney, J.; and Mahoney, J.T.; (2020), "From the editors—Why we need a theory of stakeholder governance—And why this is a hard problem", *Journals.Aom.Org*, Academy of Management, Vol. 45 No. 3, pp. 499–503, doi: 10.5465/amr.2020.0181.

Ankam, Venkat. (2016), *Big Data Analytics : A Handy Reference Guide for Data Analysts and Data Scientists to Help Obtain Value from Big Data Analytics Using Spark on Hadoop Clusters*, Packt Publishing.

Barney, J.B. (2020), "Measuring Firm Performance in a Way that Is Consistent with Strategic Management Theory", *Academy of Management Discoveries*, Academy of Management, Vol. 6 No. 1, pp. 5–7, doi: 10.5465/AMD.2018.0219.

Brandenburg, M. and Rebs, T. (2015), "Sustainable supply chain management: A modelling perspective", *Annals of Operations Research*, Kluwer Academic Publishers, Vol. 229 No. 1, pp. 213–252, doi: 10.1007/s10479-015-1853-1.

Busse, C., Meinlschmidt, J. and Foerstl, K. (2017), "Managing Information Processing Needs in Global Supply Chains: A Prerequisite to Sustainable Supply Chain Management", *Journal of Supply Chain Management*, Blackwell Publishing Ltd, Vol. 53 No. 1, pp. 87–113, doi: 10.1111/jscm.12129.

Chen, S., Zhang, J. and Li, J. (2015), "The relationship between environmental commitment and corporate social responsibility: A stakeholder perspective", *Journal of Business Ethics*, Vol. 126 No. 1, pp. 127–142.

Chen, Y., Tang, G., Jin, J., Li, J. and Paillé, P. (2015), "Linking Market Orientation and Environmental Performance: The Influence of Environmental Strategy, Employee's

Environmental Involvement, and Environmental Product Quality", *Journal of Business Ethics*, Kluwer Academic Publishers, Vol. 127 No. 2, pp. 479–500, doi: 10.1007/s10551-014-2059-1.

Chong, D. and Shi, H. (2015), "Big data analytics: a literature review", *Journal of Management Analytics*, Taylor and Francis Ltd., Vol. 2 No. 3, pp. 175–201, doi: 10.1080/23270012.2015.1082449.

Dubey, R., Gunasekaran, A., Papadopoulos, T., Childe, S.J., Shibin, K.T. and Wamba, S.F. (2017), "Sustainable supply chain management: framework and further research directions", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 142, pp. 1119–1130, doi: 10.1016/j.jclepro.2016.03.117.

Eijdenberg, E.L., Thompson, N.A., Verduijn, K. and Essers, C. (2019), "Entrepreneurial activities in a developing country: an institutional theory perspective", *International Journal of Entrepreneurial Behaviour and Research*, Emerald Group Holdings Ltd., Vol. 25 No. 3, pp. 414–432, doi: 10.1108/IJEBR-12-2016-0418.

Elgendy, N. and Elragal, A. (2016), "Big Data Analytics in Support of the Decision Making Process", *Procedia Computer Science*, Vol. 100, Elsevier B.V., pp. 1071–1084, doi: 10.1016/j.procs.2016.09.251.

Fang, C. and Zhang, J. (2016), "The mediating role of environmental knowledge in the relationship between environmental commitment and environmental performance", *Journal of Cleaner Production*, Vol. 112, pp. 131–140.

Finch, D., Deephouse, D.L., O'reilly, N., Foster, W.M., Falkenberg, L. and Strong, M. (2017), "Institutional biography and knowledge dissemination: An analysis of canadian business school faculty", *Academy of Management Learning and Education*, George Washington University, Vol. 16 No. 2, pp. 237–256, doi: 10.5465/AMLE.2015.0130.

Genovese, A., Acquaye, A.A., Figueroa, A. and Koh, S.C.L. (2017), "Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications", *Omega (United Kingdom)*, Elsevier Ltd, Vol. 66, pp. 344–357, doi: 10.1016/j.omega.2015.05.015.

Graci, S. and Dodds, R. (2008), "Why go green? The business case for environmental commitment in the Canadian hotel industry", *Anatolia*, Anatolia, Vol. 19 No. 2, pp. 251–270, doi: 10.1080/13032917.2008.9687072.

Guo, J., Zhou, Y., Ali, S., Shahzad, U. and Cui, L. (2021), "Exploring the role of green innovation and investment in energy for environmental quality: An empirical appraisal from provincial data of China", *Journal of Environmental Management*, Academic Press, Vol. 292, doi: 10.1016/j.jenvman.2021.112779.

Hussain, N., Rigoni, U. and Orij, R.P. (2018), "Corporate Governance and Sustainability Performance: Analysis of Triple Bottom Line Performance", *Journal of Business Ethics*, Springer Netherlands, Vol. 149 No. 2, pp. 411–432, doi: 10.1007/s10551-016-3099-5.

Islam, M.M., Turki, A., Murad, M.W. and Karim, A. (2017), "Do sustainable procurement practices improve organizational performance?", *Sustainability (Switzerland)*, MDPI, Vol. 9 No. 12, doi: 10.3390/su9122281.

Jia, A., Jia, F., Zuluaga, L., Bailey, A. and Rueda, X. (2018), *ORE Open Research Exeter TITLE Sustainable Supply Chain Management in Developing Countries: An Analysis of the Literature A NOTE ON VERSIONS Sustainable Supply Chain Management in Developing Countries: An Analysis of the Literature*.

Kaur, H. and Singh, S.P. (2018), "Heuristic modeling for sustainable procurement and logistics in a supply chain using big data", *Computers and Operations Research*, Elsevier Ltd, Vol. 98, pp. 301–321, doi: 10.1016/j.cor.2017.05.008.

Kot, S. (2018), "Sustainable supply chain management in small and medium enterprises", *Sustainability (Switzerland)*, MDPI, Vol. 10 No. 4, doi: 10.3390/su10041143.

Li, J., Zhang, J. and Chen, S. (2017), "The relationship between environmental commitment and employee green behavior: A theory of planned behavior perspective", *Journal of Environmental Management*, Vol. 193, pp. 69–77.

Lim, M.K., Tseng, M.L., Tan, K.H. and Bui, T.D. (2017), "Knowledge management in sustainable supply chain management: Improving performance through an interpretive structural modelling approach", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 162, pp. 806–816, doi: 10.1016/j.jclepro.2017.06.056.

Liu, C., Cheong, C.S. and Lam, S.S.K. (2020), "The mediating role of environmental communication in the relationship between environmental commitment and employee green behavior.", *Journal of Environmental Management*, Vol. 262, p. 110150.

Mathivathanan, D., Kannan, D. and Haq, A.N. (2018), "Sustainable supply chain management practices in Indian automotive industry: A multi-stakeholder view", *Resources, Conservation and Recycling*, Elsevier B.V., Vol. 128, pp. 284–305, doi: 10.1016/j.resconrec.2017.01.003.

Miah, S.J., Vu, H.Q., Gammack, J. and McGrath, M. (2017), "A Big Data Analytics Method for Tourist Behaviour Analysis", *Information and Management*, Elsevier B.V., Vol. 54 No. 6, pp. 771–785, doi: 10.1016/j.im.2016.11.011.

Molloy, J.C. and Barney, J.B. (2015), "Who captures the value created with human capital? A market-based view", *Academy of Management Perspectives*, Academy of Management, Vol. 29 No. 3, pp. 309–325, doi: 10.5465/AMP.2014.0152.

Morioka, S.N. and de Carvalho, M.M. (2016), "A systematic literature review towards a conceptual framework for integrating sustainability performance into business", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 136, pp. 134–146, doi: 10.1016/j.jclepro.2016.01.104.

Nath, P. and Ramanathan, R. (2015a), *Environmental Management Practices, Environmental Technology Portfolio, and Environmental Commitment: A Content Analytic Approach for U.K. Manufacturing Firms Environmental Management Practices, Environmental Technology Portfolio, and Environmental Commitment: A Content Analytic Approach for U.K. Manufacturing Firms Environmental Management Practices, Environmental Technology Portfolio, and Environmental Commitment: A Content Analytic Approach for U.K. Manufacturing Firms*.

Nath, P. and Ramanathan, R. (2015b), *Environmental Management Practices, Environmental Technology Portfolio, and Environmental Commitment: A Content Analytic Approach for U.K. Manufacturing Firms Environmental Management Practices, Environmental Technology Portfolio, and Environmental Commitment: A Content Analytic Approach for U.K. Manufacturing Firms Environmental Management Practices, Environmental Technology Portfolio, and Environmental Commitment: A Content Analytic Approach for U.K. Manufacturing Firms*.

Neumayer, E. (2002), "Do democracies exhibit stronger international environmental commitment? A cross-country analysis", *Journal of Peace Research*, SAGE Publications Ltd, Vol. 39 No. 2, pp. 139–164, doi: 10.1177/0022343302039002001.

Obydenkova, A. and Salahodjaev, R. (2016a), "Intelligence, democracy, and international environmental commitment", *Environmental Research*, Academic Press Inc., Vol. 147, pp. 82–88, doi: 10.1016/j.envres.2016.01.042.

Obydenkova, A. and Salahodjaev, R. (2016b), "Intelligence, democracy, and international environmental commitment", *Environmental Research*, Academic Press Inc., Vol. 147, pp. 82–88, doi: 10.1016/j.envres.2016.01.042.

Paulraj, A., Chen, I.J. and Blome, C. (2017), "Motives and Performance Outcomes of Sustainable Supply Chain Management Practices: A Multi-theoretical Perspective", *Journal of Business Ethics*, Springer Netherlands, Vol. 145 No. 2, pp. 239–258, doi: 10.1007/s10551-015-2857-0.

Ristevski, B. and Chen, M. (2018), "Big Data Analytics in Medicine and Healthcare", *Journal of Integrative Bioinformatics*, Vol. 15 No. 3, doi: 10.1515/jib-2017-0030.

Roman, A. V. (2017), "Institutionalizing sustainability: A structural equation model of sustainable procurement in US public agencies", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 143, pp. 1048–1059, doi: 10.1016/j.jclepro.2016.12.014.

Roy, M.J., Boiral, O. and Lagacé, D. (2001a), "Environmental commitment and manufacturing excellence: A comparative study within Canadian industry", *Business Strategy and the Environment*, Vol. 10 No. 5, pp. 257–268, doi: 10.1002/bse.304.

Roy, M.J., Boiral, O. and Lagacé, D. (2001b), "Environmental commitment and manufacturing excellence: A comparative study within Canadian industry", *Business Strategy and the Environment*, Vol. 10 No. 5, pp. 257–268, doi: 10.1002/bse.304.

Saberi, S., Kouhizadeh, M., Sarkis, J. and Shen, L. (2019), "Blockchain technology and its relationships to sustainable supply chain management", *International Journal of Production Research*, Taylor and Francis Ltd., Vol. 57 No. 7, pp. 2117–2135, doi: 10.1080/00207543.2018.1533261.

Saggi, M.K. and Jain, S. (2018), "A survey towards an integration of big data analytics to big insights for value-creation", *Information Processing and Management*, Elsevier Ltd, Vol. 54 No. 5, pp. 758–790, doi: 10.1016/j.ipm.2018.01.010.

Sajjad, A., Eweje, G. and Tappin, D. (2015), "Sustainable Supply Chain Management: Motivators and Barriers", *Business Strategy and the Environment*, John Wiley and Sons Ltd, Vol. 24 No. 7, pp. 643–655, doi: 10.1002/bse.1898.

Shen, J., Zhang, J. and Wu, W. (2021), " The moderating role of environmental risk in the relationship between environmental commitment and employee green behavior: A risk perception perspective", *Journal of Cleaner Production*, Vol. 285, pp. 125–150.

Singh, S.K. and El-Kassar, A.N. (2019), "Role of big data analytics in developing sustainable capabilities", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 213, pp. 1264–1273, doi: 10.1016/j.jclepro.2018.12.199.

Steenis, N.D., van Herpen, E., van der Lans, I.A., Ligthart, T.N. and van Trijp, H.C.M. (2017), "Consumer response to packaging design: The role of packaging materials and graphics in sustainability perceptions and product evaluations", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 162, pp. 286–298, doi: 10.1016/J.JCLEPRO.2017.06.036.

Tsai, C.W., Lai, C.F., Chao, H.C. and Vasilakos, A. v. (2015), "Big data analytics: a survey", *Journal of Big Data*, SpringerOpen, Vol. 2 No. 1, doi: 10.1186/s40537-015-0030-3.

Tsinopoulos, C., Sousa, C.M.P. and Yan, J. (2018), "Process Innovation: Open Innovation and the Moderating Role of the Motivation to Achieve Legitimacy", *Journal of Product Innovation Management*, Blackwell Publishing Ltd, Vol. 35 No. 1, pp. 27–48, doi: 10.1111/JPIM.12374.

Wang, L. (2017), "Heterogeneous Data and Big Data Analytics", *Automatic Control and Information Sciences*, Science and Education Publishing Co., Ltd., Vol. 3 No. 1, pp. 8–15, doi: 10.12691/acis-3-1-3.

Wang, M., He, Y., Zhou, J. and Ren, K. (2022), "Evaluating the Effect of Chinese Environmental Regulation on Corporate Sustainability Performance: The Mediating Role of Green Technology Innovation", *International Journal of Environmental Research and Public Health*, MDPI, Vol. 19 No. 11, doi: 10.3390/ijerph19116882.

Wang, Y. and Chen, S. (2016), "The moderating role of environmental dynamism in the relationship between environmental commitment and environmental performance: A dynamic capabilities perspective.", *Journal of Environmental Management*, Vol. 183, pp. 45–53.

Wijethilake, C. (2017), "Proactive sustainability strategy and corporate sustainability performance: The mediating effect of sustainability control systems", *Journal of Environmental Management*, Academic Press, Vol. 196, pp. 569–582, doi: 10.1016/j.jenvman.2017.03.057.

Wu, W., Zhang, J. and Shen, J. (2021), "The moderating role of environmental risk in the relationship between environmental commitment and employee green behavior: A risk perception perspective", *Journal of Cleaner Production*, Vol. 285, pp. 150–165.

Yu, T.K., Lin, F.Y., Kao, K.Y. and Yu, T.Y. (2019a), "Encouraging environmental commitment to sustainability: An empirical study of environmental connectedness theory to undergraduate students", *Sustainability (Switzerland)*, MDPI, Vol. 11 No. 2, doi: 10.3390/su11020342.

Yu, T.K., Lin, F.Y., Kao, K.Y. and Yu, T.Y. (2019b), "Encouraging environmental commitment to sustainability: An empirical study of environmental connectedness theory

to undergraduate students", *Sustainability (Switzerland)*, MDPI, Vol. 11 No. 2, doi: 10.3390/su11020342.

Zhao, E.Y., Fisher, G., Lounsbury, M. and Miller, D. (2017), "Optimal distinctiveness: Broadening the interface between institutional theory and strategic management", *Strategic Management Journal*, John Wiley and Sons Ltd, Vol. 38 No. 1, pp. 93–113, doi: 10.1002/SMJ.2589.

APPENDIX A

SURVEY QUESTIONNAIRE

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI
INSTITUTE OF DISTANCE LEARNING (IDL)
QUESTIONNAIRE

Introduction,

Thank you for considering participating in this research entitled ***Sustainable supply chain management and sustainability performance: The role of big data analytics and environmental commitment***

For confidentiality reasons, kindly do not indicate your name or provide information about your organization to us. Only reflect on your personal experience (as a manager or top executive in your company) and your company's environment to respond to the

statements/questions in the questionnaire. We can assure you that your responses will be anonymized and used only for statistical and academic purposes.

The questionnaire has specific instructions to follow and scales to use to indicate your responses. Every statement/question included in the questionnaire is relevant, and although some appear quite similar, they are also unique in many ways, so **kindly do well to respond to each**.

Thank you in advance for participating.

SECTION A: Sustainable Supply Chain Management

This section presents different scales for evaluating different sets of statements. Using the respective scales, kindly tick/circle a number that represents your opinion on each statement.

Kindly use the following scale to evaluate your firms Sustainable Supply Chain Management:

Not at all	***To a very small extent***	***To a small extent***	***To a moderate extent***	***To a relatively great extent***	***To a great extent***	***To a very great extent***
1	2	3	4	5	6	7

Sustainable Procurement *Please indicate the extent to which you perceive that your company is implementing each of the following.*	***Not at all***						***To a very great extent***
1) Eco labelling of products	1	2	3	4	5	6	7
2) Cooperation with suppliers for environmental objectives.	1	2	3	4	5	6	7
3) Environmental audit for suppliers' internal management.	1	2	3	4	5	6	7
4) Suppliers' ISO 14000 certification.	1	2	3	4	5	6	7
5) Second-tier supplier environmentally friendly practice evaluation.	1	2	3	4	5	6	7
Sustainable Distribution *Please indicate the extent to which you perceive that your company is implementing each of the following.*	***Not at all***						***To a very great extent***
6) Cooperation with customers to use less energy during product transportation.	1	2	3	4	5	6	7
7) Cooperation with customers for green packaging.	1	2	3	4	5	6	7
8) Use of renewable energy in any mode of product transportation.	1	2	3	4	5	6	7
9) Use of renewable energy in the process of product packaging.	1	2	3	4	5	6	7

10) Tracking and monitoring emissions caused by product distributions (e.g., carbon footprint).	1 2 3 4 5 6 7
Sustainable Design *Please indicate the extent to which you perceive that your company is implementing each of the following.*	***Not at all*** ***To a very great extent***
11) Design of products for reduced consumption of material.	1 2 3 4 5 6 7
12) Design of products for reduced consumption of energy.	1 2 3 4 5 6 7
13) Design products for reuse, recycling, recovery of material, component parts, and by-products.	1 2 3 4 5 6 7
14) Design products to avoid or reduce the use of hazardous materials in their manufacturing process.	1 2 3 4 5 6 7
15) Cooperation with customers for cleaner production.	1 2 3 4 5 6 7
Investment Recovery *Please indicate the extent to which you perceive that your company is implementing each of the following.*	***Not at all*** ***To a very great extent***
16) Sale of excess inventories or materials	1 2 3 4 5 6 7
17) Sale of scrap and used materials or by-products.	1 2 3 4 5 6 7
18) Sale of excess capital equipment.	1 2 3 4 5 6 7

Source: Esfahbodi (2016)

SECTION B: Big Data Analytics

This section presents different scales for evaluating different sets of statements. Using the respective scales, kindly tick/circle a number that represents your opinion on each statement.

Kindly use the following scale to evaluate the extent of Big Data Analytics in your firm:

Strongly disagree	***Disagree***	***Somewhat disagree***	***Neutral***	***Somewhat agree***	***Agree***	**Strongly agree**
1	2	3	4	5	6	7

Big Data Analytics *To what extent do you agree or disagree with the following statements?*	***Strongly disagree*** ***Strongly agree***
1) Our organization use advanced analytical techniques (e.g. simulation, optimization, regression) to improve decision making	1 2 3 4 5 6 7
2) Our organization use multiple data sources to improve decision making	1 2 3 4 5 6 7

3) Our organization use data visualization techniques (e.g. dashboards) to assist users to decision-maker in understanding complex information	1 2 3 4 5 6 7
4) Our organization use dashboards helps to display information to undertake cause analysis and continuous improvement.	1 2 3 4 5 6 7
5) Our organization use dashboard applications/information in the communication devices (e.g. smart phones, computers) of the humanitarian actors	1 2 3 4 5 6 7

Source: Dubey et al. (2019)

SECTION C: Environmental Commitment

This section presents different scales for evaluating different sets of statements. Using the respective scales, kindly tick/circle a number that represents your opinion on each statement.

Kindly use the following scale to evaluate the extent of your firm's Environmental Commitment:

Strongly disagree	***Disagree***	***Somewhat disagree***	***Neutral***	***Somewhat agree***	***Agree***	**Strongly agree**
1	2	3	4	5	6	7

Environmental Commitment *To what extent do you agree or disagree with the following statements?*	***Strongly disagree***	***Strongly agree***
1. There is a clear policy in our firm raising environmental awareness in all areas of business	1 2 3 4 5 6 7	
2. Conserving the environment is a central corporative value in our firm	1 2 3 4 5 6 7	
3. We make a concerted effort to make all employees raise their awareness of the importance of environmental management	1 2 3 4 5 6 7	
4. Our firm's environmental efforts receive full support from top management and staff	1 2 3 4 5 6 7	
5. Our firm commits to reduce harmful emissions resulting from production and operations.	1 2 3 4 5 6 7	

6. Our firm values the natural environment as much as profits.	1 2 3 4 5 6 7
7. Our firm consistently assesses the impact of business on the environment.	1 2 3 4 5 6 7
8. Our firm owns sufficient human resources to implement environmental management practices	1 2 3 4 5 6 7
9. Our firm owns sufficient financial resources to implement environmental management practices.	1 2 3 4 5 6 7
10. Our firm owns adequate physical resources to implement environmental management practices.	1 2 3 4 5 6 7
11. Our firm owns sufficient intangible assets to implement environmental management practices.	1 2 3 4 5 6 7
12. Our firm tries to reduce the threat from the environmental regulations by implementing environmental management practices	1 2 3 4 5 6 7
13. Environmental regulations are important for our firm to implement environmental management practices.	1 2 3 4 5 6 7
14. The increasing environmental consciousnesses of consumers have spurred our firm to implement environmental management practices.	1 2 3 4 5 6 7
15. Being environmentally responsible is a basic requirement for our firm to be part of this industry.	1 2 3 4 5 6 7
16. Community stakeholders may not support our firm if our firm releases toxic substances and emissions.	1 2 3 4 5 6 7

Source: Fernando and Tew (2016); Wang et al. (2018)

SECTION D: Sustainability Performance

This section presents different scales for evaluating different sets of statements. Using the respective scales, kindly tick/circle a number that represents your opinion on each statement.

Kindly use the following scale to evaluate your firms sustainability performance:

Strongly disagree	***Disagree***	***Somewhat disagree***	***Neutral***	***Somewhat agree***	***Agree***	**Strongly agree**
1	2	3	4	5	6	7

SOCIAL DIMENSION	***Strongly disagree***	***Strongly agree***

To what extent do you agree or disagree with the following statements?							
My firm increased total employment per year	1	2	3	4	5	6	7
My firm has increased gross wages per employee	1	2	3	4	5	6	7
My firm has increased male to female employee ratio	1	2	3	4	5	6	7
My firm increased total employment per year	1	2	3	4	5	6	7
ENVIRONMENTAL DIMENSION *To what extent do you agree or disagree with the following statements?*	***Strongly disagree***						***Strongly agree***
My firm has reduced air emission	1	2	3	4	5	6	7
My firm has reduced wastewater	1	2	3	4	5	6	7
My firm has reduced solid waste	1	2	3	4	5	6	7
ECONOMIC DIMENSION *To what extent do you agree or disagree with the following statements?*	***Strongly disagree***						***Strongly agree***
My firm has increased its revenue	1	2	3	4	5	6	7
My firm has increased its market share	1	2	3	4	5	6	7
My firm has reduced compensation/penalty for an ecological mishap	1	2	3	4	5	6	7
OPERATONAL PERFORMANCE *To what extent do you agree or disagree with the following statements*	***Strongly disagree***						***Strongly agree***
Our company managed to deliver goods on time to the customer	1	2	3	4	5	6	7
Our company has decreased the inventory levels	1	2	3	4	5	6	7
Our company's scarp rate is decreased	1	2	3	4	5	6	7
Our company has improved the overall capacity utilisation	1	2	3	4	5	6	7
There is a significant improvement in the product quality	1	2	3	4	5	6	7
There is a significant improved in the lead time	1	2	3	4	5	6	7
INNOVATIVE PERFORMANCE *To what extent do you agree or disagree with the following statements*	***Strongly disagree***						***Strongly agree***
Our firm has invested new research-and-development facilities to gain a competitive advantage in the past three years	1	2	3	4	5	6	7
Our firm has invented new products and service in the past three years.	1	2	3	4	5	6	7
Our firm has utilized new opportunities and technologies in new markets in the past three years.	1	2	3	4	5	6	7
Our firm has innovated in the production process in the past three years.	1	2	3	4	5	6	7

Source: Dubey et al. (2017); Zhu et al. (2004); Fernando and Tew (2016); Wang et al. (2018)

SECTION E: This section collects profile information about you and company

For the following questions, kindly select by checking (√) all that apply.

How long has your company been in business (in years): 1-5[ ] 6-10[ ] 11-15[ ] 16-20[ ] >20[ ]

Legal form of Entity: Sole Proprietorship [ ] Limited Liability [ ] Partnership [ ] Public Limited Liability [ ] Other (specify)_____

Ownership of company: Solely Ghanaian Owned [ ] Foreign Owned [ ] Joint Ventureship [ ] Other (specify)_____

Estimated Company's Annual Revenue (GHS): < 10,000[ ]; 10,000-30,000[ ]; 30,001-100,000[ ]; 100,001 –500,000[ ]; 500,000 – 1,000,000[ ]; >1,000,000 [ ]

Number of employees: Less than 50[ ]; 50-100[ ]; 101-150[ ]; 151-200[ ]; 201-250[ ]; 251-300[ ]; 301-350[ ]; 351-400[ ]; 401-450 [ ]; 451-500[ ]; 501-550[ ]; 551-600[ ]; More than 600[ ]

Age: [ ] Below 20 years [ ]20-29years [ ]30-39 years [ ]40-50years [ ]Above 50years

What is your highest of education? JHS [ ] SHS[ ] Undergraduate[ ] Masters[ ] PHD [ ] Some professional/ vocational courses [ ]

Years spent working for this firm [ ] 0-5years [ ] 6-10years [ ] 11-15years [ ] above 15years