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Circular Economy Capability and Supply Chain Sustainability: The Mediating effect of Green Orientation and the Moderating role of Technology Orientation

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(PG 4478320)

SEPTEMPER, 2022

DECLARATION

I hereby declare that this submitted thesis is my own work towards the attainment of MPhil in logistics and supply chain management. To the best of my knowledge, it contains no material previously published by another person or material which has been accepted for the award of any other degree of the university, except where references of other scholar's work have been cited and acknowledged appropriately.

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ABSTRACT

The main goal of the study is to examine how well the circular economy works and how sustainable the supply chain is: the role of green orientation as a mediator and the role of technology orientation as a moderator. This study was conducted using a quantitative research approach. A sample size of 180 senior managers was determined from the manufacturing firms selected in Ghana using a purposive sampling technique. A structured questionnaire guide is used as the primary data collection tool. The Statistical Package for Social Sciences (SPSS) and Smart PL-SEM were used to analyze the data. Descriptive and inferential research methodologies were used to analyze the data. The result shows that circular economy capability significantly predicts economic, environmental, and social sustainability positively. "Green" orientation significantly relates economic, environmental, and social sustainability. The mediating role of green orientation shows a significant impact on economic, environmental, and social sustainability. The result further showed that technology orientation does moderate the influence of circular economy capability on supply chain sustainability (economic, environmental, and social). The study, therefore, highlighted some managerial contributions based on the findings. The model of the study gives a clearer understanding of the core factors that relates supply chain sustainability in the context of multinational firms in Ghana. The outcome of the study also provided insight for practice by identifying individual factors that contribute to social, economic, and environmental sustainability in the supply chain. These factors can be used by multinational firms to develop strategies to deal with challenges regarding specific sustainability issues in the supply chain in Ghana. It is important to understand that, holistically, CEC, GO, and TO have a role to play in ensuring supply chain sustainability. So, it's important for the people who matter to come up with policies and good plans to help CEC, GO, and TO in Ghana deal with the problems they face.

DEDICATION

I dedicate this study to my beautiful wife Aisha Majabau, Director and Deputy Director of my department, Procurement and Supply Chain Management of Ministry of Health, Accra, Ghana. This successful completion has been possible due to their understanding, patience and encouragement that kept me sustained throughout the challenging journey.

ACKNOWLEDGEMENT

I express my profound and deepest gratitude to Almighty Allah for showering me with His grace and mercy throughout my thesis progressive journey.

My appreciation goes to my supervisor Prof. Kwame Owusu Kwateng for his excellent guidance and encouragement through this successful research project.

Prof. David Asamoah Head of Department (HoD), thank you for making me believed in myself from the beginning to the successful end of my study.

Finally, but not the least, my warmly greetings go to all my lecturers for their hard work, dedications and various support given to me enabled the attainment of my MPhil logistic and supply chain management degree from KNUST.

Thank you all very much.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

With increasing attention to environmental pollution, such as climate change, resource depletion, loss of biodiversity, and air pollution within the competitive business environment, companies today have restricted their actions that may cause threats to the environment (Gupta et al., 2019). In view of that, management of risks that arise from environmental and social factors has become more important than ever before and sustainable procurement has gained more prominence as both a concept and a practice (Jabbour et al., 2019). In the last decade, green and sustainable supply chain management practices have been developed, trying to integrate environmental concerns into organizations by reducing the unintended negative consequences on the environment of production and consumption processes (Stahel, 2016; Teixeira et al., 2016).

Sustainability is defined as the process whereby organizations meet their needs for goods, services, work and utilities in a way that generate value for money on a whole-life basis in terms of generating benefits not only to the organization but also to society and the economy, whilst minimizing damage to the environment. A sustainable supply chain is therefore an approach that ponders the economic (profit), environmental (planet) and social (people) dimensions when making procurement decisions (Bologa et al., 2017; Erol et al., 2016; Scuotto et al., 2020; Stock and Seliger, 2016). Interestingly, the concepts of green and sustainable supply chain management have been developed in parallel to the circular economy discourse, which has been propagated in the industrial ecology literature and practice for a long time (Geissdoerfer et al., 2016; Porter and Kramer, 2017; Nidumolu et al., 2019).

Sustainable supply chain management seeks to integrate environmental concerns into organizations by minimizing materials' flow or by reducing unintended negative consequences of production and consumption processes (Osterwalder and Pigneur, 2017). To date, supply chain issues remain one of the interesting areas that have garnered a lot of attention from practitioners and researchers. Also, one of the basic subjects of research around the world is hinged on ensuring the protection of the environment in the attainment of sustainability (Yahya, Jamal, Sundarakani, and Omain, 2021). Sustainability comprises economic, social, and environmental factors (Esmaeel, Zakuan, Jamal, and Taherdoost, 2018).

Sustainability in the supply chain has been an interesting topic in the policy field (Borodin, Bourtembourg, Hnaien, and Labadie, 2016). For many years now, a lot of studies found in the management literature deal with the sustainability of supply chains (SC). However, these works are from researchers in Europe, parts of Asia, and the United States (Fahimnia, Sarkis, and Davarzani, 2015). Meanwhile, supply chain sustainability studies among developing countries such as Ghana are far behind research for SC sustainability in developed countries (Jia, Zuluaga-cardona, Bailey, and Rueda, 2018). There has been a rapid increase in research on SC sustainability for developed countries since 2008 (Jia et al., 2018), and even though scholars have researched and contributed to sustainable production in businesses and industries, the growth rate is still slow. There is a need for better and smarter ways to develop sustainable production, especially in the context of developing economies (Vermeulen and Witjes, 2016).

Most studies on supply chain sustainability have been done in developed economies and focused on external factors (Mani et al., 2016; Majumdar, Shaw, and Sinha, 2020; Majumdar and Sinha, 2018; Sirilertsuwan, Ekwall, and Hjelmgren, 2018), but little work has been done in the supply chains of emerging regions, such as those in Sub Sahara Africa (SSA) (Kusi-sarpong, Gupta and

Sarkis, 2019). In addition, developing countries have seen little research on sustainability from both the supplier's and buyer's perspectives in the supply chain, even though SC sustainability remains a topical issue of international interest (Jia et al., 2018). Therefore, it is only expedient and important that supply chain sustainability research be done in various developing countries, such as Ghana, to properly address global issues in the sustainable supply chain. In the last 10 years, many different supply chain sustainability drivers have improved and been used. Circular economy issues have also become an important part of achieving sustainability in modern supply chains.

McDonough et al. (2017) viewed a circular economy as a push on the frontiers of environmental sustainability by emphasizing the idea of transforming products in such a way that there are workable relationships between ecological systems and economic growth (Francas and Minner, 2017). This is achieved by creating a paradigm shift in the redesign of material flows based on long-term economic growth and innovation (Tseng et al., 2018). It is implied that a circular economy is concerned not only with reducing the use of the environment as a sink for residuals or with delaying cradle-to-grave material flows but also with the development of metabolisms that allow for self-sustaining, natural, and repeatable methods of production (Yang et al., 2016).

The integration of Circular Economy practices into supply chain management has been advocated as a means to enhance sustainability. While empirical evidence suggests a positive relationship between Circular Economy practices and Supply Chain Sustainability, the mechanisms through which this relationship operate remain unclear. One key factor that may mediate this relationship is an organization's Green Orientation, which reflects its commitments to environmentally responsible behaviors and decisions.

The problem at hand is to understand whether and how Green Orientation mediates the relationship between Circular Economy practices and Supply Chain Sustainability.

Again, Circular Economy (CE) paradigm has gained significant prominence as a sustainable business model that aims to reduce waste, optimize resource use, and promote environmental responsibility. Concurrently, Supply Chain Sustainability (SCS) has become a critical focus for organizations aiming to balance economic, social, and environmental dimensions within their supply chain operations. This research seeks to explore the moderating role of Technology Orientation (TO) in the relationship between Circular Economy Capability (CEC) and Supply Chain Sustainability, aiming to understand how technological orientation influences the strength and direction of this relationship. As organizations strive to align their supply chain operations with circular economy principles, they need to leverage technological advancements effectively. Circular Economy Capability refers to an organization's capacity to implement circular economy practices such as product reuse, remanufacturing, and recycling. However, the effectiveness of these capabilities in promoting supply chain sustainability may vary depending on the organization's Technology Orientation.

1.2 Statement of the Problem

The concepts of green and sustainable supply chain management have been developed in parallel to the circular economy discourse, which has been propagated in the industrial ecology literature and practice for a long time (Geissdoerfer et al., 2016; Porter and Kramer, 2017; Nidumolu et al., 2019). Circular economy practices can contribute to a green environment and improve social development by institutionalizing various sustainable practices and initiatives, such as buying environmentally friendly products. Prior studies indicate that sustainable procurement plays a critical role in ensuring social and environmental responsibility (Arlow, 2018). Circular economy practices, according to past studies, play a critical role in ensuring sustainable procurement performance (Arlow, 2018). Prior studies have shown that circular economy practices significantly drive sustainability (Kravchenko et al., 2019; Tseng et al., 2020; Abad-Segura et al., 2020; Hysa et al., 2020; Del Giudice et al., 2020; Nikolaou et al., 2021; Khan et al., 2021). McDonough et al. (2017) viewed a circular economy as a push on the frontiers of environmental sustainability by emphasizing the idea of transforming products in such a way that there are workable relationships between ecological systems and economic growth (Francas and Minner, 2017). This is achieved by creating a paradigm shift in the redesign of material flows based on long-term economic growth and innovation (Tseng et al., 2018). It is implied that a circular economy is concerned not only with reducing the use of the environment as a sink for residuals or with delaying cradle-to-grave material flows but also with the development of metabolisms that allow for self-sustaining, natural, and repeatable methods of production (Yang et al., 2016). An important aspect of circular economy that has been ignored is the concept of circular economy capability. It reflects environmental performance in terms of production, but few studies have investigated CEC as an indicator of firm performance for sustainable supply chains (Zeng et al., 2017). Despite the recognition of circular economy capability as potentially instrumental in enhancing supply chain sustainability, the extent to which the two variables relate appears to have received little attention in the supply chain literature. To date, it is still unclear how circular economic capability could drive supply chain sustainability, especially in the context of developing economies. As a result, Nikolaou et al. (2021) have proposed that researchers should examine the circular economy capability and supply chain sustainability nexus in future studies. Thus, the main question which this study seeks to answer is: what is the relationship between Circular Economy Capability (CEC) and Supply Chain Sustainability (SCS)?

Again, in the view of Donaldson (2006) it is not sufficient to examine a bivariate relationship because there could be other variables which may influence the interaction between the independent and the dependent variables. It could be a moderating or mediating variable. Hence, for the purpose of valid generalization, researchers must at least propose and examine a trivariate causal relationship (Saeidi et al., 2019). In this study, Green Orientation (GO) and Technology Orientation (TO) have been proposed in the research model as a mediator and moderator respectively. Also, the interface between CEC, GO, and TO in driving a SCS has also not been given adequate attention in extant literature. In the contemporary global business environment, the imperative for sustainable practices in supply chains has never been more pressing. Circular Economy Capability (CEC), which encompasses principles such as waste reduction, resource optimization, and product life extension, has emerged as a pivotal driver of sustainability within supply chain management. Yet, understanding the mediating role of Green Orientation in the relationship between CEC and Supply Chain Sustainability remains an unexplored dimension of critical significance.

Circular economy principles encourage organizations to adopt sustainable practices, but the extent to which an organization's Green Orientation mediates the relationship between CEC and Supply Chain Sustainability outcomes remains largely ambiguous. Green Orientation represents an organization's commitment and dedication to environmental concerns, including its policies, strategies, and practices aimed at reducing environmental impact. This orientation may encompass aspects like green procurement, energy-efficient operations, and eco-friendly product design.

This research seeks to elucidate whether and how Green Orientation mediates the relationship between an organization's Circular Economy Capability and the attainment of Supply Chain Sustainability objectives.

Again, given the rapid advancements in technology and their potential to revolutionize supply chain processes, understanding the moderating role of TO in the relationship between CEC and Supply Chain Sustainability is crucial. While CEC focuses on eco-friendly practices such as recycling, remanufacturing, and product design for durability, TO represents an organization's inclination towards adopting and leveraging cutting-edge technologies like Internet of Things (IoT), artificial intelligence (AI), and block chain to enhance supply chain efficiency, traceability, and transparency. This research aims to investigate whether and to what extent an organization's level of TO amplify or dampens the impact of CEC on achieving Supply Chain Sustainability goals. To fill this gap, this study, based on resource-based view, argue that CEC may be the key to a SCS but the relationship may depend on how much organizations care about technology and being green.

1.3 Objectives of the Study

The main objective of the study is to assess the circular economy capability and supply chain sustainability: the mediating effect of green orientation and moderating role of technology orientation.

The study then seeks to address the following specific objectives:

1. To assess the extent to which circular economy capability drives supply chain sustainability manufacturing firms.
2. To examine the mediating effect of green orientation between circular economy capability-supply chain sustainability relationships.
3. To examine the moderating role of technology orientation in the relationship between circular economy capability and supply chain sustainability of manufacturing firms.

1.4 Research Questions

Given the above specific objectives, the following questions would be asked.

1. What is the extent to which circular economy capability drives the supply chain sustainability of manufacturing firms?
2. What is the mediating effect of green orientation between circular economy capability-supply chain sustainability relationships?
3. What is the moderating role of technology orientation in the relationship between circular economy capability and supply chain sustainability?

1.5 Significance of the Study

In addressing the objectives, the study contributes in two respects. Theoretically, the study extends sustainability research to strategic management by showing that circular economy capability drives the supply chain sustainability of an organization. Again, the study contributes by focusing on the moderating roles of technology orientation and the effect of mediating roles of green orientation to extend the domains of the resource-based view framework by showing that the positive relationship between circular economy capability and supply chain sustainability may be moderated by technology orientation and the mediating effect of green orientation. The study again adds to empirical studies by investigating the relationships between three different kinds of circular economy supply chain practices and sustainable supply chain performance. It contributes to the nascent knowledge about circular economy supply chains and provides useful insights for practitioners.

Practically, the study draws management's attention to the need to focus on a circular economy as a potential driver of supply chain sustainability. Further, the study seeks to inform management on the need to develop procurement and supply chain competencies within the organization to achieve competitive advantage and provide the needed commitment that goes with it since a circular economy is highly resource-intensive. The study again informs policy direction regarding the need to push from a linear economy to a more circular economy within the corporate environment since conservation of the environment, protection of human rights, and keeping economic activities running are now key in our contemporary business environment.

1.6 Overview of Research Methodology

Research Design refers to the plan for collecting and analyzing data (Bryman 2017). On the other hand, Berman (2016) defines research design as the framework of research methods and techniques chosen by a researcher. There are two types of research design, namely; descriptive and exploratory design. Exploratory research aims at providing insights into and an understanding of the problem faced by the researcher whilst Descriptive research, on the other hand, aims at describing something, mainly functions and characteristics. With the exploratory design, the data collected will help contribute to the development of the research study, however, the descriptive design will help the researcher assess the effect of mediating role of green orientation and the extent to which technology orientation moderates the relationship between circular economy capability and supply chain sustainability.

A research strategy is an overall plan for conducting a research study. It, however, guides a researcher in planning, executing, and monitoring the study. There are two main basic types of research strategy. These are surveys and case studies. A case study refers to research in which an individual, group, or a particular situation is studied, while a survey refers to research where data is gathered from an entire population or an exceptionally large sample to comprehend the opinions on a particular matter. The current study, therefore, employs a survey and uses a single respondent method. The study focuses on multinational firms in Ghana.

According to Cohen et al. (2017), research approaches are plans and procedures for research that span the steps from broad assumptions to detailed methods of data collection, analysis, and interpretation. It could be said that the research approach consists of three basic types, namely, qualitative approach, quantitative approach, and mixed approach (Saunders et al., 2017). Based on the available research approaches to the study, the researcher used a quantitative approach, which aided in assessing the relationships between the constructs.

1.6.1 Sampling and Sample Size

Sampling is the process of selecting respondents from a population under study (Hungler, 2013). It is assumed to be a representation of the population. Although there are various sampling techniques available for research, with regard to this research study, a probability sampling technique was adopted to select the sample size for the study. Sample size refers to the subset or subunit of the total population size that the researcher intends to focus on with the research study (Polit and Hungler, 2017). Yamane's formula was adopted to determine the sample size for the study.

1.6.2 Data Collection Instrument

Data collection instruments are research tools designed to collect data for the purpose of analysis (Halanad et al., 2017). Quantitatively, the data will be collected using a structured closed-ended questionnaire from the multinational firms. Again, a Likert Scale, ranging from 1 to 5, example (1- Strongly Disagree, 2- Disagree, 3- Neutral 4- Agree 5- Strongly Agree) will be adopted.

1.6.3 Data Analysis

All the analyses were conducted using IBM SPSS version 26 and Smart PLS SEM. Firstly, descriptive statistics involving the use of statistical tools such as frequency, means and standard deviations were used in analyzing the data collected. Secondly, inferential statistics involving the use of correlation and regression analyses were done to analyze the nature of relationship between the study constructs.

1.7 Scope of the Study

Geographically, Ghana is chosen as the study area to enable the researcher tests the proposed theoretical framework empirically. Contextually, the manufacturing sector was chosen to assess how supply chain sustainability can be achieved through circular economy and the mediating effect of green orientation and the moderation role of technology orientation. The choice of sector is deemed appropriate since the management of that industry is involved in several procurement and supply chain activities, hence the need to assess how circular economy capability will drive supply chain sustainability. Conceptually, the study therefore seeks to assess the mediating effect of green orientation and moderating role of technology orientation on circular economy capability and supply chain sustainability of multinational firms.

1.8 Limitation of the study

Just as related to other research, there are also some constraints related to this study. To begin with, the collected data was retrieved from a single country, Ghana, so the outcome will be difficult to generalize. Again, it is not clear whether the outcome will have the same effect on circular economy capability on supply chain sustainability and the mediating effect of green orientation and the moderating role of technology orientation in another context since it may be possible that the needs and perception of respondents in other countries may differ. Furthermore, the factors that are measured to have a positive significant relation on supply chain sustainability may prove otherwise in other countries. Secondly, the outcome of the study relies on cross-sectional data and covers the views of the managers during a specific period. Meanwhile, using a cross-sectional strategy limits the study’s capability to examine the mediating effect of green orientation and the moderating role of technology orientation in ensuring sustainability over some time. However, a longitudinal approach that follows respondents over some time could be used to offer much more insight into examining the role of the mediating effect of green orientation and the moderating role of technology orientation and supply chain sustainability. This research made use of quantitative techniques in data collection and analysis. The use of a questionnaire offered very valuable information on the subject matter. But using qualitative data like interviews could also give more information about the subject.

1.9 Organization of the Study

The study comprises five chapters. The first chapter is the study's introduction, which talks about the study's background and explains why this research was done. The chapter also captures the problem statements, research questions, the scope of the study, and an explanation of the significance of the study, and the last part of this chapter captures the definitions of the terms used. Chapter two discusses the literature review from the existing knowledge of research. In this chapter, the researcher will attempt to look further into the resource-based theory by looking at its relationship with CEC and the mediating role of green orientation. However, the social exchange theory underpins the entire model and the supply chain sustainability part is looked at by this study as supply chain sustainability. Furthermore, chapter two attempts to explain the theoretical concepts of the research as well as develop a model based on the previous research work of academic scholars. Chapter three focuses on the proposed method that the research used. It comprises the research design, the target population and sample, the data collection method, and lastly, the proposed tools that were used in analyzing the data. All these are well explained. Chapter four presents the empirical results of the study and a discussion of the findings from the field. This section contains the results of the pilot study and an analysis of the main study. The study employed both SPSS and Smart PLS software to analyze the data and validate the measurement model and the structural model employed. Chapter five discusses the conclusion of the study and summaries the findings in connection with the objectives of the study. The chapter also explains the contributions and limitations of the research and provides suggestions for future research directions.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Chapter Two of this thesis is organized into four main sub-headings. The information in this chapter is grouped into four sections: conceptual review, theoretical review, empirical review, and research model and hypotheses development. The conceptual review section provides definitions, operationalization, and how the constructs have been used in this study. The theoretical review section also provides the theoretical underpinnings of the study. The various prepositions proposed in this study were depicted using a conceptual framework, and various relationships were well discussed. The chapter ends with a summary which also highlights the gap explored in this study.

2.2 Conceptual Review

This section provides definitions, operationalization, and how these constructs have been used in this study. The model has four main constructs (Circular Economy Capability, Supply Chain Sustainability, Green Orientation, and Technology Orientation). These constructs have been operationalized in subsequent sections below.

2.2.1 Capability for a Circular Economy

The concept of "circular economy capability" (CEC) describes a business's capacity to put the 3R (reduce, reuse, and recycle) ideas into practice (Anderson, 2007). A circular economy is a system of connected circular economy practices that work together to achieve a single objective. Circular economies incorporate all economic activities, from production to consumption to waste recycling. To make the economy function as a closed-loop system in which resources-products-renewable resources' (Anderson, 2007), circular economies reduce resource usage, improve manufacturing efficiency, and minimize the environmental impact of commerce. Traditional open economic development is transformed (Sauvé et al., 2015). Despite the fact that the linear economy has been dominant since mass production, Sauvé et al. (2015) argue that the circular economy concept refers to a distinct production as well as consumption model. Industrial and consumer activities cause environmental issues, waste, and pollution, which are issues of the linear economy. The circular economy is an economic system that represents a paradigm shift in the way that human society interacts with nature and strives to prevent resource depletion, close energy and material loops, and promote sustainable development at the micro, meso, and macro levels, as described by Prieto-Sandoval et al. (2019). Schoder et al. (2019) included a circular economy definition from the European Environment Agency in their article. In theory, all types of natural resources, including biotic and abiotic materials, water, and soil, can be subject to the circular economy concept. The circular economy places a strong emphasis on concepts like waste reduction, recycling of garbage, sharing of products, and repair, reuse, renewal, and reproduction. According to (Whiles Morseletto, 2020), the circular economy is a theory that demonstrates how economic expansion can occur without endangering the environment or depleting natural resources. It also demonstrates the viability of sustainable development. In this study, the term "circular economy capability" (CEC) will be used to refer to a firm's capacity to execute the 3R principles, according to Anderson's definition of CEP from 2007. (Reduce, Reuse, and Recycle). The CEC index considers environment, society, and economy (Zeng et al., 2017). The circular economy is driven by a number of economic, social, institutional, and environmental factors (Zeng et al., 2017). Climate change is one of the things that drives the circular economy from an environmental, institutional, and social point of view (OECD, 2021). The circular economy is largely driven by climate change and other institutional and social forces (OECD, 2021). Eco-industrial parks, which are at the center of eco-industrial parks concept, are one of the three core concepts of the circular economy.

The eco-industrial park concept is based on the principles of reduce, reuse, and recycle (OECD, 2021). The other two circular economy principles are enterprise circular economy and social circular economy (OECD, 2021). According to Zeng et al. (2017), the CEC index measures the three interrelated aspects of the environment, society, and economy rather than sustainable supply chain performance, which is usually evaluated from an environmental and financial viewpoint. Climate change is one of the economic, social, institutional, and environmental drivers of the circular economy (Zeng et al., 2017). Institutional and societal forces are also important in developing a circular economy (OECD, 2021). Previous research suggests that eco-industrial parks are a fundamental part of the circular economy. Three core concepts of the circular economy are eco-industrial parks, which are circular chains made up of the '3R' ideas of reduce, reuse, and recycle (OECD, 2013). The other two circular economy ideas are "enterprise" and "social" circular economies (OECD, 2013). The study expects that circular economic capability will improve supply chain sustainability. The next section discusses supply chain sustainability.

2.2.2 Duration of the Supply Chain

Many studies have been found dealing with sustainable supply chains in the management literature, and most of these research were done in the USA, Europe, and some parts of Asia (Fahimnia et al., 2015; Jia et al., 2018). But there hasn't been much research on sustainable supply chains in developing countries, especially when it comes to the relationship between buyers and suppliers (Jia et al., 2018; Lester, Brown, Edward CWolf, and Linda Starke, 1987; Yang Liu, Zhu, and Seuring, 2017). This is likely because these countries are far from the industry. The word "sustainability" is created from the French word "soutenir," which means "to hold up or support" (Lester R. Brown, Edward CWolf, Linda Starke, 1987). Sustainability is almost certainly now being added gradually to the plans of policymakers as well as the strategies of most businesses and supply chains. According to Barbosa-Póvoa (2014), complex network systems can be used to describe sustainable supply chains (SSCs), which manage products from suppliers to customers and the returns that go along with them while taking into account social, environmental, and economic impacts. The treatment of such systems, they continued, has recently become considerably more crucial as firms struggle to handle sustainability issues brought on by the rising public awareness of environmental and social problems. Ahi and Searcy (2013) define sustainable supply chain management as a supply chain management process that considers economic, social, and environmental sustainability. According to Seuring and Müller (2008), supply chain sustainability management (SCSM) refers to the management of material, information, and capital flows along with supply chain collaboration among businesses in order to achieve sustainable development goals in all three areas of economic, environmental, and social that are in line with customer and stakeholder demands. They added that while it is hoped that competitiveness will be maintained by meeting customer expectations and other pertinent economic requirements, participants in sustainable supply chains must adhere to environmental and social standards in order to remain connected. Due to social pressures, stricter government restrictions, business image concerns, increased public knowledge, and market pressures, organizational supply chains are increasingly incorporating sustainability methods Customer and stakeholder expectations, including their reactions to any SC member violating those expectations (Tseng, Lim, and Wong 2015; Esfahbodi, Zhang, and Watson 2016), are the driving factors behind SSCM. (Glover et al., 2014; Rebs et al., 2018). (Hartmann and Moeller, 2014). Ahi and Searcy's (2013) definition of sustainable supply chain management was used in this study. They say that it is planning and making decisions about the supply chain in a way that is sustainable in terms of the economy, society, and environment. The three main components of sustainability are social, economic, and environmental aspects (Carter and Rogers 2008). Protecting global ecosystems and preserving natural resources are vital for supporting health and welfare both now and in the future (Wolsink, 2020). Aleksei et al. (2019) define economic sustainability as the state of a company in which the socioeconomic factors that define it keep their initial balance and stay within predetermined parameters when exposed to the internal and external environment. In addition to human rights, working conditions, health and safety, child labor prevention, and slave protection, socially-sustainable supply chain policies cover a wide variety of activities (Walker et al., 2014). Carter and Rogers (2008) say that the sustainability of an organization can be improved by combining these three things and working outside of its borders. This study also thought that green orientation could change the direct link between being able to do a circular economy and having a sustainable supply chain.

2.2.3 Green Orientation

Green learning orientation, according to Fong and Chang (2012) and D'Angelo and Presutti (2019), is a set of principles that companies embrace and that guide how they learn about sustainability. However, a strategic green orientation (SGO) is "an organization's long-term commitment to providing environmentally sound products (ESP) and services through the implementation of environmental improvement goals and programs in the past, present, and future," according to Hong et al. (2019). If complex performance results are to be secured through effective product design, supply chain integration, and business processes, inter-organizational innovation projects are required for SGO. Major inter-organizational innovation projects are undertaken by global enterprises to improve their environmental performance and reorganize their manufacturing and delivery systems in response to end-of-life vehicle mandates (Funazaki et al., 2003; Castell et al., 2004). An organization's long-term commitment to creating environmentally sound products and services through environmental improvement objectives and programs (SGO) is defined as "strategic green orientation" in this research. This definition was provided by Hong et al. (2019). “They also said that SGO requires a company to build on its past successes and carry out a steady stream of actions that are good for the environment over a long period of time. As a result, "green orientation" includes past, current, and future acts that demonstrate the company's actual commitment to environmental issues. This study also thinks that technology orientation may have an effect on the direct link between being able to have a circular economy and having a sustainable supply chain.

2.2.4 Technology Orientation

According to Deshpande et al. (2013), p. 232, technology orientation is the process of integrating new technologies into product development. Tsou et al. (2014) define "technology orientation" as an organization's eagerness to include new technologies in product development, in addition to its openness to new ideas. It is thought that a company's technical expertise, research funding, and technological foundation are critical to developing new, high-quality items. Because of this, firms that are focused on technology acquire new technologies and use them to produce their products and services. Grinstein (2008) defines technology orientation as the propensity for a firm to adopt new technologies, items, or innovations. According to Tambunan (2019; Zhang et al., 2018), technology orientation refers to a strategy that proactively generates and coordinates in order to stay up to date with technology advancements and then applies them in business. In this study, the term "technology orientation" is used. Tsou et al. (2014) say that a company's technology orientation is how open it is to new ideas and technologies that can be used to make new products.

2.3 Theoretical Review

Natural Resource-Based View Theory (NRBV)

The roles of green orientation as a mediator and of technological orientation as a moderator in establishing a sustainable supply chain are crucial to grasping the significance of the circular economy. The natural resource-based theory is used in this research. NRBV is a consequence of RBV (Barney, 1991; Wernerfelt, 1984). The key distinction is that NRBV takes environmental constraints into account when creating long-term plans (Mishra and Yadav, 2021). According to the tenets of NRBV, an organization needs to identify and implement valuable strategies if it wants to obtain a competitive edge (Hart, 1995; Mishra and Yadav, 2021). Existing literature demonstrates that environmental strategy improves competitive advantage via emission reduction, resource productivity, and innovation stimulation (Kwateng et al., 2022; Lopez-Gamero et al., 2016; Leonidou et al., 2017). It is theorized that CEC can facilitate more environmentally friendly supply chain operations through recycling and reusing. CEC's distinctive qualities offer a chance to improve the circular processes that contribute to achieving supply chain sustainability, which may be difficult for competitors to adopt or replicate. While NRBV does a good job of explaining how CEC affects SCS, it leaves out the role that other factors like technological advancement and environmental consciousness can have (Mishra and Yadav, 2021). This study's conceptual model demonstrates, therefore, that CEC continues to be an important internal resource that may contribute to the sustainability of the supply chain through green and technology orientations.

Knowledge is extended in only one direction, even though NRBV theory describes how businesses can maintain competitive advantage and performance through environmental management. The theory fails to set itself apart from RBV theory and the concept of resource and capability explained by NRBV theory. Hart's (1995) work, in which these three tactics were singled out, demonstrates the restrictions. As a result, academics have started looking at company success through the glasses of these three approaches. Sustainable development is a method used by academics to encompass a wide range of industry- and research-specific environmental best practices, from pollution control and product stewardship to supply chain and operations management (McDougall et al., 2019). This research, however, updated all three approaches by connecting the pollution prevention strategy with product stewardship and the sustainable development strategy with the circular economy product return and product recovery. Figure 1 illustrates the theoretical framework proposed in this study to help businesses achieve supply chain sustainability. Sustainable supply chains can be achieved, as shown in Figure 1, if businesses effectively construct or develop their circular economy capabilities. Furthermore, the study hypothesizes that businesses will be able to achieve greater supply chain sustainability by combining CEC with a green perspective. Also, the effect of GO on SCS is predicted to be moderated by the level of technology orientation, with a high level of TO enhancing the effect of GO on SCS. Taking into account RBV theory, this study used green orientation and technology orientation as mediator and moderator between CEC and supply chain sustainability.

2.4 Empirical Review

2.4.1 Supply Chain Sustainability and Circular Economic Capability

Del et al. (2020) conducted a study to look at how big data-driven supply chains affect these linkages and how circular economy practices affect company performance in a circular supply chain. The study makes use of data gathered from an online survey conducted among 378 Italian companies that have adopted the circular economy. Multiple regression analysis was used as the data processing technique. The findings demonstrate that the three types of circular economy practices that were examined—circular economy supply chain management design, circular economy supply chain relationship management, and circular economy HR management—are all important for improving business performance from a circular economy perspective. The relationship between circular economy HR management and business success for a circular economy supply chain is moderated by a big data-driven supply chain. The use of novel constructs in the study demands more investigation. Qualitative research should be used in the future to get more in-depth information, reduce chance, and make the results more reliable.

Cheng et al. (2021) looked into the relationship between SSC performance and the adaptability of the sustainable supply chain (SSC), Big Data Analytics (BDA) skills, and Circular Economy (CE) practices. For the study, 320 Indian manufacturing companies were polled. According to the findings, the BDA has no appreciable relationship on long-term performance. SSC flexibility and CE procedures play a significant moderating role between BDA capabilities and SSC performance. It is obvious that the measures are theoretical in nature and might not provide a thorough picture of the real-world challenges connected to BDA capabilities since the theoretical framework and constructs used in the study were based on the DCV. So, in the future, researchers could use both qualitative and quantitative methods to look into the connections that the model suggests.

Centobelli et al. (2021) looked at the connections between social pressure, environmental commitment, green economic incentives, supply chain relationship management, sustainable supply chain design, and the ability to have a circular economy in Italy. The study used data from 212 small and medium-sized firms to build a model, which was then tested using confirmatory factor analysis (CFA) and structural equation modeling (SEM). The literature corpus is impacted by the findings in three significant ways. They first demonstrated that environmental commitment and green economic incentives have a major impact on the design of a sustainable supply chain and supply chain relationship management. Second, they emphasized the value of supply chain relationship management and sustainable supply chain design in boosting SMEs' capacity for the circular economy. Third, they discovered that social pressure has a positive impact on environmental commitment and green economic incentives. In the future, researchers could look at the link between CE capability and economic, social, and environmental performance as well as how the size of a company affects how CE is put into action. This would provide a more accurate picture of the CE capabilities of SMEs.

Zeng et al. (2017) investigated the connections between institutional pressures (IP), sustainable supply chain management (SSCM), and circular economy competency (CEC). They made use of concrete data from businesses in Chinese eco-industrial parks. Data retrieved from 363 questionnaires distributed to eco-industrial park businesses in China, it was discovered that institutional pressure has a significant positive impact on supply chain relationship management and sustainable supply chain design, sustainable supply chain management practice is a crucial component in promoting the improvement of businesses' capacity for the circular economy, and coercive pressure, normative pressure, and mimetic pressure exert varying degrees of negative pressure. Because the study didn't make clear distinctions between the three types of organizations it looked at, the research results will need to be looked at more carefully.

Hussain and Malik (2020) conducted research to pinpoint organizational enablers of the circular economy and their connections to supply chain environmental performance. The hypothesis developed from a comprehensive review of the literature was tested using a structural equation modeling (SEM) approach using data gathered from several supply chains in the United Arab Emirates (UAE). The results showed that the circular economy made supply chains much better at protecting the environment.

2.4.2 Environmental Concerns and the Sustainability of the Supply Chain

Chan et al. (2012) looked into the relationship between green marketing, business performance, and GSCM (green supply chain management) activities (green procurement, customer cooperation, and investment recovery). This study came to several important conclusions based on responses from 194 foreign-invested companies operating in China. It first demonstrated that internal environmental orientation was a significant driver of investment recovery, despite the fact that both external and internal environmental orientations had a favorable and considerable impact on the practice of green purchasing and customer collaboration. Second, it demonstrated how these three crucial GSCM actions significantly improved corporate performance. The study also discovered that the degree of competition increases the positive impact of customer collaboration on business success. The study focused on a small number of venture groups whose work is likely to be affected in a big way by China's growing concern for the environment. The study suggested that more research be done with a bigger sample size in terms of ownership type, industry type, and geographic area. This would make the investigation more thorough and help find out if the model being suggested is valid in the real world.

Lintukangas et al. (2015) carried out a survey to highlight the importance of green supply management in developing a sustainable supply chain. It investigates whether supply risks, supplier relationship management skills, and the end-customer orientation of the supply management function are linked to a firm's green supply management practices. The links were investigated using survey data from 165 Finnish companies. The regression analysis revealed that the degree of green supply management is significantly associated with the preservation of a company's reputation; consumer awareness of green requirements places significant pressure on a company's supply management to meet end-customer expectations; and a firm's high level of supplier relationship management capability increases the adoption of green supply management. The study's findings indicated that companies utilize green supply management as a tool to implement sustainability efforts, lower reputational risks, and encourage a green attitude among their supplier networks. The paper recommends that future studies concentrate on supply management's role in business sustainability.

Habib et al. (2020) investigated the relationship between market orientation (MO) and green entrepreneurial orientation (GEO) with regard to the adoption of green supply chain management (GSCM) practices and ensuing sustainable firm performance. Additionally, the study investigated market orientation acts as a mediating element between GEO and long-term business success and the association between GEO and GSCM practices. Structured equation modeling with partial least squares, a common method in exploratory and quantitative research, was used to look at the data from 246 textile manufacturing businesses in Bangladesh. The results show that GEO has a big positive effect on MO and GSCM practices, which in turn has a positive effect on all three parts of sustainable firm performance (economic, environmental, and social). The research also discovered that MO somewhat mediates the link between GSCM practices and GEO and that both of these interactions partially mediate the link between GEO and company performance. The study's drawback indicated that data was only gathered from one country and one sector of the textile manufacturing industry, which may have limited the study's generalizability. So, in the future, research might look at many different industries in countries like China, India, Indonesia, and Vietnam.

Lin et al. (2020) looked into how a supply chain's green competitive advantage (GCA) is affected by green market orientation (GMO), green supply chain relationship quality (GRQ), and green absorptive capacity (GAC). The research employed the questionnaire developed by Deshpandé and Farley to produce a ten-item scale to assess market orientation in the context of the green market (GMO). According to the study's findings, there is a strong positive relationship between these constructs. The study's cross-sectional methodology makes it difficult to infer causal relationships from the data. To back up the findings, the study suggested that longitudinal research designs be used in future studies.

Hong et al. (2009) looked at the relationships between business unit performance, supply chain coordination, integrated product development, and strategic green orientation. Through the International Manufacturing Strategy Survey, 711 companies from around the world provided the data that this model used for validation (IMSS IV). The study found a strong positive inter-correlation between the constructs. To study complex things like green business initiatives in the context of value chains, you may need more than one research method, like case studies or survey instruments. In fact, using more than one research method may shed more light on the complex dynamics of product life cycle issues for different sets of products, from idea to disposal. So, more research should be done to find out how things unique to a country or industry might affect a company's commitment to a green approach.

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2.4.3 Green Orientation and Circular Economy

Hysa et al. (2020) conducted a study in Sweden to investigate the relationship between a few key indicators of a circular economy, such as important elements of environmental and economic growth. A fixed effect panel data analysis was used to examine the impact of the circular economy on the economic growth of European nations. In order to corroborate the findings of the regression analysis, the study also used a second method, generalized methods of moments, to compute the Arellano-Bond dynamic panel data estimate method. The findings of the two econometric models showed a strong and positive relationship between a circular economy and economic growth, underscoring the critical role that innovation, sustainability, and spending on zero-waste initiatives have in promoting prosperity. The study came to the conclusion that the regression analysis used could be made even stronger by adding more control variables and making it last longer.

De Morais et al. (2021) created a conceptual framework for comprehending the causes of CE participation and green purchasing, with a focus on the functions that social status, pure altruism, and competitive altruism play as those behaviors' motivators in Portugal. The model was empirically examined by partial least squares structural equation modeling. According to the results, competitive altruism and the desire for social status were not significant drivers of CE engagement or green purchasing, and pure altruism was instead the primary motive. Because the sample for this study was only made up of Brazilian and Portuguese citizens, future research might include more cross-cultural or national studies.

Yüce and Altinda (2022) investigated the impact of circular economics and green management on a firm's innovation performance. A total of 403 valid questionnaires from manufacturing companies were collected and analyzed as part of the study. While the impact of innovation was found to be significant on firm growth performance, the impact of green management remained limited, implying that the circular economy has no effect on firm growth performance, either positively or negatively. Academics' most important recommendations are studies on the impact of the circular economy on employee performance and organizational culture. The circular economy concept is still being researched, and new resources are being developed. This concept requires further investigation.

2.4.4 Technology Orientation and supply chain sustainability

Rezazadeh et al. (2016) looked at the relationship between technological orientation (TO), different dynamic capabilities, and performance to find out how a TO affects the performance of a business. In Iran's Science Parks, 154 small-to-medium-sized businesses (SMEs) provided survey data for the study. The results confirmed the premise that a firm's technology orientation and performance are associated, and that a firm's dynamic capabilities mediate this link. The study doesn't claim that it can scientifically measure the long-term performance of SMEs in terms of their focus on technology and their ability to change. The sustainability of performance advantages should be investigated further by utilizing longitudinal data.

In an article published in 2013, Al-Ansari et al. (2013) examined how technology orientation and innovation interact to affect company performance in small and medium-sized businesses (SMEs) in Dubai, United Arab Emirates, a developing market. A study of 200 small and medium-sized (SMEs) businesses in Dubai found that innovation and focus on technology both affected business performance, but neither had a big and direct effect on it. The study emphasizes the value of a technology-oriented approach and draws a connection between it and innovation as well as company performance, but it ignores alternative strategic approaches (such as market orientation). It also passes through the application of innovation and technology orientation. Future studies should be conducted in this area.

Park and Li (2021) studied the impact of block chain technology on supply chain sustainability performance in Switzerland. The study investigates whether the three sustainability indicators can be improved indirectly along supply chains using block chain technology via a systematic literature review and two case studies. According to the findings, block chain technology has the potential to improve supply chain sustainability performance. Even though the study and most of the literature focus on the three pillars of work, it is possible to think about how the three pillars of performance affect each other in the context of sustainability.

Marinagi et al. (2014) looked into the relation of information technology (IT) practices on supply chain competitive advantage. A survey of 76 manufacturing companies in Greece revealed the crucial role information technology practices and techniques play in creating a sustainable competitive advantage based on supply chain management. Future studies on the effectiveness of the conceptual framework in other parts of Greece could be compared to the findings.

Hunter and Perreault (2006) looked at how sales performance, information effectiveness, and sales orientation affected sales performance. Data from a significant consumer packaged goods of company’s sales force was used to construct and test the model. The results showed that, through a double-mediated mechanism including efficient information utilization and smart selling practices, a salesperson's technology orientation has a direct impact on internal role performance and an indirect impact on customer performance (planning and adaptive selling). Though generalizations to other companies in the CPG business are less much further, the use of a within-firm design raises questions about the results' applicability across a wide variety of enterprises. The limitations give us a chance to show in the future that the SEM method suggested here can be used well with a small sample size.

2.4.5 Mediation Effect of Green Orientation

Wang et al. (2022) used a moderated mediating model to look at how green learning orientation affects sustainable performance. The green innovation behavior was the variable that acted as a bridge, and corporate social responsibility (CSR) was the variable that acted as a moderator. Green learning orientation has a positive impact on green innovation behavior and sustainable performance, acting as a partial mediator between green learning orientation and sustainable performance, and the relationship between green learning orientation and green innovation behavior is dependent on green learning orientation, according to an empirical analysis of 193 valid questionnaires from middle and senior managers in Chinese manufacturing enterprises. The research's findings do not apply to other situations because only a few Chinese manufacturing companies provided the study's data. By making the study design applicable to other economies and industries, future research may be able to compare differences between countries or industries.

Fatoki et al. (2021) investigated the relationship between internal and external environmental orientation and green competitive advantage, as well as the role of green innovation as a moderator in this relationship. This study's data was gathered through a cross-sectional survey method and a quantitative research approach. According to the research, the hypotheses were tested using partial least squares structural equation modeling. The indirect effects of green innovation were enormous. However, the cross-sectional design of the survey made it hard to find links between causes and effects. The researchers suggested doing more research using a longitudinal study to improve the results.

Luu, in 2021, looked into how and when a person's green entrepreneurial orientation in Australia turns on their green creative activity. The study used multi-level structural equation modeling to look at the information that was gathered from managers and employees of tour operators in emerging markets in Asia and the Pacific. The findings revealed a positive relationship between green entrepreneurial attitude and employees' green creative behavior via the dual mediation channels of green creative self-efficacy and harmonious environmental passion. Despite the fact that the majority of the study's tour operators have environmental management guidelines in place, future research should consider other tour operator types who might be concerned about environmental issues. To make it more applicable to a wide range of situations, the current study method should be tested in both manufacturing and service industries, such as hospitality and healthcare.

Khan et al. (2019) looked at how the green marketing mix and eco-labeling affect the effect of an entrepreneur's environmental orientation on how well their business does. A sample of 160 small business owners and managers from the trading, manufacturing, and service sectors in Bangladesh were used to evaluate the multiple mediation model. The study used both the partial least squares (PLS) method and the variance-based structural equation modeling (SEM) method to test the hypotheses. The results showed that an entrepreneurial mindset has an effect on how well a small business does when green marketing and eco-labeling techniques are used. Both of these techniques help explain the link between being an entrepreneur and having a successful small business. Changing external environmental conditions can have a big impact on how well small firms perform. Because of this, the current study suggested that future studies look at things like generosity, hostility, and chaos in the outside world.

Green innovation and competitive advantage were investigated by Zameer et al. (2020). The study also investigated green innovation's role as a moderator in the impact of business intelligence and environmental orientation on green competitive advantage. The information was gathered through an online survey, and 388 valid questionnaires were processed for empirical analysis using SPSS 23.0 and AMOS 23.0. According to the authors' empirical findings, business analytics and environmental orientation are critical to green product innovation and green competitive advantage. The study says that equipment suppliers should put a lot of money into green innovations that are good for the environment to improve and keep their green competitive advantage.

2.4.6 Moderation Role of Technology Orientation

Mandal (2018) examined how big data analytics (BDA) management skills, specifically BDA management, investment, coordination, and control, affected the effectiveness of India's sustainable tourism supply chain (STSCP). The study also looked at how technology orientation affects how well BDA management capabilities relate to STSCP. According to the thoughts of 212 analytics experts, BDA management, coordination, and control are important enablers of sustainable tourism supply chain performance. Technology orientation has also been proven to improve the strategy, coordination, and control functions of BDAs as enablers. For the survey, a wide range of respondents from the SC tourism industry offered perceptual input. When trying to draw inferences for strategic purposes, such perceptual reactions can be troublesome. So, future research should focus on a specific tourism SC and use a longitudinal method.

Mandal (2017) examined how technology orientation affected organizational culture aspects and connections between resilience in healthcare in India. Development culture, group culture, rational culture, and hierarchical culture were some of the organizational culture facets that were looked at. Hospitals, lodging facilities, chemistry and pharmaceutical companies, marketing, public relations, and promotion companies, suppliers of surgical instruments and medical equipment, restaurants that provide food and beverages, and insurance companies were contacted for information on perceptions. Based on 276 completed replies, the study found that rational cultures, group dynamics, and development have a beneficial relates on HCRES. Hierarchical culture, as anticipated, had a detrimental effect on HCRES. The beneficial impacts of development, group, and rational cultures on HCRES were also found to be boosted by technological orientation. However, no significant moderator of the impact of hierarchical culture on HCRES was found. The study did not look at how organizational culture factors affected healthcare agility (the capacity to promptly meet patients' medical demands). The first-order metrics that were made should be used in future research to look at how these kinds of agile capabilities are growing in healthcare.

Mandal (2020) examined the moderating effects of technology and supply chain (SC) orientations, as well as the impacts of healthcare adaptability and resilience, on long-term healthcare performance. 159 healthcare SC professionals in India who participated in an online survey were subjected to a partial least squares analysis to look at their opinions. According to the findings, healthcare agility and resilience have a substantial impact on long-term success. It is also interesting that technology orientation has a moderating effect on the link between performance and agility. A significant moderating impact on the connection between resilience and performance was also demonstrated for SC orientation. There was a limit of one respondent per company in the research, which received replies from numerous influential people in the healthcare SC. In order to obtain a complete and accurate view of the situation, future study should attempt to get multiple responses from the same company. Future studies should employ the measuring tools developed for healthcare agility, resilience, and sustainable SC performance to conduct additional empirical testing in the healthcare sector

2.5 Conceptual Framework and Hypothesis Development

This section outlines the conceptual framework and underlying presumptions that link supply chain sustainability and circular economy capacity, with a green perspective acting as a mediating and a technological perspective as a moderating relationships. This section also discusses the six key hypotheses as shown in Figure 2.1 below. Subsections have been created and discussed for each of the hypotheses as illustrated by the research model.

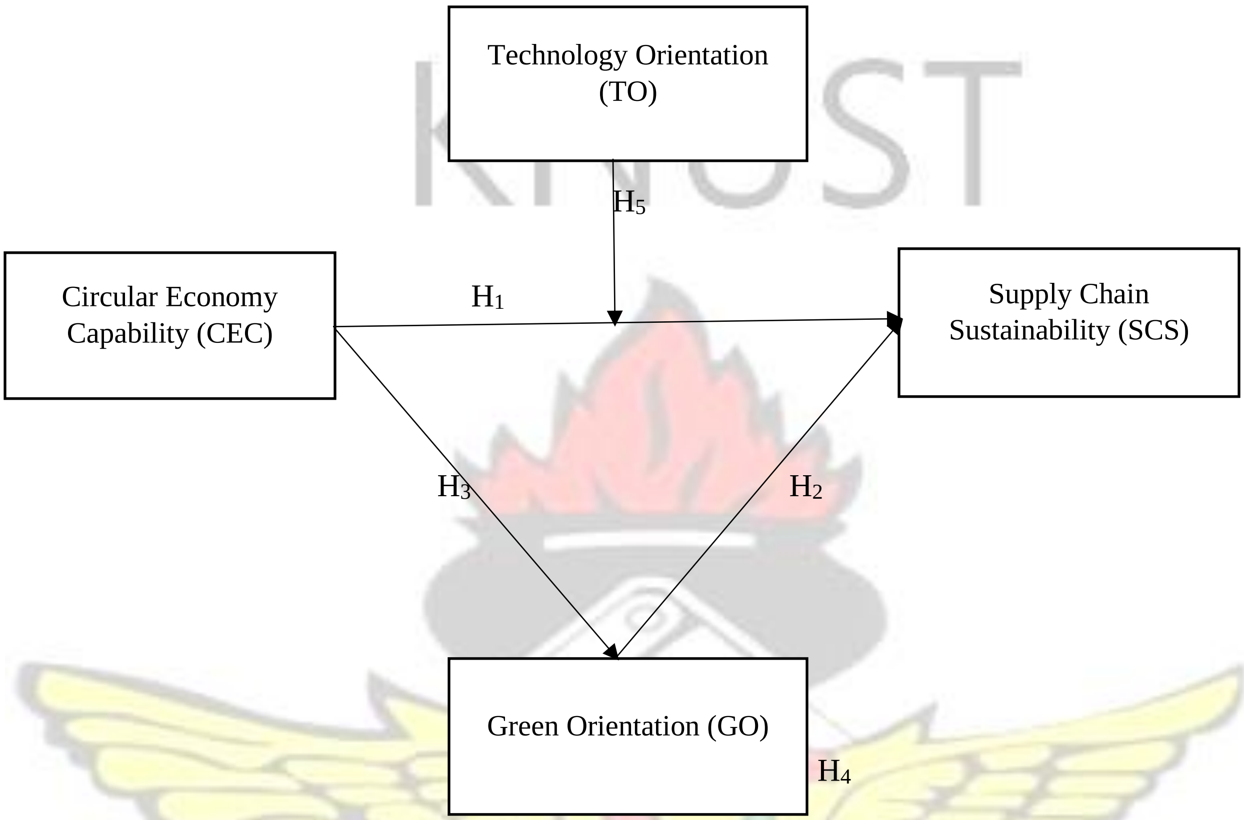

Figure 2. 1: Conceptual Framework

2.5.1 Effect of Circular Economy Capability on Supply Chain Sustainability

With an eye toward the environmental, social, and economic dimensions of sustainable development, supply chain sustainability is a reflection of the process of managing data, resources, and capital flows, as well as collaboration between companies along the supply chain (Kusi-sarpong, Gupta and Sarkis, 2019; Bals and Tate, 2018; Jia et al., 2018). Most of these researchers have taken into account the three facets of sustainability in their operationalization of SCS. To fully examine the topic of supply chain sustainability, environmental, economic, and social factors must all be taken into account, as stated by Bals and Tate (2018). Therefore, it is crucial to grasp the concept of supply chain sustainability. Sustaining a supply chain means creating, enhancing, and guarding long-term economic, social, and environmental value for all parties involved in meeting consumer demand. However, the triple bottom line of economic, environmental, and social influence is the most effective way to accomplish this (Khan, Hussain and Ajmal, 2017). According to previous studies, the emphasis of a circular economy is on resource efficiency and waste reduction, both of which lead to improved economic performance and lower costs (Piscicelli, 2023; Bianchi and Cordella, 2023; Smol et al., 2020; Tomi and Schneider, 2020). Firms' environmental and social effectiveness can suffer as a result of the circular economy because some environmental and social practices can be expensive (Dey et al., 2019). Reducing waste and meeting environmental and social goals through energy-efficient operations may be the greatest bet for any organization seeking long-term viability (Viesi, Pozzarb, Federicic, Cremaa, and Mahbub, 2017; Dey et al., 2019). However, the initial investment required to achieve energy efficiency may deter some businesses from making the switch. Therefore, building circular economy capability remain non-negotiable in the quest to achieve sustainability in any supply chain. Drawing on previous studies (Bag and Rahman, 2023; Awan and Sroufe, 2022; Marrucci et al., 2022; Bag et al., 2022; Agyabeng-Mensah et al., 2022; Kristoffersen et al., 2021; Zeng et al., 2017) which highlights the essential role of circular economy in the sustainability drive, this study envisages that building a robust capability for circular economy remain a step ahead to achieving sustainable supply chains. This leads to the first hypothesis of the study, that:

H_1: Circular economy capability has positive significant effect on supply chain sustainability

2.5.2 Effect of Circular Economy Capability on Green Orientation

Green Orientation (GO) refers to firm's holistic orientation toward natural environment (Borazon et al., 2022; Borah et al., 2021; Papadas et al., 2017). GO enables firms to identify customers with environmental needs and develop products to meet their peculiar needs (Borah et al., 2021), thereby enhancing the success and acceptability of new products. As green purchase behavior (purchasing and consuming products with minimal environmental impacts) increases among customers (Nuryakin and Maryati, 2022; Wang et al., 2020), firms with high GO will be able to develop products that will be successful when introduced to the market. Environmentally conscious customers are insensitive to price, so green manufacturing firms could charge premium price for their new products and still have market acceptability for the new product (Papadas et al., 2019; Mehraj and Qureshi, 2022). Green oriented firms have a favorable brand image, which affects the success rate of their new products (Tan et al., 2022; Mehdikhani and Valmohammadi, 2022). Green orientation is found to also have a greater impact on firm value and customer satisfaction (Huang, Y.C. and Chen, 2022). However, in the effort to achieve GO, developing the capability of embracing waste reduction strategies such as circular economy is key. Though the connection between CEC and green orientation has not yet been empirically validated, considering the fact that green is synonymous to sustainability in prior studies (Koval et al., 2023; Rodríguez-Espíndola et al., 2022; Schmidt et al., 2021; Blomsma et al., 2019) showed the essential role of CEC to sustainability. The authors therefore believes that building CEC within an organization is a step forward to shaping the orientation of both employees and senior managers orientation towards green practices. This leads to the second hypothesis of the study, that:

H_2: Circular economy capability has positive significant effect on green orientation

2.5.3 Effect of Green Orientation on Supply Chain Sustainability

Managers that prioritize sustainability are more likely to have a green orientation (Rehman et al., 2022; Yusliza et al., 2020; Eisenbeiss, 2012). Spreading a culture of green throughout an organization could have positive effects on their sustainability orientation and practices. Using clean energy, cutting costs, saving lives, and engaging in green practices and green innovation are just a few examples of how organizations' green orientation may spread and improve sustainability efforts along the supply chain (Rehman et al., 2022). Therefore, managers with high green orientation may relates the ways in which followers think about and engage with issues connected to seizing opportunities, embracing new ideas, information, and technologies, and taking calculated risks in pursuit of a social-ecological economic system (Zhao et al., 2011). Moreover, as green thinking spreads across the supply chain, the focal company may take the initiative in working with its suppliers and customers. To this end, the firm at the center of the supply chain may improve its communication and interaction with its partners in order to increase the latter's capacity to address environmental issues and, ultimately, to realize the chain's green objectives (Bouncken et al., 2014; Rehman et al., 2022). Green orientation has been demonstrated to greatly enhance environmental performance and firm performance in a previous study by Jiang et al. (2018). Furthermore, we believe that:

H_3: Green orientation has positive significant effect on supply chain sustainability

2.5.4 Mediating Role of Green Orientation

Managers green orientation is seen as a temporary measure to make the SC eco-friendlier (Papadas et al., 2017; Borah et al., 2022). Product decisions that mitigate unfavorable public impressions of the environment are at the heart of these measures (Pujari et al., 2003). Different pricing strategies for environmentally friendly items, as well as an increased focus on the supply chain's environmental performance (Zhu and Sarkis, 2007), are all results of this shift toward a "greener" attitude (Kilbourne et al., 2002). Having demonstrated in previous sections that green orientation is critical in the achievement of sustainability in the supply chain, it may not just directly enhance supply chain sustainability but also indirect as a mechanism via which circular economy capabilities may be channeled to reap superior SCS. Thus, though developing circular economy capability is important to SCS, its improvements could be achieved if managers and all stakeholders along the supply chain are green oriented. To this end, authors believe that CEC must be developed side by side with GO in the quest to improve SCS. This leads to the fourth hypothesis of this study.

H_4: Green Orientation mediates the relationship between circular economy capability and supply chain sustainability

2.4.5 Moderating Role of Technology Orientation

The degree to which a company is "technology oriented" (TO) indicates the extent to which it is prepared to incorporate cutting-edge technologies into its day-to-day and long-term strategies. Technology orientation (TO) is defined as "the ability and the determination to acquire a considerable technological expertise and use it in the creation of environmentally sustainable, economically viable, and socially just products (Mandal, 2018; 2019). Although manufacturing firms help advance economic growth, they also pose serious risks to people and the environment. Therefore, circular economy capability and technology remain crucial in the manufacturing of SCs. CEC aids businesses in creating and launching waste-reduction strategies. The efficacy of these strategies within the SCs, however, depends on the availability of adequate TO (Ali et al., 2016). The level of technological focus across manufacturing companies varies. As a result, CEC's efforts to establish sustainable manufacturing SC are dependent on TO. Higher levels of TO would make the transition to SCS easier for a company. With a greater TO, SC businesses would be able to strategically implement circular economy methods to back up their daily operations (Ryu et al., 2017). Businesses would benefit from TO since it would let them better plan out analytics infrastructure upgrades (Kache and Seuring, 2017). Companies would be able to effectively collaborate with crucial SC partners through CEC if they had sufficient TO (Hsu, 2016). When everything is said and done, TO would also affect a firm's ability to exert CEC on its SC operations. It is thus, postulated, that

H_5: Technology Orientation positively moderate the relationship between circular economy capability and supply chain sustainability

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The previous chapter focused on the concepts, theories, and literature germane to this study. The methodology used to conduct the study is presented in this chapter. This section draws on extant literature in choosing appropriate methods, techniques, and processes. It offers a comprehensive research design, strategy, and philosophy. It also embodies discussions of the chosen methods and processes. In particular, the chapter presents discussions on the study design, target population, sampling and sampling techniques, and data collection instruments. This chapter also includes tests of reliability and validity, thoughts on ethics, data processing and analysis, and a summary of the whole chapter.

3.2 Research Strategy

Basically, a research design is a blueprint for research. However, several analysts have offered several explanations of the study design. Cohen, Manion, and Morrison (2018) say that a research design is a plan or strategy for organizing research and making it possible to do. This is undertaken in order that the research questions and hypotheses posed can be answered based on evidence and warrants. Labaree (2013:1) said that the research design is "the overall strategy that you choose to integrate the different parts of the study in a coherent and logical way, making sure that you will effectively address the research problem; it is the blueprint for the collection, measurement, and analysis of data. "It is worth mentioning that there is no single blueprint for planning research; instead, "the research design is governed by fitness for purpose. The purposes of the research determine the design. Further, the research philosophy must be anchored on a research philosophy.

Creswell and Creswell (2018) say that research designs are specific plans for how a research study should be done. These plans can be based on qualitative, quantitative, or mixed methods. A qualitative investigation is a way to find out and understand what people and groups think a social or human problem or phenomenon means to them. This normally involves the use of an inductive style of research. With regard to quantitative inquiry, it is an approach for testing objective theories by examining the relationship among variables and intend are analyzed employing statistical procedures. Typically, studies under quantitative conditions involve a deductive style of research. Lastly, the mixed method is an approach to inquiry involving collecting both quantitative and qualitative data, blending the two forms of data. The basic rationale for this approach is that the merging of both qualitative and quantitative approaches offers a more detailed and utter understanding of the issue being studied than either approach alone (Teddlie and Yu, 2007; Creswell, 2014). So, it's clear that this study uses the quantitative method, since it looks at the relationships between different variables.

There are three main types of quantitative designs: experiments; quasi-experiments; and non-experiments (Leavy, 2017; Crewell and Creswell, 2018). Experiments (also called true experiments) seek to determine if a specific treatment relates an outcome. Under this design, the research divides the sampled population into treatment groups and non-treatment groups, and then determines how both groups score on an outcome (Creswell, 2014). This relies on random assignment, which ensures internal validity of the research. However, Marczyk, Dematteo, and Festinger (2005:137) opine that true experiments are "often not feasible in real-world environments." In this regard, quasi-experimental designs are typically used. In general, the quasi-experimental design is like the true experimental design, but assignments are not made randomly (Creswell and Creswell, 2018).

The final key quantitative design is the non-experimental design. These include designs in which the researcher has no control over the variables and environment of the study. Although there are several non-experiment designs, one of the major designs under this is the survey design. Cohen et al. (2018) say that the survey design is the most common type of quantitative design used in social research. According to Leavy (2017), the survey involves asking people standardized questions that can be analyzed statistically. On the one hand, surveys are employed in obtaining individuals' attitudes, beliefs, opinions, experiences, or behaviors (Creswell, 2014). On the other hand, surveys are undertaken to find relations between variables under consideration. When surveys determine the relationships, they are described as "correctional studies," as Marczyk et al. (2005:151) reiterated. In addition, surveys can either be cross-sectional or longitudinal. A cross-section survey seeks information from a sample at a single point in time, whereas a longitudinal survey seeks information at multiple points in time to track transformations that may occur over time.

This study, therefore, is specifically anchored on a cross-sectional survey design, which can also be referred to as a cross-sectional correctional study. A cross-sectional survey design is employed when a study proffers an opportunity for examining the association and variations between variables using quantitative data. Moreover, they are deductive types of research designs, involving the collection and analysis of a wide range of quantitative data from a sizeable population using descriptive and inferential statistics (Labaree, 2013). The chosen design has been widely and authoritatively used in supply chain studies.

The necessity to capture data across the various categories of multinational firms prompted the choice of the study design. The second step was to use a cross-sectional survey design (Crewell, 2014) so that the researcher could collect data and take measurements on a number of variables at the same time and also examined how the explanatory variables affected the outcome variables. Lastly, descriptive and inferential statistics were also used to further look at the answers to the standard questionnaire, making the cross-sectional survey design was the best choice (Leavy, 2017).

3.2.1 Research Design

The literature points out that there are essentially three purposes for conducting a research study, and these include: exploratory, descriptive, and explanatory (Leavy, 2017; Creswell and Creswell, 2018; Cohen et al., 2018). Exploratory aids in learning about a new topic or phenomenon. When an issue is under-researched, an exploratory purpose is indispensable as it helps in filling the gap in our knowledge about the new topic. Explanatory research tries to examine what causes and effects, correlations, or why things look the way they do (Leavy, 2017, pp. 5–6). Descriptive research tries to create detailed descriptions that include details, meanings, and context, mostly from the point of view of the people who live through them. In this light, this study can be placed under the rubric of explanatory research because it examines the conceptual framework under consideration and also investigates relationships between the various constructs.

3.2.2 Research Philosophy

Research philosophy, also called a paradigm, can be defined as the worldview or framework through which knowledge is pursued (Lincoln, Lynham and Guba, 2011). "It is a foundation perspective carrying a set of assumptions that guide the research process" (Creswell and Creswell, 2018:11) or as Mertens (2010) contended, it is a basic set of beliefs that guide action. Thus, research philosophies become the lenses through which research is conceived and executed (Babbie, 2015). In this regard, it is imperative to state the philosophy upon which this research is anchored. Generally, there are several paradigms depending on the focus and aims of the research. In this research, the positivism philosophy was adopted.

3.2.3 Positivism and Post positivist

The positivism and post positivism research philosophy evolved from natural science with the basic assumption that reality is objective, patterned, and knowable (Lincoln, Lynham and Guba, 2011; Leavy, 2017). This paradigm espouses that research is basically about making and testing claims, including identifying and testing casual relationships (Leavy, 2017; Creswell, 2014). The main goal of this rubric is to prove or disprove a claim through the application of the scientific method (Babbie, 2015). Thus, the positivism philosophy believes in objectivity, researcher neutrality, and replication (Lincoln, Lynham and Guba, 2011; Leavy, 2017). The philosophy clings to a deterministic worldview in which causes determine effects or outcomes. To this end, positivists also seek to identify and assess the causes that influence outcomes. Also, positivism holds on to reductionist, that is, research working with this paradigm always reduces ideas into a small, discrete set to test, such as the variables that comprise hypotheses and research questions. Moreover, positivism advocates believe there are laws or theories that govern the world and these need to be tested, verified, and refined in order to comprehend the world. So, for positivists, research commences with a theory, collects data that either supports or refutes the theory, and then makes necessary revisions and conducts additional tests (Creswell and Creswell, 2018). Phillips and Burbules (2000) succinctly underscored the key assumptions of the positivism philosophy to include: research is the process of making claims and then refining or abandoning some of them for other claims more strongly warranted; data, evidence, and rational considerations shape knowledge. In practice, the researcher collects information on instruments based on measures completed by the participants or observations recorded by the researcher. Research seeks to develop relevant true statements, ones that can serve to explain the situation of concern or that describe those casual relationships. Being objective is an essential aspect of competent inquiry; researchers must examine methods and conclusions for bias.

3.3 Study Population

Population has been defined in several ways. Basically, a population refers to the entire mass of observations, which is the main group from which a sample is formed. It means the characteristics of a specific group or phenomenon (Cohen et al., 2018). According to Leavy (2017), population is a group of elements about which research seeks information. Upon the determination of the people or elements the research is interested in, then a study population (sometimes called the sampling frame) is determined. The study population is the group of elements from which an actual sample is drawn. The study population arises as a result of the reality that it is sometimes practically impossible to capture all elements of a population; thus, the need to create a study population. Given the exploratory nature of the study, the population for this study included all personnel associated directly or indirectly with supply chain activities in large manufacturing firms in Ghana. Given the study is an organizational level study, managers of supply chain units and supply chain personnel were the targeted study population.

3.4. Sampling Techniques and Sample Size

The number of people or items to be included in the study is referred to as the sample size (Saunders et al., 2011). Several factors go into determining the sample size for a certain study, whether a researcher uses a qualitative or quantitative technique (Malhotra and Birks, 2007). Despite the fact that sample size is a critical decision for any research, there is no single method for selecting it (Bhat and Darzi, 2016). The A-priori sample size calculator is a popular method of finding sample size in structural equation modeling (SEM) (Soper, 2015). A total of 200 questionnaires were distributed using the convenience sampling technique. The appropriateness of the sample size was examined using the G*Power (version 3) software, which is a widely applied freeware program used to analyze power and sample size suitability (Cunningham and McCrum-Gardner, 2007). Power analysis for a repeated-measures ANOVA with one group and five predictors was conducted in G*POWER. The results highlighted that a sample size of 150 is sufficient given an alpha of 0.05, a power of 0.90, and a medium effect size (f = 0.17). Hence, the sample size of 180 exceeded the minimum required and guarantees the reliability of the results.

After the determination of sample size, the researcher next determined the sampling technique for the study. Every researcher's dream would have been to collect data from every single person in a population. This scenario is only achievable when the researcher is working with small groups of people. However, when the population of interest is large, this census approach is not always viable. Accessing potential participants is also costly, time-consuming, and complicated. As a result of these issues, studies that use huge populations, such as this one, have depended on sampling procedures to pick a representative sample from the population of interest (Malhotra, 2010). Hair et al. (2009) describe sampling as the process of selecting a sufficient number of components from a larger population or constituents in the hopes of using the data gathered from these sampled elements to make accurate judgments and inferences about the overall population.

There are two types of sampling procedures known in the literature: probability and non-probability sampling. In case study research, non-probability sampling is regularly used; while probability sampling is routinely employed in surveys and experiments. Despite this, when the sample population is exceedingly big, some researchers continue to utilize non-probability sampling in quantitative studies (Saunders et al., 2009). Each element in the sample frame has an equal chance of being chosen in probability sampling, whereas in non-probability sampling, the opposite is true (Sekaran, 2003). As a result, valid inferences about the target population are difficult to make when nonprobability sampling is used. Despite the fact that non-probability sampling frequently relies on personal judgments and that samples obtained using this technique may not always be a true reflection of the population, generalizations about the population can still be made (Malhotra, 2010). Non-probability sampling procedures include quota, purposive, snowball, and convenience sampling. Purposive sampling is the process of selecting participants based on the researcher's judgment of who has the relevant information. The study collected data from multiple respondents who were expected to have the best knowledge about the marketing and branding issues in their firms or organization performance instruments as exist in their organization. As a result, the study purposively used senior executives, operational managers, marketing managers, sales executives and other middle or functional managers who have experience and knowledge in the area of the study to provide in-depth information for analytical purposes.

3.5 Data Collection

This section outlines the data collection sources, the instruments, and the procedures employed to gather the data.

3.5.1 Data Sources

Following the research objective, this study employs both primary and secondary data to carry out work.

3.5.1.1 Primary Information

This study was based primarily on primary data, which is referred to as afresh information or data collected directly from participants for the first time (Leavy, 2017). Without doubt, there are several instruments for collecting primary quantitative data. However, in this study, the survey method (questionnaire) was used as the main instrument to gather the data. The instrument is succinctly explicated below.

3.5.1.2 Data Collection Instrument (Questionnaire)

For this survey, questionnaire instrument was the main means of gathering the primary data. In the development of new items instrument for this study, useful information and frameworks were drawn from relevant studies. Hatch (2002) says that "existing studies can provide the foundation needed to design an instrument (Questionnaire) because it lets the research see where the literature is lacking." For the study constructs, the instruments were elaborately self-developed with recourse to existing literature and processes. Experts in the study area were also there to help guide and direct the process and make sure that the changes made fit the proposed context. The principal in this was my project supervisor. According to Bhattacherjee (2012), the questionnaire was set up with a six-point Likert scale, which is a common psychometric scale used in empirical research. The subject is asked to respond to a series of statements about a topic based on how much they agree or disagree with each statement. The questionnaire was structured in such a way that it ensured ease of understanding and to generate valid results. The six-pointed Likert scale allows respondents to give response choices ranging from strongly disagree (1) to strongly agree (7). The questionnaire was self-administered; however, the researcher had the opportunity to interact face-to-face in order that the purpose of the study, wherever necessary got explained to participants. Found in Appendix (I) is the questionnaire used to collect the primary data. The justifications for the questionnaire methods, included first, the fact that it allows for uniform and large amounts of information to be collected in a short space of time (Bairagi and Munot, 2019; Saunders et al., 2016). Second, the purpose of the study necessitated the use of the survey method. Third, the questionnaire ensures quick and easy quantification of huge volumes of information that can be carried out with the aid of appropriate software (Creswell and Creswell, 2018; Cohen et al., 2018). Last but not least, the use of the questionnaire is economical and dependable for collecting relevant information for research. The questionnaire was closed-ended, which gave participants a series of closed-ended questions with options to tick their preferred choices. The questionnaire is made up of thirty (30) items categorized into two major sections (A and B). Section A covered the demographical characteristics; while Section B embodied the various supply chain sustainability constructs under review. Section B was further Balkanized into sub-sections. Sub-section I focused on circular economic capability; sub-section II looked at green orientation; and sub-section III dealt with technology orientation, while sub-section IV also relates to supply chain sustainability.

3.5.1.3 Secondary Information

The study also heavily relied on secondary data too. Secondary data is information that has been collected by others (Saunders et al., 2016). Undoubtedly, it is data collected by others for some purposes in the past. Secondary data can exist in several forms: written, typed, or in electronic forms (Bairagi and Munot, 2016). For the secondary data, we looked at and used journal articles and books that were relevant to the study.

3.6 Variables: Dependent, Independent, Mediating

This section presents the various variables used in this study. The study embodies three main variables, including dependent, independent, mediator, and moderator.

3.6.1 Dependent Variable

The dependent variable, according to Creswell and Creswell (2018), is the variable the researcher is studying. It is the variable that is affected or influence by another variable (Leavy, 2017). Thus, it is the variable researchers observe to determine the effect of an intervention. In this study, supply chain sustainability is the dependent variable. The dependent variable, which is supply chain sustainability, was measured based on social, environmental, and economic sustainability. Social sustainability has been defined in this study as the life-improving condition of employees, communities, and the development of communities that can attain that state (McKenzie, 2004). The items that were used to measure the dimensions came from the studies of Kumar and Rahman (2016), Chow and Chen (2012), & Mariadoss and Tansuhaj (2016).

Economic sustainability in this study is defined as the state of managing a business as a strong partner in the market, helping the economic situation of current and future generations of its partners at the local, national, and international levels (Chow and Chen, 2012). The measurement items used were adopted and adapted by Kumar and Rahman (2016) and Chow and Chen (2012). Environmental sustainability in this study is defined as the firm's effort to manage its activities in a way so as to do no harm to the environment, including water, air, and land for current and future generations. The measurement items used were adopted and adapted from Kumar and Rahman (2016) and Yavuz Agan , Cemil Kuzey, and Mehmet Fatih Acar (2016).

3.6.2 Independent Variable

For Leavy (2017), independent variables are the ones that likely affect or influence other variables. They are variables or elements that a researcher can manipulate to observe the reaction of the dependent variable (Gravetter and Wallnau, 2013). In this study, the independent variables were circular economy capability.

3.6.3 Mediating and Moderating Variables

A mediating variable, also referred to as an intervening variable, is the variable that can mediate the effect of the independent variable on the dependent variable (Leavy, 2017). Green Orientation is the mediating variable in this study. The study also used technology orientation as the moderating variable.

3.7 Pilot Study

Pilot testing enhances the face validity of the survey instrument by ensuring that the wording of the items are consistent with hypothesized constructs while also ensuring that measurement scales possess adequate content validity (Clark and Watson, 1995). Following the completion of the survey instrument, a pilot study was conducted to determine the reliability and validity of the synthesized research instrument ahead of the main study. The pre-test was, especially, important because the instrument was made from scratch (though it was based on existing research and scales that had been used in other studies). This made a strong case for reliability and validity analysis as a basic part of the much-desired research quality. O'Leary (2010) further reiterates that a pilot study aids the researcher to obtain some assessment of the validity of questions and the likely reliability of the data gathered in the study. Saunders et al. (2018) say that the pilot study also helps make sure that the questions on the questionnaire are easy for respondents to answer.

As suggested by Johanson and Brooks (2009), a suitable pilot testing sample size for instrument development is between 25 and 30 respondents. For this pilot study, non-sampled 25 supply chain officers in different firms were selected chiefly because it fulfilled the minimum criteria for pilot studies. Again, it conforms to assertions that the participants of a pilot study do not necessarily need to be statistically selected (Cooper and Schindler, 2011; Babbie, 2018). Thirty (30) thematic item questionnaires were administered to the non-sampled respondents. These questionnaires were retrieved and painstakingly examined by the researcher. The analysis revealed that respondents lucidly comprehended all the questions and encountered no problems in answering the items on the questionnaire.

3.8 Testing for Reliability and Validity

In general terms, reliability relates to the consistency and dependability of a measurement technique. In specific terms, it refers to the consistency and stability of the score obtained from a measure or assessment technique over time and across settings (Marczyk et al., 2005; Cohen et al., 2018). Reliability provides important information about the random factors that could affect results. For example, if the measurement is accurate, the score is less likely to be the result of random factors and measurement error. Reliability is normally expressed as a correlation coefficient, which is a statistical analysis that tells us something about the relationship between two sets of scores or variables. Adequate reliability is present when the correlation coefficient is 0.80 or higher. Usually, test-retest reliability and internal consistency are the two (2) most frequently used indicators of a scale's reliability (Babbie, 2015). Respondents didn't want to take the test again, so the test-retest part of the study was taken out and internal consistency was used instead. Although there are several ways to measure internal consistency, the study adopted the most commonly used statistic, the Cronbach’s alpha co-efficient (Leavy, 2017; DeVellis, 2012). It is indicated that when Cronbach’s alpha score is above 0.70, then the questionnaires are reliable. On the other hand, when the Cronbach’s alpha is below 0.70, then the questionnaires are unreliable and must be redesigned (Numally, 1978). Undoubtedly, validity is an important element in research, particularly quantitative designs like this study. Basically, validity can be explained as the conceptual and scientific soundness of a research study (Saunders, 2016). The goal of validity is to get rid of or reduce any outside relates, variables, or explanations that could change the study's final conclusions. Again, Marczyk et al. (2005:158) said, "It is also meant to improve the accuracy and usefulness of findings by removing or controlling as many confounding variables as possible, which gives us more confidence in the results of a given study."

3.9 Method of Data Analysis

In most types of research studies, data analysis involves steps including: preparing the data for analysis; analyzing the data; and interpreting the data. Like many other studies, this one followed the steps outlined. Upon the collection of the data, the analysis proceeded as follows. First, the collected data was tracked until it was ready to be analyzed (Creswell and Creswell, 2018). That is, the information was logged and tracked with a well-established procedure. This was done to prevent the data from becoming disorganized, uninterpretable, and ultimately unusable. A recruitment log (which involves a comprehensive record of all individuals approached about participation in the study) was set up. The advantages of this are that it allows the researcher to have adequate records of the research participants. Second, the gathered data were screened for accuracy, prior to data entry. This was important because it gave researchers a chance to get in touch with study participants again and fixed any mistakes, omissions, or mistakes (Creswell and Creswell, 2018). The goal was to make sure that the data was clean, correct, and complete.

Third, the researcher proceeded to code and enter the data into the statistical package (Leavy, 2017). Furthermore, the data was transformed by way of identifying and coding missing values; computing totals and new variables; and recording and categorizing (Marczyk et al., 2005); before the proper data analysis commenced. A descriptive study was undertaken. That is, descriptive statistics were used to describe the data collected by accurately characterizing the variables under consideration. Frequencies and averages were done. In addition, with the help of Smart PLS Software, a Structural Equation Model (SEM) was used to assess and investigate the associations and relationships (hypothesized paths) among the variables. According to Hair et al. (2014), the Structural Equation Model (SEM) is a statistical procedure that models multiple relationships between independent and dependent variables at the same time. This statistical procedure is preferred, especially, where the research design includes complex models (Hair et al., 2014). Even though the Structural Equation Model has two distinctive approaches, i.e., the Covariance-based technique and the Variance-based technique. In terms of the application, this study used the "variance-based SEM"—Partial Least Square (PLS). This decision for selection was informed by the research purpose, research framework, and data characteristics. The variance-based SEM—Partial Least Square (PLS) technique "focuses on maximizing the variance of the dependent variables explained by the independent variables instead of reproducing the empirical covariance matrix" (Hair et al., 2014).

3.10 Ethical Concerns

Basically, ethics is about what is good and bad, right and wrong. In this respect, observing ethics in research is concerned with what researchers ought and ought not to do in the process of conducting research (Cohen, 2018; Saunders et al., 2016). In the conduct of this study, the researcher had endeavored to abide by the tenets of conducting ethical research. First, the purpose of the research was clearly communicated to the research participants in order to inform them that it was their responsibility to make informed decisions about whether or not to participate in the study. Second, the researcher sought the informed consent of participants from whom information was gathered. This was done by the researcher, clearly outlining that the study was an academic study intended to fulfill academic requirements. Typically, obtaining consent is often done by allowing potential participants to sign a consent form. However, in this study, verbal consent sufficed. The researcher decided to go with verbal consent because asking people to sign a form of consent seemed too formal, which made some people uncomfortable.

Third, the participants were assured of confidentiality and anonymity. This was done by not allowing the participants to disclose their identities in order that no response could be traced or attributed to participants. In addition, all the necessary access protocols were obtained. In view of the fact that the research participants were contacted for clearance. Lastly, participants were told that they would not be able to see the data collected because it was just for academic purposes.

CHAPTER FOUR

DATA ANALYSIS, RESULTS, AND DISCUSSIONS

4.1 Introduction

This fourth chapter covers the empirical findings from the field, its analysis, interpretation, and discussion. The respondent profiles of the respondents who were included in the study are presented in the first section. In the second part are the description and analyzes of the major variables, such as circular economy capabilities (CEC), economy sustainability, environmental sustainability, social sustainability, green orientation, and technology orientation. Others such as exploratory factor analysis, confirmatory factor analysis, and structural model evaluation are all included in the third section. Smart PLS-SEM and SPSS version 23 were used for the analysis.

4.2 Respondents' Profile

Out of the 180, the findings found that 15.6% was operations, 19.45% indicated administration, 1.7% was quality control, 2.2% indicated manufacturing, 25.0% indicated procurement and supply chain management, 3.9% indicated production, 25.6% indicated sales and marketing, and 6.7% were in the store department. In addition, 18.9% of respondents were between the ages of 20 and 30, 48.9% were between the ages of 31-40, 28.3% were between the ages of 41 and 50, and 3.9% were between 51 to 60 years old. The study found that 50.6% had a first degree, 4.4% had an HND, and 45.0% had a master's degree. 17.8% said they were accountants, 17.2% said they were administrators, 1.7% said they were other, operation managers, or sales managers, 2.2% said they were factory managers and storekeepers, 7.2% said they were the head of the company, 8.9% said they were marketers, 15.0% said they were marketing managers, 15.6% said they were procurement/supply chain officers, 3.9% said they were production managers, and 5.0% said they were warehouse managers. The study looked into years of experience, with 33.9% having 1–5 years of experience, 10.0% having 7–10 and more than 15 years of experience, and 46.1% having 6 to 10 years of experience.

Table 4. 1: Respondents' Profile

Variables	Categories	Frequency	Percent
Department	Operations	28	15.6
	Administration	35	19.4
	Quality Control	3	1.7
	manufacturing	4	2.2
	Procurement and supply-chain management	45	25.0
	production	7	3.9
	Marketing and sales	46	25.6
	Stores	12	6.7
Age	20-30	34	18.9
	31 - 40	88	48.9
	41-50	51	28.3
	51-60	7	3.9
level of education.	First degree	91	50.6
	HND	8	4.4
	Master's degree	81	45.0
Job Title	Accountant	32	17.8
	Administrator	31	17.2
	Other	3	1.7
	Factory Manager	4	2.2
	The entity's leader	13	7.2
	Marketing	16	8.9
	Marketing manager	27	15.0
	Operation manager	3	1.7
	Procurement/Supply Chain Officer	28	15.6
	production manager	7	3.9
	Sales manager	3	1.7
	Stores	4	2.2
	Warehouse manager	9	5.0
years of experience.	1-5 years	61	33.9
	11 - 15 years	18	10.0
	6-10 years	83	46.1
	over the age of 15	18	10.0
	Total	**180**	**100**

4.3. Response Rate and None Response Bias

Data were gathered from March 10th to August 30th, which is approximately four months. Overall, 200 questionnaires were administered to managers, supply chain professionals, procurement professionals, and operations managers using the approach described in the previous chapter. Of the 200 questionnaires administered, 180 valid questionnaires representing 90% were retrieved from respondents. According to Kamel and Lloyd (2015) the response rate of more than 50% in business management research is considered good for analysis. Therefore, the 90% response rate reported for this study served as an acceptable basis for drawing conclusions.

Considering the long duration of the data collection, it was imperative to evaluate the presence of survey bias in the dataset. In this regard, several precautionary procedures were taken in this study to avoid common methods and response bias (Podsakoff, MacKenzie and Podsakoff, 2012). First, as part of strategies to minimize bias in the dataset, questionnaires were translated into local language for few respondents who had issues with understanding the concepts as used in the study. Prior study of Brislin (1970) opined that translating into one's native language is beneficial for gathering reliable information about phenomena in a foreign environment. Secondly, respondents were informed that the information they submitted would be kept totally personal and private. This assurance kept them from succumbing to social desirability bias or giving appealing responses (Podsakoff et al., 2012). Thirdly, the researcher also provided definitions of the key constructs as used in the study, to guide respondents where the researcher was not available to provide such an explanation.

Apart from these strategies that were used, several statistical tests were conducted to validate the absence of bias in the data. Firstly, the data was subjected to Harman's one-factor test, as suggested by the study of (Scott and Bruce, 1994). The highest components with an eigenvalue greater than one accounted for 24.462 % of the variance, thus no single factor exceeded 50% of the total variance (See Table 4.4). Again, the Partialling out of General Factor in PLS Model procedure as recommended by Tehseen et al. (2017) was also employed. The result showed just a slight difference of 0.05 between the original R^2 and the R^2 after the general factor. Finally, the inter-correlation between the variables was investigated. The correlation result shows that the highest correlation among two constructs was found between circular economy and innovation performance (r=0. 695) since this correlation value is below the (r=0.90) see (Appendix II) threshold as indicated by earlier studies of (Pavlou and Xue, 2007; Spector and Brannick, 2010; Uddin et al., 2018).

When the number of people who take the survey is less than the total number of people in the population, this is called non-response bias. Low survey response rates are a common cause of non-response bias, which in turn can affect the quality of the sample used to draw conclusions and the validity of the study overall. Non-response bias was evaluated by contrasting the early and late respondents' responses in order to cut down on it in this study. Those that returned their questionnaires early did so inside the original one-month response frame, while those who returned theirs later are known as "late respondents." The result did not show any statistically significant differences between the two groups for any of the variables used in this study as suggested by Oppenheim (2001). The result confirms that non-response bias is not a problem in this study and samples represent targeted group. Specifically, the first 90 responses and the last 90 responses were considered as early responses and late responses respectively. Afterwards, a T-test analysis was employed to test for non-response bias. The results of the t-test analysis did not indicate any significant difference (see Table 4.2). Hence the study confirms that data gathered on the constructs in the first month is not different from the responses in the last month of the data collection.

Table 4. 2: Test for None Response Bias (Independent T Test)

Constructs	Groups	F	Sig.	T statistics
Circular Economy Capability	1	0.116	0.734	1.495
	2			
Supply Chain Sustainability	1	1.496	0.020	1.871
	2			
Green Orientation	1	1.221	0.074	-0.171
	2			
Technology Orientation	1	1.867	0.173	1.453
	2			

Source: (Field Data, 2022)

4.4 Correlation Analysis and Descriptive Statistics

The study's primary constructs are investigated in this part using bivariate correlational analysis. The correlational linkages of both the individual and composite constructs created were examined. In Table 4.2, the study's bivariate correlational analysis is presented. Below the diagonal, one may find Spearman's Rho. The Spearman's correlation approach was thought to be better suitable for discrete or non-numerical variables due to the translation of latent constructs from observable variables. Table 4.2 also showed that the Circular Economy Capability was scored (Mean = 4.59; SD = 1.759). Economic Sustainability score (Mean = 5.66; SD = 1.234). 5.88; standard deviation = 1.048).5.31; standard deviation = 1.336).5.39; standard deviation = 1.435).5.65; standard deviation = 1.157).

Table 4. 3: Descriptive Statistics and Correlation Analysis

Constructs	Mean	StD	1	2	3	4	5	6
Circular Economy Capability	4.59	1.759	1					
Economic Sustainability	5.66	1.234	0.659	1				
Environmental Sustainability	5.88	1.048	0.584	0.801	1			
Green Orientation	5.31	1.336	0.674	0.612	0.586	1		
Social Sustainability	5.39	1.435	0.635	0.659	0.642	0.677	1	
Technology Orientation	5.65	1.157	0.623	0.605	0.586	0.740	0.608	1

According to Table 4.2, Circular Economy Capability has a positive correlation (r = 0.69, P .05; r = 0.584, P .05; r = 0.67, P .05; r = 0.67, P .05; r = 0.67, P .05; r = 0.63, P .05) with Economic Sustainability, Environmental Sustainability, Green Orientation, Social Sustainability, and Technology Orientation, according Environmental Sustainability, Green Orientation, Social Sustainability, and Technology Orientation had a positive correlation with Economic Sustainability (r = 0.801, P .05; r = 0.612, P .05; r = 0.659, P .05; r = 0.605, P .05). Non-Environmental Sustainability has a positive correlation with Green Orientation, Social Sustainability, and Technology Orientation Culture (r = 0.586, P.05; r = 0.642, P.05; r = 0.586, P.05). According to Table 4.2, there is no risk of multi-collinearity because the correlations between the variables were moderate. As a result, Table 4.2 shows that all of the study's variables had positive correlations with one another.

4.5 Exploratory Factor Analysis (EFA)

Exploratory factor analysis can be used as a measurement reduction technique for studies with between twenty and fifty items (Chang and Chen, 2013). Exploratory factor analysis may be used in the study to reduce variability and make each conceptual behavior simpler to understand, analyze, and evaluate in light of the research's indicators. Hypotheses must address the accuracy of the scale used and demonstrate the relationship between two or more variables in order to produce, validate, or reject alternative theories (Williams et al., 2012). When factor analysis is utilized, the following procedure is employed to achieve the objectives of this phase of the study: In this work, exploratory factor analysis was employed to identify the items that would accurately reflect or measure the latent variables (Edkins and Pollock, 1996). This was done using the principal components analysis (PCA) with the varimax method from the SPSS software. To ensure precise interpretation and uniformity of the study parameters, the varimax technique was applied. According to Pallant (2005), for a matrix item to be a meaningful indication, its loading must be greater than or equal to 0.30. Norusis (1993), on the other hand, asserted that a significant factor loading should be more than or equal to 0.50. However, in this experiment, a threshold of 0.70 was used. If an item didn't meet the criteria, it was discarded.

4.5.1 Test of Common Method Bias

In the study, common procedure bias was investigated and the adequacy of the measurement model's components was confirmed using Harman's single factor test. According to Podsakoff et al. (2003), the exploratory factor analysis one-factor test, sometimes referred to as the Harman, assesses whether a single factor accounts for or explains more than 50% of the calculated variance (EFA). The result, as given in Table 4.3 below, indicates that when the principal component analysis extraction approach was applied, the percentage of variance was fully described by a single factor, 24%, falling below the EFA's 50% cutoff criterion. This indicates that the dataset does not contain CMB. The correlation matrix was also used to support the absence of CMB while adhering to the restrictions of Harman's one-factor technique. Tahseen et al. (2007) recommended that the correlations between the key constructs not exceed a particular threshold in order to confirm the absences of CMB. The results of the study demonstrated that the main components only had weak (r<0.9) correlations. This shows that the study model was devoid of common method bias (CMB) and validates the results of Harman's one-factor test.

Table 4. 4: Common Method Bias

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.296	24.462	24.462	9.296	24.462	24.462
2	4.628	12.180	36.642	4.628	12.180	36.642
3	3.348	8.810	45.453	3.348	8.810	45.453
4	2.855	7.513	52.966	2.855	7.513	52.966
5	2.416	6.357	59.323	2.416	6.357	59.323
6	1.935	5.093	64.416	1.935	5.093	64.416
7	1.809	4.760	69.175	1.809	4.760	69.175
8	1.425	3.749	72.925	1.425	3.749	72.925
9	1.163	3.060	75.984	1.163	3.060	75.984
10	1.125	2.962	78.946	1.125	2.962	78.946
11	.975	2.567	81.513			
12	.889	2.341	83.853			
13	.796	2.095	85.948			
14	.717	1.886	87.834			
15	.570	1.499	89.333			
16	.511	1.345	90.678			
17	.435	1.144	91.823			
18	.385	1.013	92.836			
19	.366	.964	93.800			
20	.324	.852	94.652			
21	.272	.716	95.368			
22	.267	.703	96.071			
23	.237	.624	96.695			
24	.218	.575	97.270			
25	.174	.457	97.727			
26	.170	.447	98.174			
27	.144	.379	98.553			
28	.109	.288	98.841			
29	.098	.257	99.098			
30	.092	.241	99.340			
31	.068	.178	99.517			
32	.056	.147	99.664			
33	.042	.110	99.774			
34	.030	.080	99.854			
35	.023	.061	99.916			
36	.015	.040	99.956			
37	.013	.033	99.989			
38	.004	.011	100.000			

Extraction Method: Principal Component Analysis.

4.5.2 Bartlett's Test of Sphericity and Kmo Test

The results in Table 4.4 show that the study's KMO sampling adequacy was 0.919. It further demonstrates that, when compared to 0 or an identity matrix, values under this dimension have a relatively strong correlation with one another. The suitable sample size for the investigation shows that real-value calculations using exploratory factor analysis would be possible. This was shown to be significant in Table 4.4 below with a p value less than 0.05. The results imply that the internal correlations between variables may be caused by extra factors. The study revealed that the majority of the measurement instruments employed to assess the latent concept had considerable adjustments.

Table 4. 5: Bartlett's Test of Sphericity and KMO Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.919
Bartlett's Test of Sphericity	Approx. Chi-Square	3738.472
	df	253
	Sig.	.000

4.6 Confirmatory Factor Analysis

Utilizing Smart PLS version 3, confirmatory factor analysis was done to determine the measurement model's validity and reliability. The process evaluated the validity and reliability of the constructs using the maximum likelihood estimation method. The model measurement assessment was a requirement of the structural model analysis. Cronbach's Alpha (CA), Composite Reliability (CR), and Average Variance Extracted (AVE) were used to measure the model's reliability and validity.

The reflecting model measurement is the first step in the model measurement assessment process. The results of using the indicator loading are shown in Table 4.5. They show that it ranges from

0.710 to 0.916. It proves the 0.708 thresholds proposed by Hair et al. (2019). Due to its capacity to explain more than 50% of the indicator variance, the construct serves as evidence of good item dependability. Each component was statistically significant, as can be shown in Table 4.5 above. Two internal consistency measures, Cronbach Alpha and Composite Reliability, were employed to assess the reliability of the study's constructs further. (Hair et al., 2019) Strong Cronbach Alpha and Composite Dependability Scores, in this case, show that the reliability was high. This study's conclusions show that the Cronbach Alpha scores range from 0.812 to 0.893. According to Hair et al. (2019), Cronbach Alpha levels above 0.95 constitute a serious threat since they imply or show item recurrence, which reduces construct validity. The average variance extracted (AVE) for all items on each concept is the statistic used to assess convergent validity. The AVE is found by taking the mean value of each indicator on a build and dividing it by four. A construct must account for at least 50% of the difference between its component components to receive a score of 0.50 or higher (Hair et al., 2019). The results of this investigation, which are presented in Table 4.5 above, indicate that AVE, which was also used to assess the convergent validity of the constructs, was found to be more than the 0.5 thresholds. The multicollinearity issue was investigated once again in the study using VIF. The inner and outer collinearity statistics (VIFs) were both below the 3 thresholds, according to Ringle et al. (2015) and Berker et al. (2016).

Bootstrapping can be used to determine if the Fornell-Larcker Criterion value is significantly different from 1.00 or a lower threshold value of 0.85 or 0.90 in addition to these criteria, depending on the study's context (Sarstedt and Franke, 2019). Table 4.6, where all Fornell-Larcker Criterion values are less than 0.90 or 0.85, illustrates how discriminant validity is proven.

Table 4. 6: Reliability and Validity

Constructs	Items	Loadings	CA	CR	AVE	VIF
Circular Economy Capability	CEC1	0.774	0.911	0.927	0.585	2.345

	CEC2	0.795				2.335
	CEC3	0.785				2.297
	CEC4	0.759				2.280
	CEC5	0.749				1.986
	CEC6	0.781				2.302
	CEC7	0.757				2.229
	CEC8	0.754				2.182
	CEC9	0.726				1.924
Economic Sustainability	ECO1	0.841	0.909	0.929	0.687	2.951
	ECO2	0.834				2.961
	ECO3	0.796				2.171
	ECO4	0.831				2.702
	ECO5	0.839				2.948
	ECO6	0.832				2.893
Environmental Sustainability	ENV1	0.845	0.887	0.922	0.748	2.147
	ENV2	0.903				2.020
	ENV3	0.891				2.807
	ENV4	0.818				1.917
Green Orientation	GO1	0.702	0.922	0.935	0.589	2.117
	GO10	0.801				2.079
	GO2	0.716				2.183
	GO3	0.711				2.252
	GO4	0.774				2.588
	GO5	0.793				2.436
	GO6	0.801				2.664
	GO7	0.799				2.485
	GO8	0.780				2.725
	GO9	0.792				2.092
Social Sustainability	SOC1	0.828	0.928	0.946	0.777	2.293
	SOC2	0.888				2.376
	SOC3	0.892				2.128
	SOC4	0.889				2.657
	SOC5	0.907				1.655
Technology Orientation	TO1	0.823	0.891	0.924	0.753	2.076
	TO2	0.905				2.010
	TO3	0.865				2.427
	TO4	0.877				2.541

Table 4. 7: Discriminant Validity Using Fornell-Larcker Criterion

Constructs	**1**	**2**	**3**	**4**	**5**	**6**
Circular Economy Capability	0.765					

Economic Sustainability	0.659	0.829				
Environmental Sustainability	0.584	0.801	0.865			
Green Orientation	0.674	0.612	0.586	0.768		
Social Sustainability	0.635	0.659	0.642	0.677	0.881	
Technology Orientation	0.623	0.605	0.586	0.740	0.608	0.868

4.7 Goodness of Fit Measure

The analysis proceeds to the structural model evaluation and hypothesis testing using the variances of dependent variables as well as the model's predictive relevance using Stone-Q2, Geisser's path coefficients, and significance levels after the measurement model evaluation passes all reliability and validity requirements (t-values). To determine Q2, the study employed the blinding process. The Q2 numbers for economic sustainability, environmental sustainability, green orientation, and social sustainability were all above the criteria (>0) by 0.502, 431, 452, and 0.522, respectively.

Significant values for the coefficient of determination (R2) were found for economic sustainability, environmental sustainability, green orientation, and social sustainability. As a result, independent factors account for around 51% of the variance in economic sustainability, 44% in environmental sustainability, 45% in green orientation, and 53% of the variance in social sustainability, as shown in Table 4.7 and Figure 4.8 below.

Table 4. 8: Goodness of Fit Measure

Constructs	**R Square**	**Q² (=1-SSE/SSO)**

Economic Sustainability	0.507	0.502
Environmental Sustainability	0.437	0.431
Green Orientation	0.454	0.452
Social Sustainability	0.527	0.522

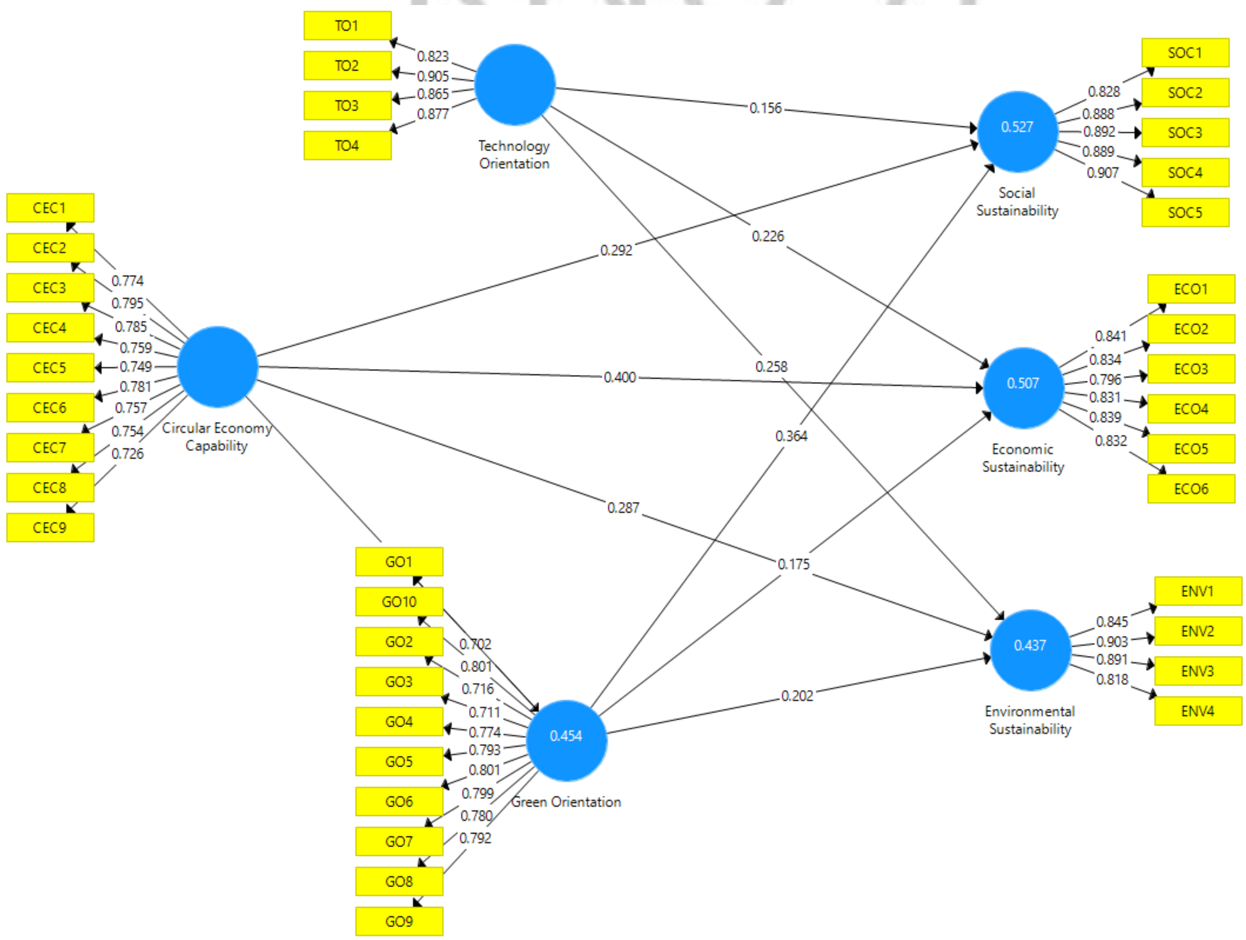

Figure 4. 1: Measurement Model Assessment

4.7.1 Structural Model Evaluation

The main objective of the study is to assess the circular economy capability and supply chain sustainability: the mediating effect of green orientation and the moderating role of technology orientation. The hypothesis and construct relationship were tested using the standardized path coefficients. The path's significance level was calculated using the bootstrap resampling procedure

(Henseler et al., 2009), with 500 iterations of resampling (Chin, 1998). The result of the structural model evaluation was discussed below.

The analysis's findings demonstrated that the first hypothesis (H1a) was supported, and as a result, circular economy capability significantly predicted economic sustainability (B = 0.452; t = 7.553; P value = 0.000; Sig 0.005). The study came to the conclusion that circular economy capability significantly influenced economic sustainability. So, the more a company can use the circular economy, the more sustainable its supply chain is.

As a result, circular economy capability strongly predicted environmental sustainability (B = 0.346; t = 5.530; P value = 0.000; Sig 0.005), according to the analysis's findings, which demonstrated that the second hypothesis (H1b) was supported. The study comes to the conclusion that circular economy capability is significantly influenced by environmental sustainability.

According to the analysis's findings, which demonstrated that the third hypothesis (H1c) was supported (B = 0.67; t = 18.460; P value = 0.000; Sig 0.005), circular economy capability strongly predicted green orientation. So, the study comes to the conclusion that the green orientation is affected by the ability to have a circular economy.

As a result, circular economic capability strongly predicted social sustainability (B = 0.327; t = 4.688; P value = 0.000; Sig 0.005). The analysis's findings supported the fourth hypothesis (H2a). The study's main finding is that the ability to have a circular economy has a big effect on social sustainability.

The analysis's findings demonstrated that the fifth hypothesis (H2b) was supported, and as a result, green orientation significantly predicted economic sustainability (B = 0.308; t = 4.780; P value = 0.000; Sig 0.005). The study came to the conclusion that green orientation significantly influenced economic sustainability.

As a result, green orientation strongly predicted environmental sustainability (B = 0.354; t = 4.987; P value = 0.000; Sig 0.005), according to the analysis's findings, which demonstrated that the sixth hypothesis (H2c) was supported. The study comes to the conclusion that environmental sustainability has a big effect on how green people are.

According to the analysis's findings, which demonstrated that the seventh hypothesis (H3) was supported (B = 0.67; t = 18.460; P value = 0.000; Sig 0.005), green orientation strongly predicted social sustainability. The study comes to the conclusion that going green has an effect on social sustainability.

Again, the eighth (H4a) hypothesis was confirmed, indicating that green orientation mediates the impact of circular economy capability on social sustainability in a favorable way (B=0.307; t=5.573; P=0.000; Sig0.005). This suggests that green orientation is a big part of the link between circular economic capability and social sustainability.

The ninth (H4b) hypothesis was confirmed, according to which green orientation mediates how favorably circular economic capability affects economic sustainability (B=0.207; t=4.517; P=0.010; Sig0.005). This suggests that the relationship between circular economic capability and social sustainability is influenced by green orientation in a specific way.

The tenth (H4c) hypothesis was confirmed, according to which green orientation mediates how favourably circular economy capability affects environmental sustainability (B=0.238; t=4.765; P=0.010; Sig<0.005). This suggests that the relationship between circular economy capability and environmental sustainability is significantly mediated by green orientation.

The analysis's finding also demonstrated that the eleventh hypothesis (H5) was confirmed, meaning that technology orientation negatively moderates the influence of circular economy capability and supply chain sustainability (B=0.112; t=2.305; P value =0.022; Sig<0.005). The negative sign indicated that the value of the coefficient of circular economy capability in explaining supply chain sustainability partially increased as the level of technology orientation increased.

Table 4. 9: Hypotheses Testing for Direct and Indirect Hypothesis

Hypotheses	**Path Coefficient**	**T Statistics**	**P Values**	**Results**
H1a: Circular Economy Capability -> Economic Sustainability	0.452	7.553	0.000	Supported
H1b: Circular Economy Capability -> Social Sustainability	0.327	4.688	0.000	Supported
H1c: Circular Economy Capability -> Environmental Sustainability	0.346	5.530	0.000	Supported
H2a: Green Orientation -> Economic Sustainability	0.308	4.780	0.000	Supported
H2b:Green Orientation -> Environmental Sustainability	0.354	4.987	0.000	Supported
H2c: Green Orientation -> Social Sustainability	0.456	6.315	0.000	Supported
H3: Circular Economy Capability -> Green Orientation	0.674	18.460	0.000	Supported
H4a: Circular Economy Capability -> Green Orientation -> Social Sustainability	0.307	5.573	0.000	Supported
H4b: Circular Economy Capability -> Green Orientation -> Economic Sustainability	0.207	4.517	0.000	Supported
H4c: Circular Economy Capability -> Green Orientation -> Environmental Sustainability	0.238	4.765	0.000	Supported
H5: TO (CEC-SCS) -> Supply Chain Sustainability	-0.112	2.305	0.022	Supported

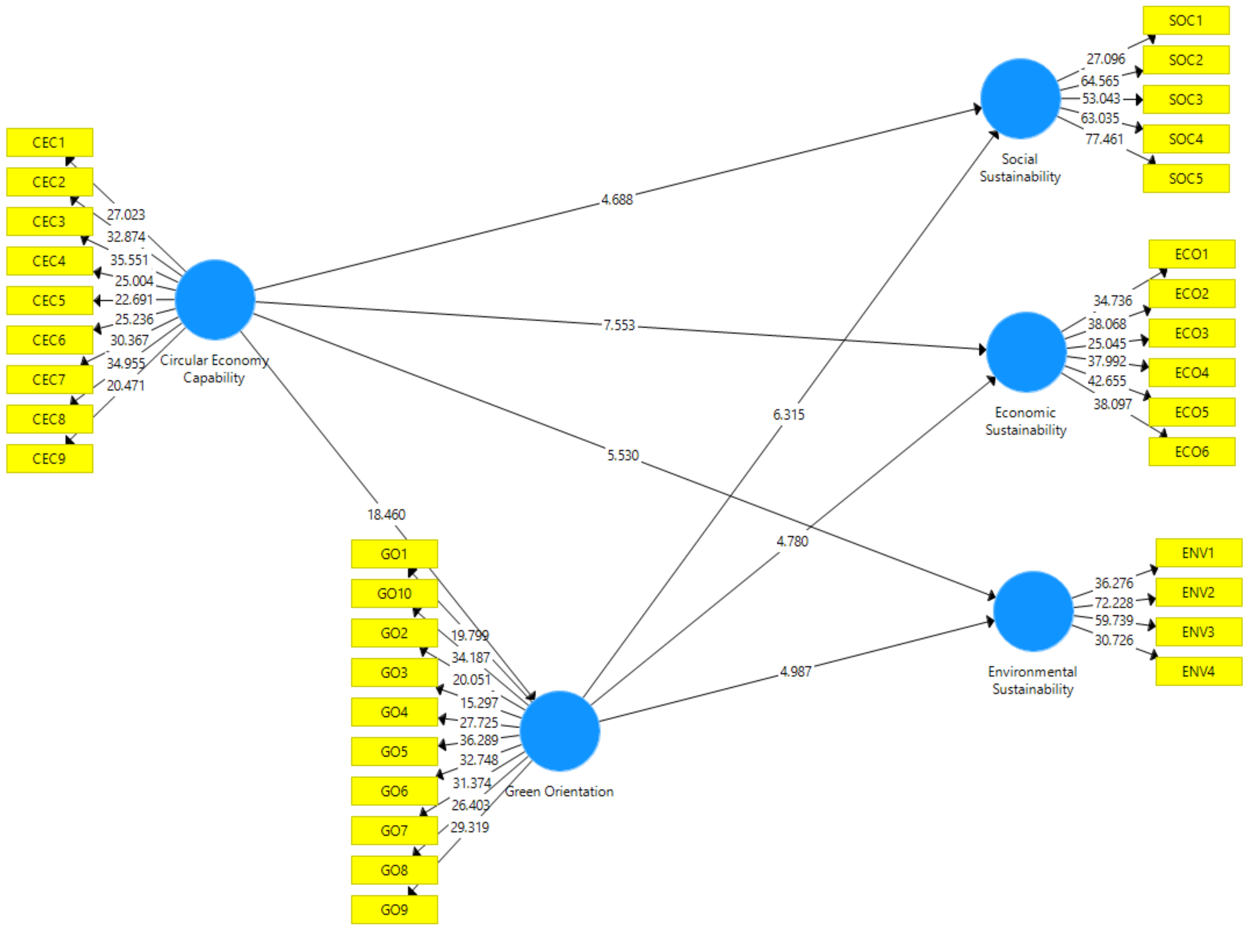

Figure 4. 2: Structural Model Evaluation

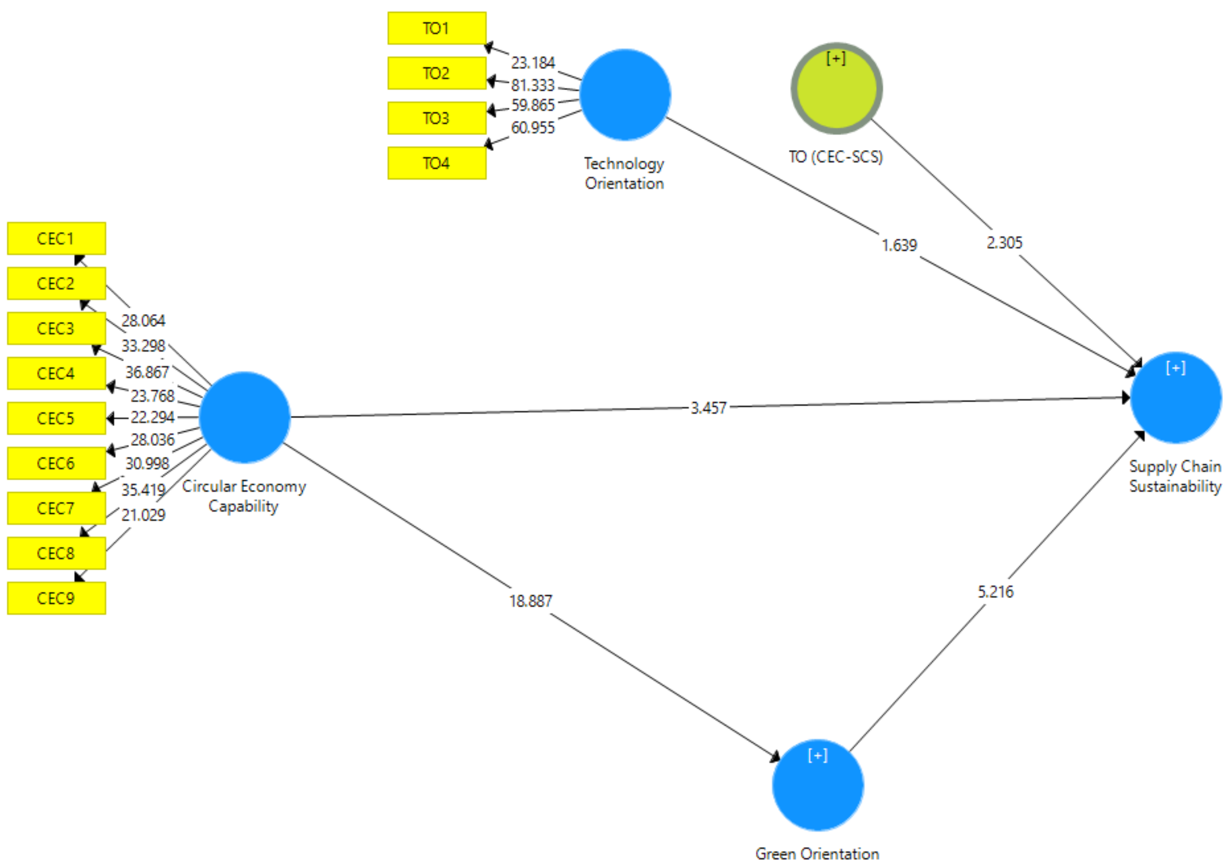

Figure 4. 3: Structural Model Evaluation (Moderating Effect)

4.8 Discussion of Results

The main objective of the study is to assess the circular economy capability and supply chain sustainability: the mediating effect of green orientation and the moderating role of technology orientation. The next section talks about the different hypotheses and how they have been tested or dealt with.

4.8.1 The Impact of Circular Economy Capability on Supply Chain Sustainability

The study's first objective assesses the extent to which circular economy capability drives the supply chain sustainability of multinational firms. The results of the analysis showed that the first hypothesis (H1a) was true. As a result, the ability to create a circular economy was a strong predictor of economic sustainability. The study came to the conclusion that circular economy capability significantly influenced economic sustainability. The results of the analysis showed that the second hypothesis (H1b) was supported because the ability to have a circular economy strongly predicted environmental sustainability. The study comes to the conclusion that circular economy capability is significantly influenced by environmental sustainability. As a result, circular economic capability strongly predicts social sustainability. The analysis`s findings supported the fourth hypothesis (H2a). The study`s main finding is that the ability to have a circular economy has big effect social sustainability. The study comes to the conclusion that circular economy capability has a positive and significant impact on supply chain sustainability. The result showed that circular economy capability significantly drives all three dimensions of supply chain sustainability. The literature underscores the environmental advantages of CEC in supply chains. The Circular Economy framework, as proposed by Bocken et al. (2016), posits that CEC significantly reduces resource consumption and waste generation. This corresponds with the principles of the Natural Capital Theory, which highlights the finite nature of natural resources and the necessity to manage them sustainably (Costanza et al., 1997). By conserving resources and minimizing waste, CEC contributes to the reduction of environmental impacts, such as carbon emissions and resource depletion. From an economic perspective, CEC can lead to substantial cost savings, a notion supported by several studies (Ghisellini et al., 2016; Pansera et al., 2019). The Resource-Based View (RBV) theory suggests that firms that effectively manage and leverage resources can achieve competitive advantages (Barney, 1991). CEC, by optimizing resource utilization and reducing waste disposal costs, aligns with the RBV framework. Additionally, the Service-Dominant Logic (Vargo & Lusch, 2008) argues that CEC encourages product-service systems, generating new revenue streams through services like repairs, refurbishment, and sharing, which can enhance supply chain profitability. In summary, the literature and theoretical frameworks converge to highlight the multifaceted implications of the positive effect of Circular Economy Capability on Supply Chain Sustainability. These implications span environmental, economic, resilience, regulatory, reputational, innovation, social, and long-term dimensions. As businesses increasingly integrate sustainability into their strategies, CEC emerges as a transformative force, aligning profit with environmental stewardship, and contributing to a more sustainable and resilient future. Understanding these implications is crucial for organizations seeking to thrive in a rapidly changing global landscape while minimizing their environmental footprint. These results are in line with previous research (Khan et al., 2021; Dey et al., 2020; Walker et al., 2022; Nikolaou et al., 2021; Agrawal et al., 2021) that showed how important circular economy capability is for driving sustainability in the supply chain (Khan et al., 2021; Dey et al., 2020; Walker et al., 2022; Nikolaou

4.8.2 The Effect of Green Orientation on Supply Chain Sustainability

This section examines the link between green orientation and supply chain sustainability. The analysis's findings demonstrated that the fifth hypothesis (H2a) was supported, and as a result, green orientation significantly predicted economic sustainability. The study came to the conclusion that green orientation significantly influenced economic sustainability. As a result, green orientation strongly predicted environmental sustainability, according to the analysis's findings, which demonstrated that the sixth hypothesis (H2b) was supported. The study comes to the conclusion that green orientation is significantly influenced by environmental sustainability. According to the analysis's findings, which demonstrated that the seventh hypothesis (H2c) was supported, green orientation strongly predicted social sustainability. As a result, the study draws the conclusion that green orientation affects Supply Chain Sustainability. According to the analysis's findings, which demonstrated that the third hypothesis (H3) was supported, circular economy capability strongly predicted green orientation. As a result, the study draws the conclusion that circular economy capability affects green orientation. Green Orientation, characterized by an organization's commitment to environmentally responsible practices, plays a pivotal role in influencing and driving Supply Chain Sustainability. This discussion explores the implications of the positive effect of Green Orientation on Supply Chain Sustainability, drawing insights from literature and theoretical frameworks. The literature consistently emphasizes the environmental benefits of Green Orientation within supply chains. A Green Orientation promotes sustainable practices such as eco-friendly sourcing, energy efficiency, and emissions reduction (Sarkis et al., 2010). This aligns with the principles of Environmental Stewardship (Andersen & Strandenæs, 2012), emphasizing responsible resource use and minimizing ecological harm. By integrating environmentally friendly practices, Green Orientation contributes to reduced carbon emissions, decreased resource depletion, and minimized environmental impacts. From an economic perspective, Green Orientation can lead to cost savings and increased profitability (Seles et al., 2015). The Resource-Based View (RBV) theory (Barney, 1991) suggests that firms that effectively manage and leverage resources, including environmental resources, can gain competitive advantages. Green Orientation aligns with this perspective by optimizing resource use, reducing waste, and potentially attracting eco-conscious customers, which can boost revenues. The literature and theoretical frameworks converge to underscore the multifaceted implications of the positive effect of Green Orientation on Supply Chain Sustainability. These implications span environmental, economic, resilience, regulatory, reputational, innovation, social, and long-term dimensions. Green Orientation is instrumental in aligning business goals with sustainability imperatives, fostering not only economic growth but also environmental stewardship and societal well-being. Understanding these implications is essential for organizations striving to navigate the evolving landscape of sustainable supply chains and demonstrate their commitment to a greener and more sustainable future.

4.8.3 Green Orientation's Mediating Role

The study's second objective examines the mediating effect of green orientation between circular economy capability and supply chain sustainability relationships. Again, the eighth (H4a) hypothesis was proven to be true. This shows that green orientation mediates the effect of being able to use a circular economy on social sustainability in a positive way. This suggests that the relationship between circular economic capability and social sustainability is significantly mediated by green orientation. The ninth (H4b) hypothesis was confirmed, according to which green orientation mediates how favorably circular economic capability affects economic sustainability. This suggests that the relationship between circular economic capability and social sustainability is influenced by green orientation in a specific way. The tenth (H4c) hypothesis was confirmed, according to which green orientation mediates how favorably circular economic capability affects environmental sustainability. This suggests that green orientation is a big part of the link between being able to have a circular economy and keeping the environment healthy. Green Orientation, characterized by an organization's commitment to environmentally responsible practices, plays a pivotal role in influencing and driving Supply Chain Sustainability. This discussion explores the implications of the positive effect of Green Orientation on Supply Chain Sustainability, drawing insights from literature and theoretical frameworks. A Green Orientation promotes sustainable practices such as eco-friendly sourcing, energy efficiency, and emissions reduction (Sarkis et al., 2010). This aligns with the principles of Environmental Stewardship (Andersen & Strandenæs, 2012), emphasizing responsible resource use and minimizing ecological harm. By integrating environmentally friendly practices, Green Orientation contributes to reduced carbon emissions, decreased resource depletion, and minimized environmental impacts. These implications span environmental, economic, resilience, regulatory, reputational, innovation, social, and long-term dimensions. Green Orientation is instrumental in aligning business goals with sustainability imperatives, fostering not only economic growth but also environmental stewardship and societal well-being. Understanding these implications is essential for organizations striving to navigate the evolving landscape of sustainable supply chains and demonstrate their commitment to a greener and more sustainable future.

4.8.4 Technology Orientation's Moderating Role

The study's third objective examines the moderating role of technology orientation in the relationship between circular economy capability and supply chain sustainability of manufacturing firms. The analysis's finding also demonstrated that the eleventh hypothesis (H5) was confirmed, meaning that technology orientation negatively moderates the influence of circular economy capability and supply chain sustainability. The negative sign showed that as the level of technology orientation went up, the value of the coefficient of circular economy capability in explaining supply chain sustainability went up a little bit. The literature suggests that when TO inversely moderates the CEC-SCS relationship, it can pose challenges to environmental impact reduction. Circular economy principles advocate for resource optimization and waste reduction, but an excessive TO focus on rapid technological advancement may lead to increased resource consumption and electronic waste (Geng et al., 2019). This counterproductive effect could hinder progress toward environmental sustainability goals. From an economic standpoint, an inverse moderating role of TO imply potential trade-offs. While TO may drive supply chain efficiency through advanced technologies, it can also introduce costs associated with frequent technological upgrades and resource-intensive manufacturing processes (Bocken et al., 2016). These trade-offs can strain profitability and sustainability objectives, necessitating careful balance. The implications extend to social and long-term dimensions. Excessive TO could lead to job displacement due to automation, potentially impacting communities negatively (Frey & Osborne, 2017). Moreover, the long-term viability of supply chains might be compromised if environmental sustainability is sacrificed for short-term technological gains. The inverse moderating role of Technology Orientation in the relationship between Circular Economy Capability and Supply Chain Sustainability introduces a complex set of challenges and trade-offs. Balancing the pursuit of technological advancement with sustainability objectives is essential. Organizations need to carefully manage these dynamics to ensure they do not inadvertently hinder progress towards a more sustainable and resilient future. Striking the right balance between technology and sustainability is critical for organizations aiming to thrive in an increasingly interconnected and environmentally conscious global marketplace.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

The main objective of the study is to assess the circular economy capability and supply chain sustainability: the mediating effect of green orientation and the moderating role of technology orientation. This chapter presents a summary of the study's findings as well as the conclusion, which were briefly presented in the first portion of this chapter. The chapter concludes with recommendations and further studies.

5.2 Summary of Findings

5.2.1 Circular Economy Capability and Supply Chain Sustainability

The study's first objective assesses the extent to which circular economy capability drives supply chain sustainability manufacturing firms. The study came to the conclusion that circular economy capability significantly influenced economic sustainability. The study comes to the conclusion that circular economy capability is strongly related with environmental sustainability. The study draws the conclusion that circular economy capability affects the green orientation. As a result, circular economic capability strongly predicts social sustainability. The study's main finding is that the ability to have a circular economy has a big effect on social sustainability.

5.2.2 Green Orientation's Impact on Supply Chain Sustainability

This section examines the link between green orientation and supply chain sustainability. Result showed that green orientation significantly predicted economic sustainability. The study came to the conclusion that green orientation significantly associated with economic sustainability. The study comes to the conclusion that green orientation is significantly related with environmental sustainability. Findings indicates green orientation strongly predicted social sustainability. As a result, the study draws the conclusion that green orientation affects social sustainability.

5.2.3 Mediating Role of Green Orientation

The study's second objective examines the mediating effect of green orientation between circular economy capability and supply chain sustainability relationships. Findings indicates that green orientation mediates the impact of circular economy capability on social sustainability in a favourable way. This suggests that the relationship between circular economic capability and social sustainability is significantly mediated by green orientation. This suggests that the relationship between circular economic capability and social sustainability is associated with green orientation in a specific way. This suggests that green orientation is a big part of the link between being able to have a circular economy and keeping the environment healthy.

5.2.4 Moderating Role of Technology Orientation

The study's third objective examines the moderating role of technology orientation in the relationship between circular economy capability and supply chain sustainability of manufacturing firms. The negative sign showed that as the level of technology orientation went up, the value of the coefficient of circular economy capability in explaining supply chain sustainability went up a little bit.

5.3 Conclusion

The main goal of the study is to examine how well the circular economy works and how sustainable the supply chain is: the role of green orientation as a mediator and the role of technology orientation as a moderator. This study was conducted using a quantitative research approach. A sample size of 180 senior managers was determined from the manufacturing firms selected in

Ghana using a purposive sampling technique. A structured questionnaire guide is used as the primary data collection tool. The data was looked at using the Statistical Package for Social Sciences (SPSS) and Smart PL-SEM. Descriptive and inferential research methodologies were used to analyse the data. The result shows that circular economy capability significantly predicts economic, environmental, and social sustainability positively. " "Green" orientation significantly relates economic, environmental, and social sustainability. The fact that green orientation acts as a bridge between economic, environmental, and social sustainability is a big deal. The moderating role of technology orientation positively moderates the influence of circular economy capability on supply chain sustainability (economic, environmental, and social). The study therefore highlighted some managerial contributions based on the findings. The model of the study gives a clearer understanding of the core factors that influence supply chain sustainability. The outcome of the study also provided insight for practice by identifying individual factors that contribute to social, economic, and environmental sustainability in the supply chain. These factors can be used by multinational firms to develop strategies to deal with challenges regarding specific sustainability issues in the supply chain in Ghana. It is important to understand that, holistically, CEC, GO, and TO have a role to play in ensuring supply chain sustainability. So, it's important for the people who matter to come up with policies and good plans to help CEC, GO, and TO in Ghana deal with the problems they face.

5.4 The Study's Contribution

The outcome of this research sufficiently addresses all three objectives set out from the onset of the research by bringing out and examining the key factors that impact supply chain sustainability in Ghana, especially among multinational firms. Even though the study's implications are important to talk about, it is also important to talk about the study's practical and theoretical contributions.

5.4.1 Contribution to Research in Academia.

The reviewed literature has confirmed that limited or no past studies over the period have seen the important relationship that exists between these factors: circular economy capability, green orientation, technology orientation, and supply chain sustainability (social, economic, and environmental), especially in the context of emerging economies like Ghana. Previous work has also shown that most of the studies evaluated these factors as standalone or separately in their studies. But, as far as the researcher knows, none of these factors have been looked at together, especially in Sub-Saharan Africa. To fill this identified gap in the existing literature, the researcher understudied by combining all of the aforementioned variables to see how they could work together in one model. A conceptual or theoretical model was developed and tested empirically to give a new meaning to the relationship circular economy capability, green orientation, technology orientation, and supply chain sustainability have on each other. This empirical justification provides novel knowledge on the impact of circular economic capability, green orientation, and supply chain sustainability. From the literature review to the knowledge of the researcher, there is little work connecting these factors studied by the researcher in just one piece of research. This new discovery gives us a new way to look at the factors of being able to use a circular economy, being focused on being green, being focused on technology, and having a sustainable supply chain. This research has revealed that circular economy capability and green orientation are key essential factors that predict supply chain sustainability. A lot of researchers have studied and found other factors which drive supply chain sustainability, but most of these studies were done in settings such as manufacturing, service, and the clothing industry. However, the studies did not cover all these variables in one setting. Hence, this piece of work adds up to existing knowledge by way of positively validating the effect of circular economy capability, green orientation, and technology orientation on supply chain sustainability in developing Africa. The contribution has emphasized green orientation as a very important factor that could significantly relate supply chain sustainability. Additionally, there are other contributions given by this research work. This piece of work is one of the novel research projects that studies the moderating role of technology orientation and the mediating effect of green orientation in the relationship between circular economy capability and supply chain sustainability, particularly in Ghana and Africa. This research work gives a fresh understanding of how multinational firms in Ghana assess the factors that combine to drive supply chain sustainability in Ghana. Again, this piece of work contributes to knowledge by giving a very good meaning to how firms' measure supply chain sustainability in multinational firms, which researchers have been silent on.

5.4.2 Contribution to Practice

Supply chain sustainability is new in Africa, particularly in Ghana. To the best of the researcher's knowledge, the study is new research done on the moderating role of technology orientation and the mediating effect of green orientation in the relationship between circular economy capability and supply chain sustainability in Ghana. Hence, this research will provide very useful information to managers and regulators of multinational firms and policymakers to take into consideration the factors that would support sustainable supply and sustainability in the supply chain of multinational firms. Additionally, this piece of work would support firms' management, the companies, and stakeholders. Firms will be able to focus on areas of continuous improvement in the supply chain, which will ensure the sustainable and improved production of quality products and services to the world market as a competitive advantage for the continuous achievement of premium prices. Stakeholders will be able to happily work to achieve results such as good quality products when they see that their relationship with the firm is sustainable and their concerns are continuously being addressed. The companies will be assured of a sustainable business and have access to increased production of good-quality products from suppliers.

5.5. Limitations and Future Research Suggestions

The outcome of the study shows that the model of the research truly predicts the role of circular economy capability, green orientation, technology orientation, and supply chain sustainability in Ghana. This research was done among managers in multinational firms in Ghana. Since the result cannot be generalized as it may be different for different industries in different countries, the researcher recommends that the scope of the study be extended to include other countries since different countries may have different managers' concerns and needs that may affect the study outcomes. Again, a comparative study can be conducted across different countries to determine whether the outcome in Ghana can be similar to other countries.

Also, the research was conducted using quantitative methods to examine the role of circular economy capability, green orientation, technology orientation, and supply chain sustainability in Ghana. A qualitative approach can be used to conduct this same research and to examine the same relationship. Using a qualitative method, a thorough assessment of the relationship between a green buyer and a green supplier could be done.

Future research can also consider suppliers in addition to the managers since, in gathering the data, some suppliers were of the view that they should be part of any future studies because they would like to outline their views on the buyer-supplier relationships and their influence on supply chain sustainability. This is an important aspect that will give the whole research a new point of view.

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