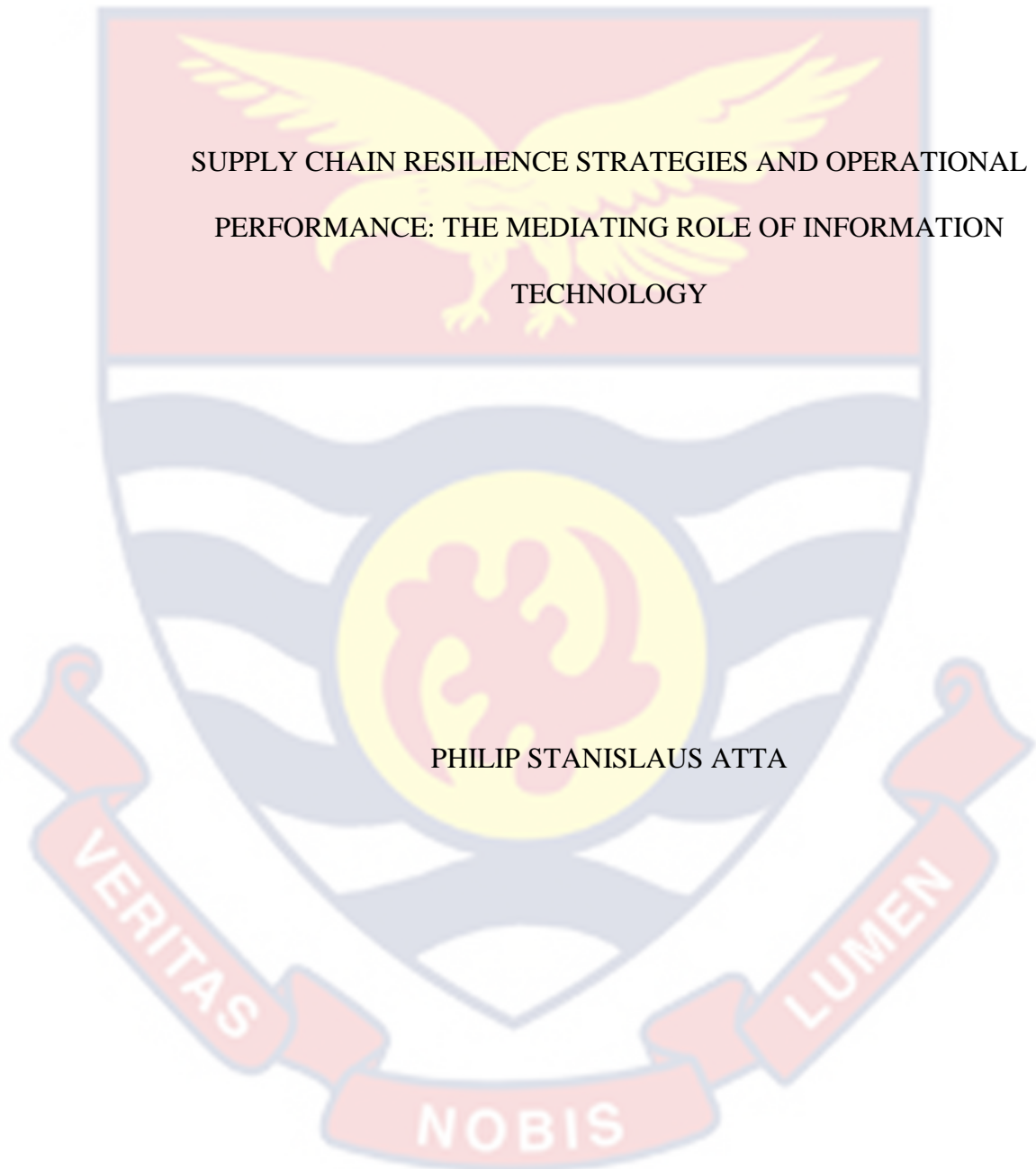UNIVERSITY OF CAPE COAST

SUPPLY CHAIN RESILIENCE STRATEGIES AND OPERATIONAL

PERFORMANCE: THE MEDIATING ROLE OF INFORMATION

TECHNOLOGY

PHILIP STANISLAUS ATTA

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UNIVERSITY OF CAPE COAST

SUPPLY CHAIN RESILIENCE STRATEGIES AND OPERATIONAL

PERFORMANCE: THE MEDIATING ROLE OF INFORMATION

TECHNOLOGY

BY

PHILIP STANISLAUS ATTA

Thesis submitted to the Department of Marketing and Supply Chain
Management of School of Business, University of Cape Coast, in partial
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Procurement and Supply Chain Management

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DECLARATION

Candidate's Declaration

I hereby affirm that this thesis is entirely original work of mine and that no portion of it has ever been submitted for credit toward another degree at this university or anywhere else.

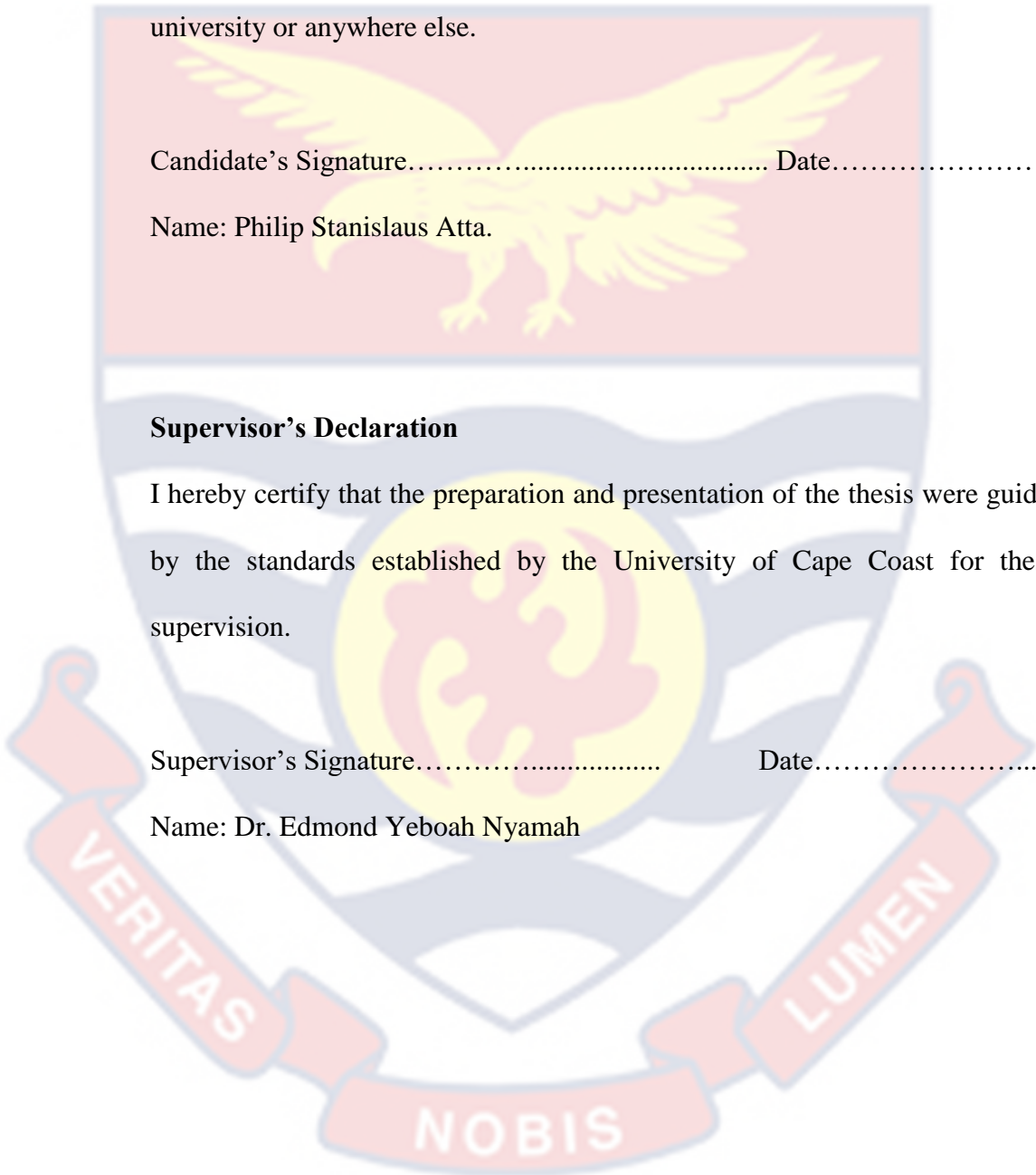Candidate's Signature………….............................. Date……………………

Name: Philip Stanislaus Atta.

Supervisor's Declaration

I hereby certify that the preparation and presentation of the thesis were guided by the standards established by the University of Cape Coast for thesis supervision.

Supervisor's Signature…………................. Date…………………..

Name: Dr. Edmond Yeboah Nyamah

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ABSTRACT

This study's main goal is to investigate the relationship between operational performance and supply chain resilience techniques, as well as the mediating influence of information technology. In this essay, the idea developed in the literature on resource-based views is expanded, and it is connected to the supply chain in the Greater Accra region. Using research that is empirical, an investigation on managers, administrators and officers from some key firms in Greater Accra Region were performed. The study employed a quantitative method with a positivist approach directed the study. It adopted an objective measurement of reality. And to determine whether the validity of the study hypotheses, structural equation modelling (SEM) was applied. The study achieved this by developing significant objectives and, for the most part, productive hypotheses. The following deductions were made from the main findings: Information technology is the top-ranked method for achieving Supply Chain Resilience (SCR) among the food processing SMEs during the Covid-19 pandemic, according to objective one. Prior to and throughout the pandemic, collaboration was found to considerably and favourably improve the businesses' operational performance. The study also discovered that agility helped food processing SMEs perform better operationally before and during the Covid-19. Collaboration, agility, and organizational success were all mediated by information technology. According to the report, managers of food processing SMEs should keep emphasizing IT as a means of guaranteeing supply chain resilience.

KEYWORDS

Supply Chain

Resilience

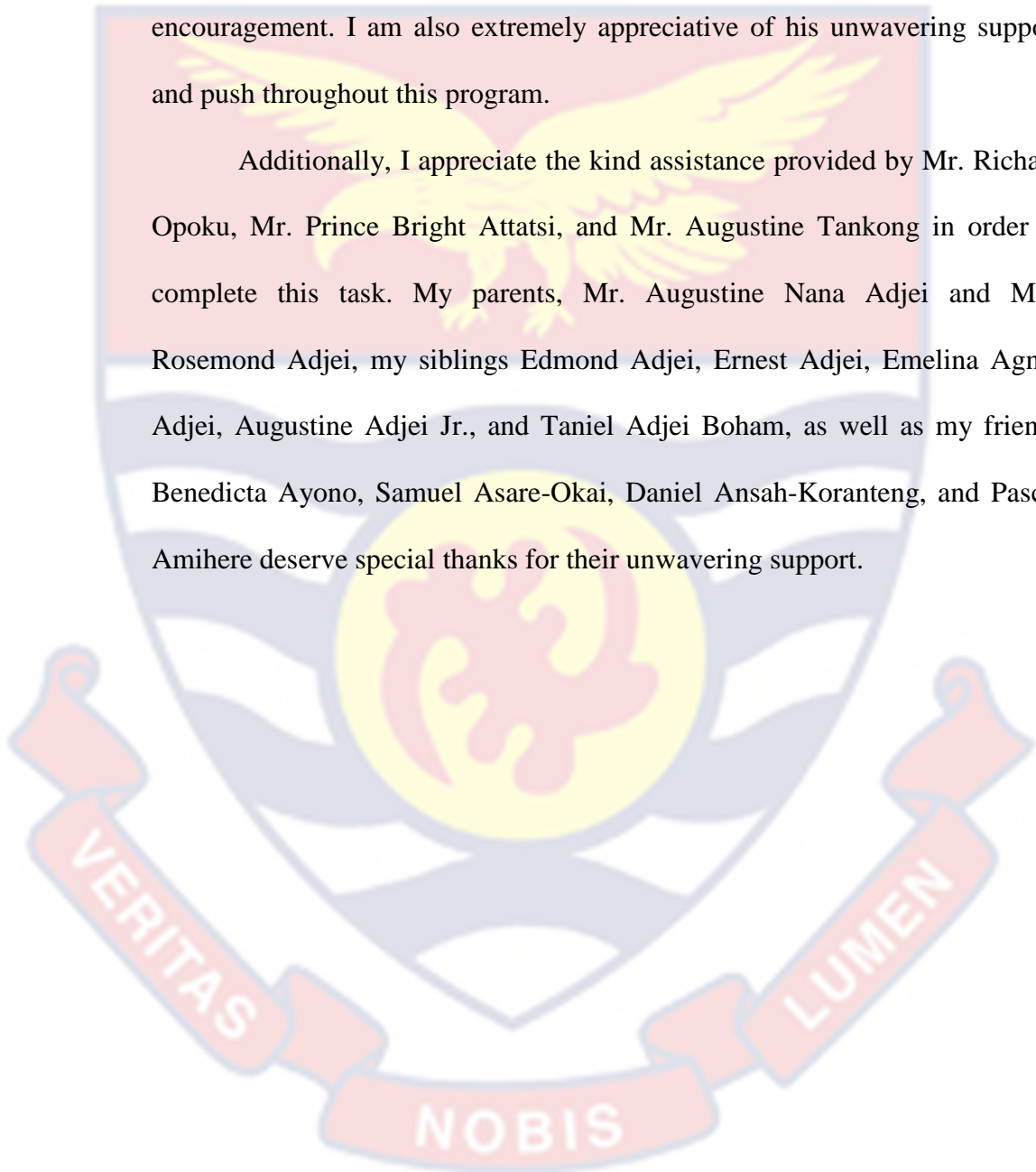Collaboration

Agility

Information Technology

Operational Performance

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Additionally, I appreciate the kind assistance provided by Mr. Richard Opoku, Mr. Prince Bright Attatsi, and Mr. Augustine Tankong in order to complete this task. My parents, Mr. Augustine Nana Adjei and Mrs. Rosemond Adjei, my siblings Edmond Adjei, Ernest Adjei, Emelina Agnes Adjei, Augustine Adjei Jr., and Taniel Adjei Boham, as well as my friends Benedicta Ayono, Samuel Asare-Okai, Daniel Ansah-Koranteng, and Pascal Amihere deserve special thanks for their unwavering support.

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DEDICATION

To my family

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CHAPTER ONE

INTRODUCTION

In an increasingly interconnected and dynamic global business landscape, supply chains serve as the backbone of economic systems, enabling the competent flow of goods, services, and information across borders. However, this intricate system of suppliers, manufacturers, distributors, and clients is susceptible to a myriad of uncertainties, from calamities and geopolitical unrest to changes in consumer tastes and technical disruptions. As organizations strive to navigate these challenges, Supply chain resilience is now recognized as a key strategic necessity.

As organizations continue to grapple with disruptions and uncertainties, research on how information technology shapes the connection between operational performance and supply chain resilience solutions holds promise for redefining the way we conceive, manage, and optimize modern supply chains.

Background to the Study

Small and medium-sized enterprises continue to play an important role in the economy. crucial roles in the development of jobs, innovation, and income (Li, Anaba, Ma, Li & Mingxing, 2021). According to the World Trade Organization (2017), SMEs generate between 60 and 70 percent of the yearly employment and 55 out of every 100 of the gross domestic products in industrialized nations like the United States, Germany, and China (GDP). Similarly, in rising economies such as Nigeria, South Africa, Brazil, and Ghana, these enterprises account for over 40 percent of GDP and 70 percent of employment (Amoah & Amoah, 2018). These are clear indications that the

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growth of SMEs is synonymous with economic development of global economies. (McCann & Ortega-Argilés, 2016; Naudé, 2012). In view of this, researchers continue to focus on identifying and addressing the performance challenges of SMEs, especially in emerging economies.

The modern-day business environment has become turbulent with uncertain customer demands, fluctuating macroeconomic variables, unhealthy competitions and global pandemics like the Spanish flu, Ebola, SAR-CoV-2 and COVID-19. (Eichengreen, El-Ganainy, Esteves & Mitchener, 2021; Temjanovski, 2021; Bhattacharyya & Thakre, 2021). The COVID-19, for instance, nearly brought global businesses to their knees with SMEs experiencing the most effect. The pandemic, however, has rather distinct effects on supply networks. Manufacturing, distribution centers, logistics, and markets may all be impacted sequentially or simultaneously, and paralysis may set in during overlapping time windows but the food processing in Ghana are mostly affected (Li et al., 2021; Ramanathan et al., 2021).

As per the United Nations Development Programme [UNDP] (2019 and 2020) though, about 35.7 percent of SMEs underwent liquidation through to 2019, whereas about 64.3 percent collapsed entirely. The length of the food supply chain makes resilience efforts challenging for food companies (Adobor & McMullen, 2018; Ali, Tan, & Ismail, 2017; Manning, 2016). Interruptions like the COVID-19 pandemic must be endured and recovered from by the food processing industries (B'en'e, 2020; Hecht et al., 2019). For instance, (Ambulkar et al, 2015) pointed out that a firm's resilience is determined by its ability to foresee, adapt to, and act quickly in response to changes brought on by supply chain disruptions. Businesses may fulfill unpredictable demand and

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gain a competitive advantage by anticipating disturbances, making plans for them, responding to them swiftly, and recovering from them more rapidly. (Bui et al., 2020; Hohenstein et al., 2015; Sa'et al., 2019; Stone & Rahimifard, 2018). In actuality, the risks and vulnerabilities brought on by interruptions determine how resilient a firm's supply chain will be.

According to statistics provided by the Ghana Statistical Service (GSS) in August 2020 in partnership with the World Bank and the United Nations Development Program (UNDP), more than 244,000 businesses started modifying their business strategies to incorporate increased resilience around the time of the shutdown (Gerald et al., 2020; Chinedu et al., 2020). According to Ofori-Atta (2020), the pandemic's social and economic effects have both direct and indirect trends. In particular, they have an impact on Ghana's manufacturing, trade, and investment with other countries, particularly with China, Europe, and the United States, as well as indirectly on the slowing of global economic growth, the disruption of consumer goods, and Ghana's economic growth.

Few research has been done on how the current COVID-19 outbreak has affected businesses that handle food, making it more difficult for management to accept the disruption inside their organization and at the supply chain level (Gerald et al., 2020). According to the research, poor knowledge exchange, inadequate risk assessment, and poor supplier management make it difficult to execute supply chain resilience solutions (Shashi et al., 2020). Additionally, the idea that all supply chain resilience components can be utilised has minimal empirical backing (Sa et al., 2019; Stone & Rahimifard, 2018). Using resource-based theory (RBT) as a

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theoretical lens, this study analysed the resilience strategies adopted by the food processing firm which can enhance operations during and after the pandemic COVID-19. This is done to provide supply chain resilience methods a more detailed context so that responsive tactics may be developed to take advantage of them while also accounting for time and resource constraints.

Supply chain management has adopted resilience, a multifaceted and cross-disciplinary term that has roots in psychology and environment (Pettit, Fiksel & Croxton, 2019; Ponomarov & Holcomb, 2009). It might be well-defined as the organization's capacity to anticipate, recognize, and defend itself from dangers before bad results occur (Hollnagel & Woods, 2017). The capability to quickly convalesce after a disruption in the supply chain and to endure or decrease its consequences is known as resilience in the supply chain. Disruptions to the supply chain might result from unforeseen competition, industry movements, consumer purchasing patterns, or a pandemic (Hobbs, 2020).

The capacity of the network to recover from a disturbance and achieve a stable or enhanced system state is known as supply chain resilience (Melnyk, Closs, Griffis, Zobel, & Macdonald, 2014). The capacity of a business or set of firms to endure, adapt, and advance in the face of difficulty is known as supply chain resilience (Pettit, Croxton & Fiksel, 2019). Because they can foresee their impact, high-performance firms are able to react and recover rapidly from catastrophic disasters. Businesses with resilient supply chains should be able to lessen their susceptibility to transportation delays and a variety of supply disruptions, according to Pettit et al. (2019). (Ponomarov & Holcomb, 2009; Spiegler et al., 2012; Tukamuhabwa et al., 2017).

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The vast majority of literature frequently discusses collaboration and agility when discussing supply chains resilience strategies (Hohenstein et al., 2015; Johnson et al., 2013). Collaboration, agility, and information technology are examples of resilience methods acknowledged in the literature as mediating the operational performance of the small- and medium-sized business supply chainbusinesses (Chen et al., 2019; Dickens et al., 2021; Pettit et al., 2010; Scholten et al., 2014; Shahbaz et al., 2018).

Collaboration is information sharing between supply chain parties that lowers uncertainty and complexity (Gunasekara, Subramanian & Rahman, 2015). Supply chain complexity will undoubtedly be reduced by information exchange between all operations in a process and essential relationships (Asare, 2014; Lohmer et al., 2020; Scholten et al., 2014). In a world of multinational corporations, partnerships are essential for efficient supply chain operations.

The supply chain actors must use an ERP system to transmit information in real time in order to promote collaboration. Collaboration would minimize uncertainty and complexity through appropriate information sharing and cooperation in the initial stages of supply chain activity (upstream side). For instance, collaboration throughout supply chain and product design will reduce the complexity and unpredictable nature of supply chain operations.

The capacity to quickly adjust to change by altering one's original, stable setup is known as agility (Wieland & Wallenburg, 2013). Many academic publications define agility using the word quickly, stressing the importance of speed (Ambulkar, Blackhurst & Grawe 2015; Closs et al. 2004;

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Hohenstein et al. 2015; Klibi, Martel, & Guitouni 2010; Longo & Oren 2008). To adapt is the verb that appears most frequently in definitions of resilience, and several papers have used it (Adger et al., 2005;Ambulkar, Blackhurst & Grawe 2015; Burnard & Bhamra 2011; Datta, Christopher, & Allen 2007; Davoudi et al., 2012; Day, 2014; Erol, Sauser & Mansouri, 2010; Folke et al., 2010; Madni & Jackson 2009; Mallak, 1998; McDonald, 2006; Pettit, Fiksel & Croxton 2010, 2013; Ponis & Koronis, 2012; Ponomarov 2012; Ponomarov & Holcomb, 2009; Starr, Newfrock, & Delurey, 2003; Wildavsky, 1988; Xiao, Yu & Gong 2012).

Our study suggests that because words like swiftly and adapt lack direction, they might mean either going back to the old state or transforming into a new one. These literary descriptors are all most closely associated with agility, which is the second quality of resilience employed in the hypothetical model (Wieland & Wallenburg, 2013).

The capacity of a company to maintain acceptable service levels in the event that essential business activities or processes are disrupted is known as information technology (IT) as a mediator on operational performance on supply chain resilience strategies (Salam & Bajaba, 2023). According to Li (2012), the development of advanced information technology (IT) has lessened the geographic distance by creating a virtual information highway and making integrated supply chains conceivable. Companies that export goods from China to the US and Europe are looking for innovative approaches to increase the efficacy of their supply chains. Throughout the supply chain, integration of business processes and connections between suppliers and consumers are made (Dallasega, Rauch & Linder, 2018). According to Li

(2012), the development of advanced information technology (IT) has lessened the geographic distance by creating a virtual information highway and making integrated supply chains conceivable. Companies that export goods from China to the US and Europe are looking for innovative approaches to increase the efficacy of their supply chains. Infor links suppliers and consumers throughout the supply chain by integrating corporate operations (Dallasega, Rauch & Linder, 2018).

E-solutions are becoming more and more necessary in a supply chain in order to boost cooperation and compete on the global stage. It allows us the possibility to look at how differently external IT use on the supplier and customer sides affects SC resilience (Gu, Yang & Huo, 2021). IT use that goes beyond corporate borders is crucial for organizations to connect with upstream and downstream partners in order to exchange information and quickly fix issues (Gu, Yang & Huo, 2021). Supplier or customer IT installations were split into forms of exploitative and explorative use in order to assess their influence on enhancing SC resilience (Dallasega, Rauch & Linder, 2018).

The usage of IT is an effective technique for boosting information exchange and processing skills that are advantageous for disruption recoveries, according to Andriopoulos and Lewis (2009) and Tushman and O'Reilly (1996). Businesses need to be professionals at utilizing IT to either investigate unstructured processes or leverage their present structured procedures (Dubey et al., 2019a; Galbraith, 1974; Premkumar et al., 2005; Zhou & Benton Jr, 2007).

These strategies collaboration, agility, and the mediating function of IT have been found to have an impact on SMEs' operational success. The

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capacity of different business divisions to work together in synergy to achieve more output is the best definition of operational performance (Tsai, 2011). In other words, according to Drew and Thomas (2018), it is the level at which all business divisions work together to achieve certain corporate goals. Operational performance measurements are the main metrics used to evaluate an organization's operational performance (Rompho, 2018).

Few indicators are used consistently across the whole business environment, but different firms utilize diverse metrics to determine their own performance. Customer happiness index, staff contentment, index revenue, generation productivity, and gross profit are only a few of these variables (Fornell et al, 2012). For instance, Li et al., discovered supply chain resilience had a beneficial impact on company performance, which is consistent with earlier findings by (Jain et al., 2017; Scholten et al., 2020; Tukamuhabwa et al., 2017).

The resource-based view theory examines the relationship between a firm's internal characteristics and performance as the basis for a competitive advantage and performance and takes into account the use of a variety of tangible and intangible resources. It emphasizes a company's financial stability as the primary competitive advantage and success determinant (Penrose, 1959).

When evaluating competitive advantage origins, it adopts two principles (Barney & Mackey, 2012). First, in terms of the resource bundle they handle within a market or within a strategic group, this suggests that firms can be heterogeneous. The theory particularly contends that

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organizations, especially SMEs in Ghana, may use supply chain resilience methods as essential tools for enhancing performance.

With respect to these ideas or considerations, this study seeks to delve into the intricate interplay between supply chain resilience strategies, information technology, and operational performance (Oliveira-Dias et al., 2022). By exploring how information technology acts as a mediating mechanism, the research aims to provide a comprehensive framework that elucidates the pathways through which organizations can harness technology-driven resilience to drive superior operational outcomes despite interruptions (Baker-Shelley et al., 2017).

The outcomes of this study might have broad repercussions for theory and practice, providing a detailed knowledge of how contemporary supply chains may successfully navigate unstable settings while retaining peak performance. 2020 (Wood & Bischoff). In developing economies like Nigeria, Kenya and Ghana, small and medium-sized businesses keep operating to play vital roles in economic development; thus, the need for them to become more resilient. This is because, the advent of the COVID-19 directly affected their performance levels; pushing government, its ministries and other agencies to devise strategies to address them.

Statement of the Problem

COVID-19, a contagious virus that prohibited human contact, has spread over the world by the end of 2019. It was classified as a pandemic by the World Health Organization (WHO) due to how swiftly it spread over the world. Due to the virus's global proliferation, nations have developed

preventative measures to stop its transmission. The nation's social and economic life has been severely hampered by the closure of COVID-19.

In Greater Accra and Greater Kumasi, the partial shutdown caused a sizable number of businesses to close, and even those that were unaffected reported a decline in clients and orders. Ghana's economy has been significantly impacted by the COVID-19 epidemic, which has forced many businesses, especially small and medium-sized ones, to reduce expenses by decreasing hours, salaries, and in some cases, laying off staff.

This study's main goal is to increase our knowledge of supply chain resilience strategies that emphasize cooperation and adaptability in information technology and supply chains. Given that the great majority of small and medium-sized businesses in Greater Accra have extensive and expanding global supply chains, it is essential to shed some light on the tactics that businesses use to increase operational performance through supply chain resilience.

Undoubtedly, the Covid-19 outbreak severely impacted Ghana's food processing industries, particularly in the Greater Accra Region because it has the biggest concentration of SMEs, according to Li, Anaba, Ma, and Li (2021). Government officials implemented measures to stop the pandemic's spread. These regulations included limiting people's freedom of movement and shutting down businesses. These had a substantial impact on 10 the businesses' operations. Small and medium-sized businesses' operational performance may be enhanced via cooperation and agility.

The bulk of Ghana's SMEs, particularly those in the food processing industries, and their operational performance have been significantly impacted

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by the coronavirus epidemic. Prior to the pandemic, these businesses used various tactics to become robust and improve their operational performance (Hudecheck et al., 2020). The pandemic's effects are severe, and these crises have long-term repercussions for Ghana's food processing companies' supply chains, which may have an impact on operational performance simultaneously on several different levels.

The majority of the research was done outside of Ghana's borders (Li et al., 2021; Dania et al., 2018; Ma et al., 2020; Allaoui et al, 2019). The few research conducted in Ghana was carried out prior to the epidemic. These researches took into account additional uncertainty that wasn't pandemic (Darkwah, 2016; Naab et al. 2018; Ahmed et al, 2013). Even though the individual relationships between supply chain resilience strategies, operational performance, and information technology have been studied to some extent, there is still a need to fully understand how information technology mediates the relationship between resilience strategies and operational outcomes.

Since research usually focuses on individual components of these constructs, a thorough examination of their relationships is required. By evaluating the mechanisms by which information technology influences the relationship between supply chain resilience strategies and operational performance ten months before and ten months during Covid-19, this study aims to close this gap by ranking the supply chain resilience strategies employed by the food processing firms. In doing so, it hopes to enlighten academics and industry professionals, ultimately assisting in the creation of more effective and flexible supply chain management strategies.

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Purpose of the Study

The goal of this study was to determine how supply chain resilience measures affected the operational performance of small and medium-sized food processing businesses in Ghana's Greater Accra Region.

Research Objectives

The study was guided by the following specific objectives to:

1. Rank the supply chain resilience strategies of food processing industries before and during COVID-19.

2. Assess the effect of collaboration on operational performance of food processing SMEs in Greater Accra Region

3. Examine the effect of agility on operational performance of food processing SMEs in Greater Accra Region.

4. Analyse the mediating effect of information technology on performance between collaboration and agility on food processing SMEs in Greater Accra Region.

5. Examine the mediating effect of information technology between collaboration and operational performance of food processing SMEs in Greater Accra Region.

Research Question

What is the level of concordance of supply chain resilience strategies of SMEs before and during COVID-19?

Research Hypotheses

The study tested the following research hypotheses:

H_1: Collaboration significantly improves the operational performance of the food processing SMEs in the Greater Accra Region.

H_2: Agility significantly improves the operational performance of food processing SMEs in the Greater Accra Region.

H_3: Information technology as a mediating effect significantly improves the operational performance of food processing SMEs in the Greater Accra Region.

H4: Information technology as a mediating effect significantly improves the relationship between collaboration and operational performance of food processing SMEs in the Greater Accra Region

Significance of the Study

This study engrossed on the difficulties small and medium-sized food processing firms encountered during the pandemic as well as the consequences of the worldwide shutdown that was implemented to stem the spread of the corona virus. Once more, the report shows that the COVID-19 significantly affected SMEs and led to the temporary or permanent closure of several of them. The government implemented lockdowns, curfews, a prohibition on all outside movements, and other restrictions that reduced resident mobility to prevent the COVID-19 virus from spreading. Because SMEs contribute positively to the economy of the country, this led to a fall in supply and demand, which reduced revenue. It offers young people the chance to work, and small businesses cover expenses like daily living, schooling, housing rent, utilities, and other costs for families.

Delimitations of the Study

The Greater Accra Region of Ghana hosted the research. The Greater Accra Region of Ghana, which is well known for having a robust SME population, was the focus of the investigation. As a result, not all SMEs were

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considered. This study sought to understand how supply chain resilience impacted the operational efficiency of food processing businesses. There were 260 small and medium-sized enterprises (SMEs) operating in the Greater Accra Region that processed food. The survey targeted 150 SMEs. Managers, owners, supply chain managers, and administrators acted as proxies for the sampling frame.

Questionnaires were distributed to respondents using a systematic selection approach in which, after randomly selecting the first respondent. The remaining respondents were chosen based on the nth count (Malhotra, 2007). According to Malhotra (2015), systematic sampling is acceptable when the ordering of the components is connected to the feature of interest and allows for easy expansion of the sample's representativeness. Structural Equation Model and the The data were analysed using the Statistical Product for Service Solution (SPSS version 22.0).

Limitations of the Study

The study used a probabilistic sample approach because of its philosophical underpinnings, especially the simple random sampling procedure. Because of the philosophical positivist approach that served as the study's foundation, the study was also restricted to an explanatory research design and afterwards concentrated on quantitative research technique.

Organisation of the Study

The research was divided into five chapters. The first chapter's introduction covers the backdrop of the study, an explanation of the problem, purpose, research objective, questions and hypotheses, significance of the inquiry, delimitations and restrictions of the study, and study organization.

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Chapter 2 includes an overview of relevant works, a discussion of the theoretical and conceptual reviews, a theoretical framework, and an empirical analysis in addition to the literature review. The third chapter discusses the research methodology. This section covers the research field, population, sampling procedures, data sources, data collection methods, methods for data presentation and analysis, as well as the research philosophy, methodology, and design. While the study's summary, findings, and suggestions are offered in the last chapter, the analysis and results review are covered in Chapter 4.

CHAPTER TWO

LITERATURE REVIEW

Introduction

The chapter provided more context by examining the theoretical foundations of the research as well as alternative empirical explanations for the phenomenon under consideration. The three primary subtopics under which it is precisely categorized are the conceptual framework, empirical review, and theoretical underpinnings of the study. Within the theoretical examination, the viewpoints that were based on resources were investigated. The empirical study focuses on strategies for supply chain resilience, such collaboration and flexibility. Information technology and risk management practices. The chapter comes to a close with the conceptual framework that explains how the key variables in the research relate to one another. The COVID-19 idea is highly valued by SMEs that process food sector when it comes to epidemics or pandemics. The assessment of current literature incorporates both the identification of the factors influencing supply chain resilience and a study of the field's corpus of knowledge.

Theoretical Review

This part looked at the hypotheses underlying the study. the theory of contingencies, the resource-based approach, and the social networking theory.

Resource Based View Theory

According to the Resource Based View (RBV) philosophy (Sehgal, 2010) is simply that social and economic view context theory that posits that, a social or economic entity can assume a competitive forefront in business if such entities are able to strategically configurate and align their internal

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competences with their external opportunities in order to exploit economic gains and as well minimize the threats that exist in the external business environment.

A competitive advantage may be maintained by employing certain resources that are limited, irreplaceable, irreplaceable, and only partially imitable, according to the resource-based viewpoint on competitive advantage (Hart & Dowel, 2010). According to Helfat and Peteraf, resources are all of a company's assets, competencies, organizational practices, corporate characteristics, information, and knowledge that are under its control and that allow it to create and implement strategies aimed at increasing its effectiveness and efficiency (2003). Helfat and Peteraf (2003) and Hart and Dowel (2010) extended the resource-based viewpoint to include natural resource integration and diverse capabilities.

The RBV theory promotes the autonomous positions of the organization, when planning to initiate the change within the organization's supply chain. RBV's theory defines internal operating processes as critical components of organizational resources, such as the incorporation of online networks into tasks such as tendering. When seeking suppliers, the organization will find it easy to meet industry benchmark standards and this can be done effectively by introducing sophisticated electronically conducted tendering process (Subramaniam, Iranmanesh, Kumar & Foroughi, 2019). RBV concept ensures that the company manages its procurement position with high sensitivity until it understands that processing efficiency can link its competitive advantage (Zhang, Pawar & Bhardwaj, 2017). The Resource Base View Theory, which serves as the study's theoretical foundation, will aid in

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establishing an empirical link between supply chain resilience strategies and how food processing companies can build on their internal resource competencies to be able to leverage their activities to have an impact on the Greater Accra Region's food processing companies' operational performance.

The key tenet of the resource-based perspective is that a company may acquire a long-lasting competitive advantage by acquiring valued, scarce, imperfectly imitable, and non-substitutable resources (Belhadi et al., 2021). A resource is defined as anything that may be utilized to increase the strategy, resilience, and performance of an organization (Blackhurst et al., 2011). Resources are any assets that are distantly tied to the firm, whether they be tangible or intangible (Caves, 1980). Resources might include things like a company's name, the knowledge, skills, and talents of its employees, technology, equipment, money, contracts, and effective procedures and processes (Wernerfelt, 1984).

Resources are viewed as assets because they help a company operate better, compete more successfully, and achieve its goals and objectives (Porter, 1981). According to the RBV, a company is in its greatest position when it creates resources that provide it a competitive advantage as well as support it in the case of a disruption (Wernerfelt, 1984). External partnerships, which heavily rely on social networking, may be leveraged to acquire such resources. The idea highlights the need of both internal and external resources in establishing skills (such as resilience), which will help firms achieve long-term operational success and satisfy customers.

Furthermore, analytical hypotheses with applications to resilience, such being a perspective depending on resources (RBV), complex capacities,

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and contingency theory Leveraging applications for resilience (Dubey et al., 2020), may be used in conjunction with resilience methods and organizational efficient strategies to use empirically-based analytics to analyze COVID-19's effects on the Greater Accra region's food processing industries. Pereira et al. (2014) discuss the relationship between supply chain resilience and procurement, while Day (2014) discusses a dynamic adaptive structures architecture that connects supply chain resilience techniques to disaster recovery. Recent research has looked on the role of other resources as complementarities in SMEs' influence on business performance (Poku & Ansah, 2014; Jeffers et al., 2008). When paired with other resources or processes, SMEs, in particular, become a valuable firm resource (Lin et al., 2013; Barrett et al., 2012).

Contingency Theory

Professor Fred Fieldler, an Austrian psychologist, created contingency theory in the 1960s. This idea was taken into account in the study while analysing the effect of uncertainty on the operations of processed food companies. Networks of supply are fraught with unpredictability. Variations in the calibre and timeliness of arriving supplies or in the amount desired by customers are examples of external causes of uncertainty. Inter-functional differences in material quality standards or delivery timelines are one of the internal sources of uncertainty.

When consumers and suppliers conceal information because they believe it would not be in their best interests to do so, a supply chain participant is likewise perplexed (Flynn & Lu, 2016). A supply chain member may discover that some uncertainty is so excessive that its decision-makers

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struggle to even conceptualize what the right questions to ask are when it enters new markets, experiences competitive instability, or is shocked by a low probability-high impact event, such as a natural disaster.

In essence, there are several ways that uncertainty might show up, such as ambiguity, unpredictable outcomes, and a lack of knowledge. Since Thompson's seminal work in 1967, uncertainty has received substantial discussion in the literature on organization theory; nevertheless, empirical research on uncertainty in the context of supply chain management has only lately focused on this issue (e.g., Hult, et al., 2010; Bode, et al., 2011). Although the literature on organizational theory accepts that uncertainty can take many different forms, it has traditionally been referred to as variability in the supply chain management study (Fredendall & Melnyk, 1995; Germain, et al., 2008).

Individuals, functional divisions, enterprises, and eventually supply chains may be affected by supply chain uncertainty (Carter, et al., 2015a). Additionally, supply chain integration is sometimes recommended as a technique to manage uncertainty without considering the various demands that various types of uncertainty bring. In the context of supply chain management, the lack of a clear understanding of uncertainty has produced several contradicting findings that have not yet been reconciled. We make two attempts to educate you.

There is no perfect organizational structure for a business, management, or decision-maker, according to contingency theory (Abba, Yahaya & Suleiman, 2018). Instead, a combination of internal and external forces decides the best course of action. Leaders of contingents are adaptable

in their technique selection and adaption to match changing circumstances at a particular stage of the organization's operation (Shao, Feng & Hu, 2016).

The contingency hypothesis tested the link between supply chain integration by focusing on process and structural alignment with the environment (Flynn, Koufteros & Lu, 2016). Organizational centralization, formalization, flatness, and dimensions of uncertainty (environment). The debut of COVID 19 is a representation of the environmental ambiguity that significantly affects an organization's daily operations. Government regulations put into place during the epidemic had an impact on the supply chain used by food processing businesses. The contingency hypothesis tested the link between supply chain integration by focusing on process and structural alignment with the environment (Flynn, Koufteros & Lu, 2016). Organizational centralization, formalization, flatness, and dimensions of uncertainty (environment). Government regulations put into place during the epidemic had an impact on the supply chain used by food processing businesses.

Social Networking Theory

According to (Borgatti & Li, 2009) a theory that focuses on people, groups, and organizations, as well as the web of interpersonal connections that both limits and facilitates human behaviour in various social systems, known as social network theory. The network theory has emerged as one of the most important concepts for administration of purchasing and suppliesin recent years (Spina, Caniato, Luzzini & Ronchi, 2016). Most frequently, the relationships between companies, suppliers, customers, and purchasers are described using the network theory. According to several experts, the network

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theory focuses on how businesses collaborate with different entities within their supply chains, such as suppliers, consumers, or purchasers. (Wynstra, Spring & Schoenher, 2015)

To begin with the history and roots of the idea, it can be said that in the 1970s, the term "relationship" was not used to describe operations, for example with suppliers, even if the phrase "supply chain management" was already in use at the time (Harland, 1996, p. 69). Even yet, a first exposure to supplier assessment and the contribution of stronger connections with regard to quality, delivery, and pricing were visible (Harland, 1996, p. 69). However, the early studies in this decade focused on deeper interactions between two organizations, rather than the network view itself, by exploring subjects like trust, cooperation, or strategic collaborations (Mills, Schmitz & Frizelle, 2004).

After that time and in the early 1980s, businesses began to report changes toward increased competition and a call for a shift away from central coordination and multi-level hierarchies toward a variety of flexible structures, indicating that the traditional hierarchical pyramids are similar to a network approach (Snow & Miles, 1992).

At that time, highly competitive businesses began to streamline operations to focus on their core competencies, reorganize management structures, and outsource some aspects of daily operations (Snow & Miles, 1992). Instead of focusing on vertical integration, new corporate organizations sought out strategic relationships with independent suppliers in order to prevent development (Snow & Miles, 1992). Despite embracing the network method, early 1980s research was still primarily concerned with observing

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how basic partnerships between two organizations worked together or describing strategic alliances (Yee & Platts, 2006).

The Resource-Based View, Contingency Theory, and Social Network Theory are combined, in order to better comprehend how information technology, operational performance, and supply chain resilience techniques relate to one another. In relation to supply chains resilience and operational performance, these theories offer useful perspectives through which to examine the complex linkages and mechanisms that underpin the mediating function of information technology.

Conceptual Review

The principles supporting the investigation were examined and clarified in this part.

Supply Chain Resilience

The concept of resilience has a variety of diverse aspects (Kamalahmadi & Parast, 2016; Ponomarov & Holcomb, 2009; Ponis & Koronis, 2012). Although there are many different definitions of resilience, ours is based on the notion that, as put out by Davidson et al. (2016) and Ambulkar et al. (2016), resilience is the capacity of a supply chain to "rebound" in the event of a disruption (2015). Therefore, resilience is defined as a system's capacity to bounce back from, adapt to, and change itself in the face of disruptions while preserving an appropriate level of operational continuity (Brandon-Jones et al., 2014). Davidson et al. (2015); Ambulkar et al., (2016).

According to this perspective, resilience is made up of two essential yet complementary components: the capacity for resistance and the capacity

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for recovery. A system's recovery capacity is its capability to restore regular functioning after an interruption, whereas a system's resistance component refers to its ability to completely avoid disruptions. This paradigm states that resilient supply chains can keep value flowing to customers despite interruptions by quickly addressing and recovering from disruptions when they occur (Ivanov, Sokolov, & Dolgui 2014).

In the past, SMEs have been defined using quantitative, qualitative, or occasionally both metrics (Abor & Quartey, 2010; Dababneh & Tukan, 2007). Quantitative standards are based on numerical figures such as the quantity of personnel, annual revenue, asset worth, and balance sheet value, among other things. The qualitative criteria, on the other hand, place a greater emphasis on traits like market and capital ownership (including whether or not the enterprise's management and ownership are autonomous and the enterprise's market share in terms of economics) (Bolton Report, 1971; Abor & Quartey, 2010).

We designate businesses with 10 to 99 employees as SMEs in accordance with USAID's requirements; businesses with 10 to 49 employees are classified as "small," while businesses with 50 to 99 employees are classified as "medium" (Dababneh & Tukan, 2007). Small and medium-sized companies (SMEs) are commonly referred to as the "backbone" and "engine" of economic growth (Van Gils, 2005; Abor & Quartey, 2010). SME growth is essential to the socioeconomic progress of emerging nations.

In Sub-Saharan Africa, Small and medium-sized business activities include primarily concentrated in the unorganized sector. Due to their ability to generate jobs and alleviate poverty, SMEs have grown to be more important

tools in the economic progress of emerging nations (Beck et al., 2008). SMEs are essential for Sub-Saharan Africa's economic liberation and decrease of poverty since they provide hundreds of thousands of jobs. For instance, SMEs in Ghana provide the great majority of low-income households with a means of sustenance as well as business training, revenue creation, and job possibilities for both skilled and unskilled labor (Aryeetey, 2001

Involvement of SMEs in Sub-Saharan Africa for instance, SMEs in Ghana provide the great majority of low-income households with a means of sustenance as well as business training, revenue creation, and job possibilities for both skilled and unskilled labor (Aryeetey, 2001). Small and medium-sized enterprises (SMEs) play significant roles in socioeconomic development, particularly in developing countries, where they are frequently referred to as the "backbone" and "engine" of economic progress (Van Gils, 2005; Abor & Quartey, 2010).

Ghana accounted for over 70% of the nation's GDP and 90% of its commercial organizations in 1795. In the SME sector, social networks, resiliency, and performance (Aryeetey, 2001; Abor & Biekpe, 2007; Mensah, 2004).The design and manufacture of innovative products for people from all socioeconomic tiers has been made possible by SMEs' promotion of innovation through the provision of specialized skilled services.

SMEs in Africa struggle to operate and survive due to a variety of issues, despite their essential contributions. Deficits in infrastructure include a lack of regulated market structures and organizations that support such structures, inadequate communication networks, and ineffective contract enforcement processes. These factors all seriously disrupt SMEs and their

supply chains. There has previously been discussion of supply chain resilience in the context of SMEs in the literature (e.g. Gunasekaran et al., 2011; Sullivan-Taylor & Branicki, 2011; Ates & Bititci, 2011). The majority of supply chain resilience research, however, has been conceptual in nature, focusing on the idea and definition of supply chain resilience (Bhamra et al., 2011; Kamalahmadi & Parast, 2016).

The supply chain resilience of SMEs has, nevertheless, been the subject of several empirical investigations. By examining the major components using information from 40 SMEs, Gunasekaran et al. (2011) created and assessed a methodology for assessing the resilience and competitiveness of SMEs (internal variables, enabling factors, and external factors). Palet et al. investigated the factors that contribute to and have an impact on the economic resilience of Swedish SMEs with a textile industry in a research that was published in 2014. No studies have empirically evaluated the impact of supply chain resilience on the efficiency of SMEs, according to our study of the literature. By examining the relationship between supply chain resilience and customer-focused business performance, this study contributes to the body of knowledge on supply network resilience.

Resilience Strategies

Small and medium-sized businesses' resilience is referred to as the manifestation of a firm's capacity and ability to withstand exogenous forces, secure the company's continuity and survival, and carry out business renewal and reorientation (Branicki et al., 2018) There is a close link between business ventures' entrepreneurial efforts and their resilience tactics (Kantur, 2015). Other research has shown that entrepreneurs are resilient in the face of

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extreme calamities such as Hurricane Gudrun in Sweden, the 2010 Christchurch earthquake (Smallbone et al., 2012), and Australia's wildfire.

Based on a more comprehensive resilience theory from several disciplines, writers like (Stone & Rahimifard, 2018) have articulated supply chain resilience. The data is scattered and unstructured since it originates from several sources. There aren't enough articles available, and just one of them provides an overview of the studies on how pandemic outbreaks affect logistics (Dasaklis et al., 2012a) Given the purpose of this study is to identify the gaps in knowledge on the effects of epidemic outbreaks on the supply chain and highlight relevant lessons that will assist decision-makers and policymakers improve their response strategies for epidemic outbreaks (Queiroz et al., 2020). However, a number of research initiatives have been launched.

Supply chain resilience is now studied and categorized into three categories: performance characteristics, predicted pandemic effect, and crisis management. Performance-related criteria include sales, place in the supply chain, market success, financial performance, and operating performance. The estimated pandemic cost component aids in reducing the expected effect of a pandemic, which has an influence on order delivery time and quality as well as income. The sub-factors "Impact of pandemic on firm performance" and "Impact of pandemic on revenue" have been added to this factor. It is equally crucial for a firm to reduce the pandemic's anticipated negative effects under the present COVID-19 situation. The following supporting aspects must be taken into consideration in order to achieve this aim.

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Another crucial factor is the degree of customer satisfaction with order quality and lead time (Ivanov, 2020). The corporation must avoid delivering items to customers late because to the pandemic crisis, and defective and missing shipments must be kept to a minimum. It must be ensured that the present epidemic does not reduce the firm's income below a tolerable level. Any drop-in revenue of more than 40% is considered a red flag that requires immediate action. Prior to a crisis, prepare yourself (Rapaccini et al., 2020). To ensure that supply chain activities are not impacted, a more proactive strategy to handling the crisis is necessary given COVID-19's disruptive impact on business operations. The actions listed below must be taken.

To prepare for pandemics, people must be continually aware and take proactive precautions. Educating officials is necessary on the reality that pandemics are unavoidable and that safety measures must be made to prevent the firm from suffering severe losses. The company must immediately switch out goods, modify working procedures, and adapt to changes in order to be prepared for the pandemic. Additionally, the majority of empirical research was carried out in emerging countries, especially in Western Europe and North America (Tukamuhabwa et al., 2017). In earlier research, high-profile, isolated occurrences were the focus, including terrorist threats (Yeboah et al., 2014), the global financial crisis (Cheng & Lu, 2017), railway accidents (Stone & Rahimifard, 2018), conflict (Tukamuhabwa et al., 2017), and Hurricane Harvey.

Hurricane Katrina (Scholten & Schilder, 2015)   Large-scale disasters are a common theme in SCRES concept papers. This emphasis is reasonable yet disasters of this magnitude are uncommon, and typical supply chain

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resilience definitions make no reference to them. Long-term, recurring interruptions are significantly more likely to occur in most supply systems. It is suggested that such attacks are more likely to put their capabilities in jeopardy.

Many previous researches have attempted to investigate resilience of the supply chain while some studies relied on well-established frameworks for supply network resilience, the bulk of studies used a qualitative method. Despite the fact that supply chain resilience is researched as a single construct, the numerous components that influence resilience are unclear, and very few studies have examined these factors determined how important each factor is. This quantification would allow enterprises in the present pandemic to prioritize which aspects to increase and which factors to avoid in order to improving their supply chain resilience plans.

Resilience plans aim to minimize disruptions that could compromise the supply chain's ability to operate efficiently. From another perspective, the approach may be constructive or reactive, while other ways could be adaptive, resilient, or redundant (Levenberg et al., 2017) delivers realistic continuity and versatility by holding safety stock. These researches, on the other hand, primarily focus on resiliency tactics and do not go into detail into the many types of disturbances and how they influence people.

Before a disruption occurs, proactive approaches such as preservation processes, personnel preparation, immunization, positioning and reinforcement, and others are utilized, whereas the reactive system is used once a disruption occurs. The supply chain resilience technique has recently been criticized by Kamalahmadi and Parast (2016) and Tukamuhabwa et al.,

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among others (2017). Small and medium firms are difficult to categorize due to their ambiguous existence, and there is no universal definition for them (Nyarku & Oduro, 2018) These businesses differ from one another depending on who is describing them. These firms differ in terms of capitalization, employment, and revenues. As a result, if scale-based characteristics (net worth, profitability, turnover, and personnel count) apply to a single industry, all businesses can be categorized as minor. However, when the same size classification is applied to a specific market, the results can vary.

A small and medium-sized entity (SME) is defined as any enterprise, project endeavor, or economic activity with a gross asset base of less than $1 million under the Venture Capital Trust Fund Act of 2004 (Act 680). (Excluding land and building). Additionally, it is worth little more than $1 million cedi. According to the US Agency for International Development (USAID), a small firm is one that does not include land or buildings and has fixed assets worth less than $250,000 USD. The International Labour Organization (ILO) claims that no one definition can adequately encompass all of a "small" or "medium" company's characteristic. Most reports of this size are based on metrics like attrition, balance sheet totals, or job statistics. The Venture Capital Trust Fund Act of 2004 (Act 680) defines a small and medium-sized firm (SME) as an industry, project endeavour, or economic activity with a gross asset base of less than $1 million (excluding land and building).

Collaboration

The literature that is currently available on cooperative supply networks is included in this section. Collaboration is defined as the process

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through which two or more businesses plan and execute supply chain activities with the aim of achieving common objectives. (Brandon-Jones, Squire, Autry & Peterson, 2014). The literature on cooperative supply networks that is currently available is covered in this section. The link between information exchange, shared decision making, electronic data interchange, and organizational efficiency in the context of Malaysian manufacturing is stated in (Cao & Zhang, 2011; Shahbaz et al., 2018). Collaboration is described as two or more organizations cooperating to plan and carry out supply chain activities with the aim of attaining common objectives.

The results of the study show that independent factors including information exchange, collaborative decision-making, and electronic data interchange have a positive effect on organizational efficiency (Zhou & Benton Jr, 2007). Implementing supply chain collaboration ways across the food processing industries as a supply chain resilience strategy is also a significant predictor, according to this study, which is similar to other developed countries (Belhadi, Kamble, Jabbour, Gunasekaran, Ndubisi and Venkatesh ,2021).

Individuals, manufacturers, and buyers' associations would all benefit from it. These articles raise some key ideas in their debates. Similar to other developed countries, this study indicates that implementing supply chain cooperation approaches among the food processing industries as a supply chain resilience strategy is also a significant predictor. It would support individuals, as well as manufacturers and buyers' organizations. In their debates, these articles make some important points. These articles look at three aspects of collaboration: knowledge exchange, target similarity, and shared

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decision-making, all of which contribute to company success (Cao & Zhang, 2011) discovered that partnering with the supply chain enhances organizational efficiency in their study. (Scholten & Schilder, 2015).

Agility

According to Ramesh et al., (2010) and Queiroz et al. (2011), agility is the readiness to perform in a dynamic and competitive environment that is always changing (2020). One of the best ways to improve supply chain stability is to create networks that can react more quickly to changing conditions. (2011) (Sarkis et al.) In order to respond quickly to unforeseen occurrences and, as a result, retain a decisive edge in a cloudy and unpredictable environment, durability obviously requires endurance. By forming a partnership with a highly responsible vendor, supply chains may reduce the risks related to inventories. Agility defines it as "a supply chain's fast capacity to adapt to change by changing its initial stable structure" (Wieland & Wallenburg, 2013).

Resilience of the supply chain is both proactive and reactive strategies are possible, according to Wieland & Wallenburg (2013). In light of this, supply chain responsiveness and supply resilience are linked in the event of delays or calamities (Cheng & Lu, 2017). Because of operational challenges, supply chain disruption control that is both proactive and reactive is the foundation of agility recovery preparation. A post-disruption reaction technique known as agility was created before the disruption stage and put into practice thereafter. The effective application of network redundancy that was proactively built is a key lever for supply chain resilience in the optimization of agility. Supply chain agility is a measure of the supply chain's visibility and

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resiliency. High supply chain velocities are referred to as such, and enhanced information-sharing activities improve supply chain visibility.

Information and Technology

According to SMEs are essential to the long-term operation of large-scale local and international supply networks (Beske-Janssen et al., 2015) Companies must choose suitable collaborating firms (suppliers) to address disruptions; the bulk of these are SMEs with state-of-the-art information technology (IT) systems (IS). Most SMEs attempt to leverage contemporary ITs like electronic data interchange (EDI), enterprise resource planning (ERP), and e-commerce in order to first boost their own supply chain performance and subsequently their partners' supply chain efficiency. Gunasekaran, Rai, and Griffin (2011).

The effective sharing of information amongst supply chain participants has unquestionably profited from information technology, boosting transparency and fostering commitment and trust among the aforementioned parties. Contrarily, the supply chain's resilience is a result of IT disruption. (Von Falkenhausen et al., 2019) examined the macroeconomic cost of supply chain knowledge system instability at the business level. They discovered that the type of attack and how it is used to support supply chain operations affect supply chain robustness to IT and cyber interruptions, not the equipment used (Stecke & Kumar, 2009)

Certain IT interruptions, according to the study, might have a substantial impact on oil and gas supply networks. However, the authors found that, like other types of supply chain interruptions like as labour conflicts or natural catastrophes, IT disruptions can be quite robust. As a result, the use of

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information technology and related systems must be carefully managed and implemented, or the saviour may become a source of considerable concern and disruption (Barman, Das & De, 2021).

On the one hand, by controlling and keeping an eye on internal business processes, internal IT usage may help the target company deal with disruptions to some level. On the other hand, the majority of firms today have access to software programs and IT infrastructure for internal operations. An example of such an internal IT use would be an ERP system (Gu et al., 2021). Companies still experience SC disruptions as a result of internal IT's inability to get outside data. The effectiveness of reacting to, adjusting to, and recovering from SC outages will depend on the breadth and depth of information that IT connections with suppliers and customers grows. Even if the widespread SC disruptions caused by the corona virus pandemic have had an impact on many enterprises.

Even though many businesses have had global SC outages, Haier can still rely on their excellent external IT linkage with global partners for daily production and sales planning, resulting in dependable customer service throughout the difficult times. The severity of COVID-19 compelled most food processors in Ghana to implement technologies that necessitated significant adjustments in existing technology in order to be sustainable. Current technological improvements have dramatically improved most companies' ability to interact and share information. (Gu et al., 2021).

(Elleuch et al., 2016) contend that a company's culture, vision, and soft management strategies, such as excellent communication and connections with key consumers and stakeholders, are more important than its more rigid,

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materialistic components. Mandal (2017) found that the focal organization and its supply chain partners must establish a risk management culture based on the findings of an empirical investigation. According to research (Brege & Kindström, 2020), an organization's degree of innovation is related to its learning culture and participative decision-making. In-depth analyses of values, attitudes, and behavioral patterns are required for cultural transformation, according to (Pereira et al., 2014), with innovation and creativity playing a crucial role.

Operational Performance

To evaluate the effectiveness and efficiency of supply chain interactions and processes that span several organizational departments and organizations and enable supply chain orchestration, a group of measures collectively referred to as performance may be utilized. Performance is the capacity to carry out predetermined activities successfully in order to achieve goals and aims (Dubey et al., 2020; Maestrini et al., 2017). Performance assessment is a wide concept with several applications depending on the needs and goals of the user. Profit, return on equity (ROE), return on capital employed (ROCE), return on sales (ROS), and other financial and accounting terminology can all be used to assess a company's performance.

According to a thorough evaluation, all supply chain participants should be taken into account, performance metrics should include both financial and non-financial elements, all supply chain levels and procedures should be taken into account, and performance should be gauged by operational performance. The impacts of risk sources and supply chain procedures are measured by a range of techniques, such as company or

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organizational performance, product performance, operational performance, logistic performance, financial performance, or operational performance (Shahbaz et al., 2018). (Shahbaz et al., 2018) However, the parameters employed to evaluate the performance indicated above are comparable. Supply chain management was evaluated using operational performance, with quality and flexibility serving as key performance indicators.

The measure of a company's responsiveness to its customers' needs is its operational performance (Huo, 2012). Assuring the quality, dependability, and adaptability of on-time client deliveries is essential for the success of the supply chain. According to Brandon-Jones et al. (2014), business-related interruptions can hinder value flows and impair operational effectiveness. Organizational changes may have disastrous consequences, such as operational and financial losses. (Abeysekara et al., 2019; Yu et al., 2019).

Due to their inability to recover from such tragedies, some enterprises collapse and leave the market under extreme circumstances. Because of this, supply chain disruptions put businesses, especially SMEs, at risk and harm operational effectiveness (Blackhurst et al., 2011). According to Brandon-Jones et al. (2014), in order to handle shocks and the difficulties and turbulence they bring with them, organizations must acquire resilient capacities. As a result, a company's resilience determines its capacity to offer value to its customers despite disruptions.

According to the RBV method, businesses that invest in resources and build competencies (such resilience) not only strengthen their competitive position, but also get rid of the risks associated with uncertainties and vulnerabilities. In the event of a disruption, this ensures that consumers will be

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able to access goods and services in a fast, flexible, and reliable manner. As a result, resilience is a skill that strengthens supply chains and enables them to successfully alter their operations in the face of disruptions, according to Brandon & Jones et al. (2014), Ambulkar et al. (2015), and Davidson et al. (2016). This capability ensures that customers continue to receive value.

Empirical Review

This section of the empirical review is customized to the particular goals of the study. The review will assist in presenting preceding researchers' arguments and conclusions, as well as emphasizing areas of agreement and disagreement, so assisting in avoiding previous academics' mistakes. Additionally, the review will assist in refining the issue definition and hypothesis generation.

Collaboration and Operational Performance

In (Li & Gao, 2015). International Journal of Engineering Business Management, Collaboration to Enhance the Efficiency of the Fresh Food Supply Chain. This study focuses on aspects like inventory turnover and decreased transportation costs to explore how collaboration impacts the effectiveness of fresh food supply chains. Key findings and opportunities for further study from a review of the literature on supply chains and enterprise resilience. Even though it is not specifically about food processing, this review paper from the International Journal of Production Economics discusses the principles of supply chain resilience, which are closely related to teamwork (Kamalahmadi & Parast 2016).

Empirical studies often provide insights through case studies of specific food processing companies or supply chain networks. These case

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studies showcase real-world examples of successful collaboration strategies and highlight lessons learned from challenges faced. (Simatupang, & Sridharan, 2002). The International Journal of Logistics Organisation.

A study by Baah et al., (2021), supply networks have become more competitive as a result of the necessity to maintain competitiveness in a constantly shifting economic environment. As a result of managers' recognition of the competitive advantages that supply chains offer over other resources, they are already formulating competitive strategies centered around supply networks. In order to determine how much supply chain visibility, stakeholder confidence, environmental performance, and financial performance are impacted by predictive supply chain cooperation, research was conducted. This study focused on manufacturing companies because of their interactions with suppliers, resource consumption, energy use, and greenhouse gas emissions.

Due to its usefulness for predictive research models like those employed in this study, the study used a survey research method, a quantitative technique, and partial least square structural equation modelling to analyse and interpret data. The study finds that cooperation among supply chain participants improves performance in terms of stakeholder satisfaction, supply chain visibility, the environment, and financial results. The study's findings suggested that companies that participate in collaborative supply chain management reap benefits from doing so. These findings showed that supply chain cooperation has a significant, positive, and powerful impact on supply chain visibility, stakeholder confidence, environmental performance, and financial performance.

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This study is one of the few to offer information on the benefits of supply chain collaboration on performance from the perspective of manufacturing companies operating in underdeveloped nations. This study thereby advances our knowledge of supply chain cooperation generally, its relationships to other company characteristics, and the manner in which it influences management, academic, and supply chain partner decisions. The term "operational resilience" was first used by Essuman et al., (2020), who also looked at how it relates to "operational efficiency" in a number of operational disruption situations.

Disruption absorption and recoverability are two conceptually separate components that together make up the multidimensional notion of operational resilience. It is suggested that each of these components affects operational efficiency differently under various operational disruption scenarios. Using original data from 259 businesses in an economy in Sub-Saharan Africa, the article empirically proves its premises.

Again using structural equation modeling as their analytical tool, Essuman et al. (2020) discovered that both disruption absorption and recoverability had a beneficial effect on operational efficiency. In addition, the study discovers that although disruption absorption has a bigger effect in high operational disruption scenarios, recoverability has a stronger effect in low operational disruption scenarios. Our knowledge of the complexities behind how and when operational resilience improves operational efficiency is improved by this research. This study has important implications for how operational resilience is deployed, as well as how disruption situations affect operational resilience's efficiency value.

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According to Baah et al., (2021), businesses have moved their competitive tactics to supply chains in order to stay competitive in a continuously evolving business environment. Since supply networks provide competitive advantages over other resources, they are currently the cornerstone of managers' competitive strategy. The goal of the study is to find out how supply chain collaboration affects financial, stakeholder, and environmental performance. This study focused on manufacturing companies because of their interactions with suppliers, consumption of resources and energy, and emissions of greenhouse gases.

The research is one of the few to provide results about how much of a supply chain collaboration may influence performance from the viewpoint of manufacturing enterprises operating in a developing country. Thus, this research adds to a greater knowledge of supply chain cooperation in general, its relationships with other company characteristics, and how it influences managerial, academic, and supply chain partner choices.

Agility and Operational Performance

The capacity of a business to swiftly adjust and adapt to changes in the market, client demands, and unanticipated interruptions is referred to as agility in the supply chain. For food processing firms, agility is crucial to maintain a competitive edge, especially in dynamic and unpredictable environments. Here are some key insights and concepts related to agility in the supply chain of food processing firms. Agile supply chain enables food processing firms to adjust production, distribution, and inventory levels rapidly in response to changing consumer preferences, demand fluctuations, and supply disruptions.

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This flexibility helps companies meet customer needs while minimizing costs and risks. (Christopher & Towill, 2001)

Agile supply chains emphasize accurate demand forecasting and responsive production planning. The capacity to act swiftly and accurately anticipate changes in demand helps food processing firms adjust their operations proactively. (Chen et al., 2000). Collaborative relationships with suppliers are essential for agility. Building strong ties with suppliers allows food processing firms to access real-time information, share demand forecasts, and coordinate production adjustments effectively Ho, Zheng, Yildiz and Talluri (2015).

Agile supply chains often rely on dynamic inventory management strategies. Implementing techniques such as postponement and safety stock optimization can help food processing firms balance inventory levels and respond to changes in demand quickly (Swafford, Ghosh & Murthy, 2006). Digital tools, real-time data sharing, and technology-driven communication play a pivotal role in agile supply chains.

Advanced technology enables food processing firms to monitor and analyze supply chain performance, facilitating faster decision-making. (Bowersox & Closs, 1996). Empirical research often includes case studies of food processing firms that have successfully implemented agile supply chain strategies. These case studies provide insights into the specific practices and approaches that led to increased agility and competitive advantage. (Caplice & Sheffi, 1995).

The Mediating Role of Information Technology between Supply Chain Resilient Strategies and Operational Performance

In their work, Baah et al. (2021) looked at how (1) additive manufacturing (AM) enhances supply chain resilience to withstand any disruptions in the distribution of green products and (2) promotional investment speeds recovery speed. Environmental performance, service level performance, and economic performance are the relevant measures. These indicators are examined using the industry 4.0 architecture, which combines inventory and production planning, reverse logistics, and consumer behaviour, and the Bass (1969) model of innovation dispersion. The Taguchi experimental design framework was used for the simulation investigation.

There may be trade-offs between different combinations of information-sharing and I&PP regulations, according to adoption trends based on the Bass model and the rate of recovery and production on AM during the interruption period Lohmer et al., (2020). The extensive sensitivity analyses aid management decisions in the present. In addition to the potential advantages of Industry 4.0, This study reveals that when utilized in conjunction with an inventory management system, it is important to pay special attention to the recovery speed. Another contribution of the current study to the problems of social sustainability is the combination of consumer behaviour (the Bass model) with digital technologies. Resilience is crucial for controlling the ripple effect, according to earlier study. None of them, however, have addressed the expanding breadth of resilience required to tackle the cascading effects brought on by the cessation of the distribution of green products in a reverse logistics system.

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The application of artificial intelligence (AI) in supply chain management (SCM) is still in its early stages, according to Nayal et al (2021). As a result, this essay will look at the factors that influence the adoption of artificial intelligence and show how it affects supply chain risk reduction (SCRM). The research strategy, methodology, and technique of the study assess the impact of supply chain integration (SCI), information sharing (IS), and process variables on the adoption of AI in addition to aspects based on the technology, organization, and environment (TOE) framework (PF). After receiving responses from 297 respondents from Indian agro-industries, structural equation modelling was used to assess the hypotheses (SEM).

According to the study's conclusions, SCRM gains from the adoption of AI, and process considerations, information sharing, and supply chain integration (SCI) all have a significant impact on the decision to implement. Artificial intelligence has a negligible effect on organizational, technical, and environmental aspects. This paper provides information on the critical role AI adoption plays in lowering supply chain risks brought on by disruptions like the COVID-19 pandemic to experts in research, academia, policymaking, innovation, technology service providers, and management.

What seeks to shed light on how our understanding of and usage of disruptive technologies, particularly big data analytics and the Internet of Things (IoT), is developing (Aryal et al., 2020). The study examines how various supply chain and related areas deal with disruptive change in different ways. The four components of the systematic review technique used in this work include collecting pertinent literature, descriptive analysis, category selection, and material assessment. Applying the latent semantic analysis

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approach with Leximancer, which provides more rapid, accurate, and consistent content analysis, was the final stage in discovering important themes and patterns in the literature.

The empirical analysis discovered significant patterns in big data analytics and IoT across two time periods, with research showing rapid growth after 2015 after showing stable growth up until that point. The main finding of the review is that customer service, support, and supply chain networks, systems, and performance have been the main focus of contemporary big data research. The focus of the primary IoT research questions has switched from corporate information management and large supply chains to more specialized areas like supply chain design, model, and performance. The authors hope to raise awareness of this method of research while also identifying important trends in the study of disruptive technologies across time.

This project's goal is to create theoretical and experimental hypotheses on the relationships between supply chain risks throughout the world, supply chain resiliency, and mitigation strategies. Supply chain resilience is stressed as a dynamic capability while lowering supply chain risk in sourcing, production, and delivery, according to the design, methodology, and strategy of certain studies. The moderating impact of various mitigation approaches is investigated to improve supply chain resilience.

To identify the most efficient risk mitigation strategies for distinct risk scenarios, data were collected by survey and evaluated using structural equation modeling and further testing. The effectiveness of seven mitigation measures has an impact on the relationship between supply chain risks and

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resilience, making it imperative to improve supply chain resilience capabilities. The findings add to the theoretical development of risk management challenges in international supply networks by underlining the need of supply chain resilience capabilities.

The research results provide management advice on how to reduce supply chain risk on a worldwide scale by utilizing efficient supply chain resilience techniques in an unstable environment. The effects of approaches for enhancing supply chain resilience are the subject of the first empirical study in this field. The findings offer theoretical guidance for future supply chain resilience research as well as useful takeaways for dealing with unanticipated catastrophes.

When the COVID-19 epidemic was at its worst, food supply routes in the UK and the rest of the world were disrupted (Ramanathan et al., 2021). Although societal changes have improved the resilience of the supply chain, excessive demand volatility presents challenges for distribution, logistics, and supply. The writers of this essay look at what caused the initial disruption in supply chains and offer advice to firms based on tried-and-true techniques and ideas. A variety of research methodologies are used by the researchers.

The authors first carried out an exploratory inquiry, gathering information from freely accessible web sources. Regression was then utilized by the authors to analyze various situations in light of the data already available. After that, the writers spoke with two people from the UK retail sector in two interviews. In order to provide businesses and supply chain players with decision-making points for handling current and potential future disruptions, these scenarios have been compared and contrasted. The findings

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of the current exploratory investigation shed insight on supply network instability. Numerous possible business strategies were put out by the writers both during and after the epidemic. Supply chain companies can make wise judgments during a pandemic epidemic according to the regression model. The authors might create a resilience model once the entire COVID-19 data set is available.

Evaluation of the outcomes of actions taken in connection with a job is done through the process of operational, financial, and environmental performance evaluation (Panwar, Jain, Rathore, Nepal, and Lyons, 2017; Gimenez & Ventura, 2005). (Dey & Cheffi, 2013). Explicitly (Frohlich & Westbrook, 2001) or inferentially, supply chain robustness is linked to enhanced performance (Narasimhan & Kim, 2002).

As a result, operational performance assessments encompass both internal efficacy and quantitative organizational processes (Azim, Ahmed & Khan, 2015; Turkulainen & Ketokivi, 2012). According to Feng et al. (2018), operational performance was assessed based on a company's ability to quickly change the product mix, its exemplary track record of on-time customer delivery, the lead time for processing client orders, and its ability to provide excellent customer assistance. Other operational success metrics include Product performance, flexibility in the product mix, volumetric flexibility, and product unit cost, competitive advantage, capacity to react to change, operating cycle, inventory turns, and adherence to product requirements (Boyer & Lewis, 2002). (Hallgren & Olhager, 2009; Pshaei & Olhager, 2019). (Khan, Azim, & Ahmed, 2015).

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Indicators like value addition, efficiency, increased order fulfillment rate, delivery, and quality time (Trattner, Hvam, Forza, and Herbert-Hansen, 2019), cost performance, service performance (Bae, 2017), product performance, brand name, product innovation, cost effectiveness, price competitiveness, on-time delivery (Huo, Gu, and Prajogo, 2016), waste cost reduction, and others were also used to quantify OP (Dey & Cheffi, 2013).

Lessons from the Empirical Studies

The majority of research (Latif et al., 2020; Chithambo et al., 2020; Chu et al., 2017; Abdullah & Yaakub, 2017; Huang & Yang, 2014; Ye et al., 2013) were undertaken in contexts other than those of West African poor nations. Conducting this research in Ghana's industrial sector solves this vacuum, particularly by focusing on food processing enterprises. Similar research in Ghana (Afum, Sun, & Kusi, 2019) focused on general food and beverage firms rather than those in the capital city's food processing sector.

Structured questionnaires appear to be an appropriate method for collecting primary data in this type of empirical study. Thus, primary data from a few food processing firms in Ghana's Greater Accra Region were gathered using structured questionnaires. Thus, primary data from a few food processing firms in Ghana's Greater Accra Region were gathered using structured questionnaires. the use of structural equation modeling and the Statistical Package for the Social Sciences for the study of the formulated research objectives was greatly influenced by similar data analytical techniques employed by some of the empirical studies that relied on primary data (Latif, et al., 2020; Afum, Sun & Kusi, 2019; Chu, et al., 2017; Abdullah & Yaakub, 2017; Ye, et al., 2013). These studies actually relied on the

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SMART PLS application (Latif, et al., 2020; Afum, Sun & Kusi, 2019; Abdullah & Yaakub, 2017) because of the robustness nature of such application. As a result, the SMART PLS application was used to process and analyze data in this study.

The results concerning the impact of supply chain resiliency on the operational performance of firms appeared to be consistent, with some studies identifying a greater number of supply chain resiliency strategies as having a favorable effect on firms' operational performance and others finding that the resilience strategies improved the firm's financial performance after adoption.

These parallels underline the need for more study to empirically determine the true nature of the connection between supply chain resilience techniques and businesses' operational success in varied cultural contexts, such as rising nations like Ghana. Additionally, the empirical review demonstrates that the majority of studies (Latif et al., 2020; Afum, Sun, & Kusi, 2019; Chu et al., 2017; Huang & Yang, 2014) used a Likert type of rating to determine respondents' thoughts on the items. This finding influenced the use of a 5-point Likert scale before and during the COVID-19 pandemic to gauge participants' opinions in this study.

The study's reliance on primary data for model configuration was influenced by the fact that those empirical investigations that employed structural equation modeling did so as well (Latif, et al., 2020; Afum, Sun & Kusi, 2019; Chu, et al., 2017; Abdullah & Yaakub, 2017; Huang & Yang, 2014). The supply chain resilience technique used for this research was also impacted by how prior empirical studies examined similar characteristics

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(Afum, Sun & Kusi, 2019; Abdullah & Yaakub, 2017; Chu, et al., 2017; Huang & Yang, 2014).

Conceptual Framework

The goals for the study are reflected in the conceptual framework. The methodology demonstrates how measures for supply chain resilience affect businesses' operational success. This conceptual framework is created to provide readers a clearer idea of the kinds of interactions and connections that the research wants to investigate in the operational performance of SMEs in the Greater Accra Region. It considers the theoretical analysis, study empirical assertions, types of data analysis procedures, and the fundamental connections between the constructs.

The conceptual framework is shown in Figure 1
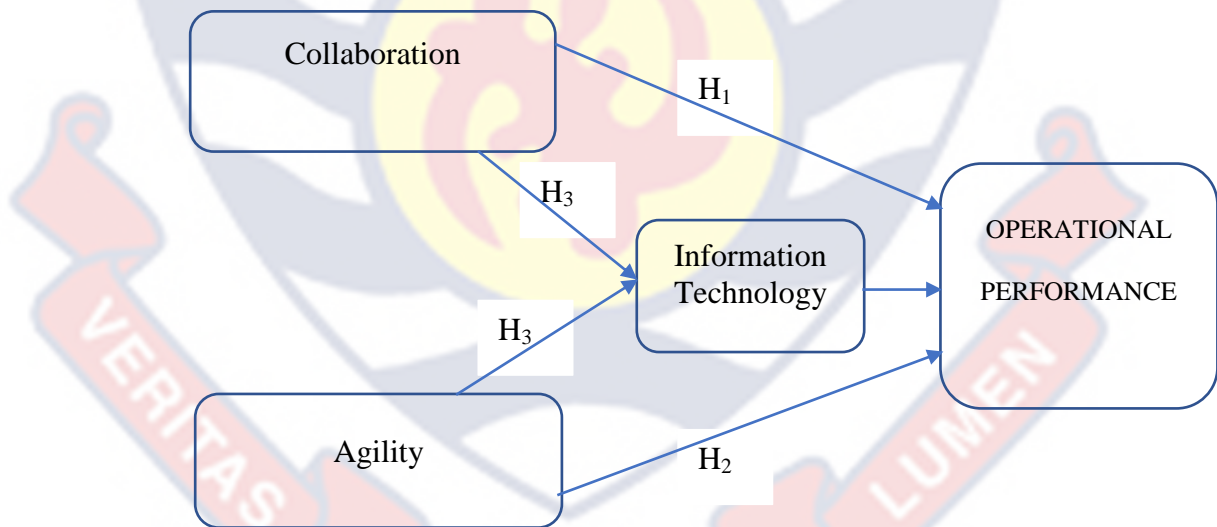
Figure 1: Conceptual Framework
Source: Field Data

Chapter Summary

The primary concepts (constructs) that comprised the thematic areas have been thoroughly defined, operationalized, and presented in this chapter.

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Based on the particular study objectives, patterns found through an empirical examination, and the theme regions' thematic areas, a conceptual framework expressing the links between the constructs has been created. A review of certain similar research' empirical data has also been conducted.

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CHAPTER THREE

RESEARCH METHODS

Introduction

The goal of this study is to determine how the performance of operational food processing companies in Ghana's Greater Accra Region before and during COVID-19 is impacted by supply chain resilience strategies for SMEs. Scholars have typically placed a strong emphasis on the two primary categories of research methods: qualitative and quantitative, despite the fact that this study used a quantitative technique. The research was therefore influenced by positivism, an approach more closely associated with quantitative research that adopts an unbiased evaluation of reality outside of the study (Creswell & Garrett, 2008). According to the literature, quantitative research is appropriate when the goal of the study is to form judgements and reach conclusions.

Research Philosophy

The research subscribed to positivist philosophy. According to the positivist philosophy, it is feasible to apply absolute truth to a phenomenon's scientific examination (Ballard, 2018; Alnaser, Ghani & Rahi, 2019). Therefore, the study makes the assumption that using scientific research methodologies, objective data pertinent to the particular research aims will be generated to guide the development of explanations for actions that are acceptable from a scientific standpoint. The basic attribute of positivism is empiricism. It asserts that there is an objective, universal reality that is governed by rules and procedures that are universal, and that this objective

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reality is really perceptible to humans through their senses in their surroundings (Kankam, 2019).

The positivist philosophy emphasizes objectivity in the context of testing theories or hypotheses while also emphasising the researcher and the investigation as different structures via distance (Singh et al., 2019). The positivist paradigm aids in producing discoveries that can be replicated and generalized (Kiyala, 2019). Because it exclusively considers observable phenomena and ignores unobservable phenomena, positivism is attacked (Markovits et al., 2019).

Research Approach

A research approach is a strategy that covers all necessary phases, from general assumptions to specific techniques for gathering, analyzing, and interpreting data (Boohen. Sheridan & Kotey, 2008; Creswell, 2014; Creswell & Clark, 2017). The positivist viewpoint and a quantitative methodology were employed in the investigation. The quantitative approach allows the characterization of study-related challenges using quantitative techniques, which aids in the generalization of results (Creswell & Clark, 2017). The procedure is quick, scientific, and yields logical results. It uses quantitative data collecting methods such as survey and questionnaire results (Crotty, 1998; Creswell, 2014). Therefore, it's crucial to look into the connections between and among different factors (Creswell & Creswell, 2017). The study's particular objective is to ascertain how supply chain resilience methods affect operational performance.

The research for this study was particularly pertinent since it sought to ascertain how supply chain resilience strategies, as well as the effects of

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collaboration and agility, influenced the effectiveness of the food processing SME's in the Greater Accra Region. The study also looked at the role of technology as a middleman. The decision was made to concentrate on Accra because of its degree of industrialisation. Accra is where most small and medium-sized enterprises are found.

Research Design

The study's methodology will have a significant impact on the research design that is chosen (Grove, Burns & Gray, 2012; Creswell, 2014). The explanatory research design was chosen based on the study's quantitative methodology. The explanatory design improves comprehension of a particular subject and offers superior, impartial conclusions to support the generalization of data (Burns et al., 2011; Creswell, 2014). It works well for accurate details about a circumstance. Large volumes of data from a sizable target population are gathered and economically analyzed by the design utilizing both descriptive and inferential statistical methods (Tabachnick & Fidell, 2007). Lewis, Saunders, and Thornhill claim the following (2011). Researchers may have better control over their study techniques thanks to the explanatory design.

To get information from distributed respondents over a region, the explanatory design employs structured questionnaires. The design is therefore appropriate for interviewing representatives of food processing businesses scattered over Ghana's Greater Accra Region. Additionally, this approach analyses causal relationships between and among variables using statistical methods that need a substantial quantity of numerical data (Wahyuni, 2012; Beins & McCarthy, 2017). The design is therefore appropriate for

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interviewing representatives of food processing businesses scattered over Ghana's Greater Accra Region.

However, the explanatory design has significant flaws that might skew the results of a research (Robson & McCartan, 2016; Wildemuth, 2016). Using this method to guarantee a representative sample might take time, according to Wildemuth (2016). Because data are collected based on respondents' thoughts and beliefs, Robson and McCartan (2016) noted that this technique may provide results that are biased. Thus, this could affect how objective the results are (Creswell & Creswell, 2017). The explanatory research design was more appropriate according to the study's objective as well as the research philosophy and technique.

Data Collection Instrument

A self-administered questionnaire that was sent in person and by mail to the intended respondents served as the data collecting technique. Plano and Badiee (2010) assert that questionnaires guarantee strong generalizability of outcomes and considerable efficiency in data collection compared to more intensive research approaches. But as Creswell and Garrett (2011) noted, when a questionnaire has been created and distributed, it can be challenging to change the categories of data that are gathered. The questionnaire was chosen for this kind of investigation because it is a self-reported measure that protects anonymity.

Companies in Ghana's Greater Accra Region engaged in the food processing business were surveyed to gather information for the research. The study's research is best carried out in Ghana's largest commercial and industrial region because it is still developing and has many SME

concentrations, especially in the food processing industry, increasing logistics infrastructure, evolving market and supply chain arrangements, and significant market uncertainty (due to market dynamisms and competitive intensity).

Profile of the Study Area

The industry of small- and medium-sized food processors sector in the Greater Accra Region served as the subject of this study. a region that was severely damaged by the COVID-19 and is home to the bulk of small and medium-sized companies. To satisfy the demands of end customers, the industry essentially transforms raw materials or works in progress into completed items (Kasim, Zubieru & Antwi, 2015). In this area, there are several businesses that produce and prepare food. To meet the diverse demands of end clients, each organization, in turn, performs certain activities. The food processing industries are part of the SMEs sector, which makes a substantial contribution to economic growth through GDP, resource consumption, job creation, and revenue generation (import and export tariffs, taxes, and GDP) (Agyapong, 2010).

The contribution of these two business types to Ghana's manufacturing GPD ranges between 32 to 43% yearly, according to the Association of Ghana Industries (AGI) 2017 annual report. This amply demonstrates the important contribution they provided to the expansion of the food processing sector. The primary focus of this study was on SMEs engaged in the food processing sector in Ghana's Greater Accra Region. Because Greater Accra contains the most small and medium-sized enterprises (SME) in the nation, it was selected as the study's focus region (AGI, 2017).

Sixty to seventy percent of companies that processed foods have registered, according to AGI (2017). Because these firms frequently utilize supply chain resilience methods to complete related duties, the conclusions of this study can be more extensively applied if it concentrates on metropolitan regions with highly concentrated companies.

Population

The Greater Accra Region of Ghana's food processing sector operations managers, managers, and administrators would be the study's target population. According to the Association of Ghana Industries and the NBSSI 2020 statistics, there are 150 recognized food processing industries in the Greater Accra Region. As a result, the population of the research will consist of all officially registered food processing SMEs in the Greater Accra Region. The Association of Ghana Industries and businesses in the Greater Accra Region with contact information or locations listed in the Ghana Yellow Pages in 2021 were the sources for the data. First, the companies were contacted to gauge their interest in taking part in the study. Only SMEs (firms with nine to 139 people) were selected for this survey, thus companies interested in participating were asked to estimate how many employees they had. A total of 150 SMEs were asked to take part in the study if they were interested in doing so.

Addresses and email addresses of the 217 food processing SMEs were collected for surveys, some of which were distributed online. A single informant in each company who held a relevant managerial role (such as an owner-manager, administrator, or operations manager) was given the questionnaires as a result of past research (Huo, 2012) sampling methodology.

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Using the study's fundamental random approach, data were collected from each unit (member) of the target population.

The census method was employed to improve the reliability and accuracy of study findings (Creswell, 2014). As a result, every company in the study's target audience was of utmost importance. As a result, information was acquired from 150 important food processing SMEs in Ghana's Greater Accra region. The owner-managers, production/operation officers, and administrators inside these SMEs provided the key data with regard to their thoughts, experiences, and job roles that directly affect supply chain operations.

The minimal sample estimate criterion proposed by Hair, Sarstedt, Ringle, and Mena (2012), sometimes known as the "10-times rule," was used in the study to determine the smallest sample size appropriate for the PLS-SEM approach. The criterion conditions that the minimum the sample size ought to be 10 times the greatest number of structural pathways that are targeted at a single construct in the structural model. The structural model used in this study contained four structural paths that led to a particular latent component. Therefore, $4 \times 10 = 40$ was the least sample size that could be used. Other academics have broadly endorsed this 10-times minimum sampling determination approach (Hair Jr, Hult, Ringle & Sarstedt, 2021; Hair, Sarstedt, Hopkin & Kuppelwieser, 2014). As a result, the study used this criterion to estimate the appropriate minimum sample size.

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a result, every company in the study's target audience was of utmost importance. As a result, information was acquired from 150 important food processing SMEs in Ghana's Greater Accra region. The owner-managers, production/operation officers, and administrators inside these SMEs provided the key data with regard to their thoughts, experiences, and job roles that directly affect supply chain operations.

Pre-Testing

Prior to administration, the questionnaire underwent a pre-test to confirm its clarity and information validity (Starks & Trinidad, 2007). Pre-testing is the primary objective of the pilot research. the questionnaire on a representative sample and then utilize the results of the study to make any necessary changes to the questionnaire before it is used in the primary research. In the Central Region's Cape Coast Metropolis, pre-testing was conducted on a few chosen food processing SMEs.

Pre-testing

Prior to administration, the questionnaire underwent a pre-test to confirm its clarity and information validity (Starks & Trinidad, 2007). The major goal of the pilot study is to pre-test the questionnaire on a representative sample and then utilize the results of the study to make any necessary changes to the questionnaire before it is used in the primary research. In the Central Region's Cape Coast Metropolis, pre-testing was conducted on a few chosen food processing SMEs. This is due to the Greater Accra Region's homogenous character attribute across businesses.

Data Collection Instrument and Procedure

The intended respondents were mailed a self-administered structured questionnaire that was used to gather data. According to Plano and Badiee (2010), as compared to more intense research designs, a questionnaire ensures great efficiency in data collecting and high generalizability of results. Because it is a self-reported measure that ensures confidentiality, the questionnaire was chosen for this type of study and the constructs were discovered through a survey of the literature and verified instruments. As a result, it is more likely to elicit a true response from responders regarding the information requested. To eliminate ambiguity and pique respondents' attention, the questionnaire was written in a concise and relevant style. The 5-point Likert Scale was used to score the resilience techniques, with 1 indicating strong disagreement and 5 indicating strong agreement. A 5-point

Respondents were asked to judge the degree of advancement in OP measures when it came to assessing operational success on a scale of 1 to 5, with 1 representing significant disagreement and 5 denoting great agreement. The Likert Scale was considered as a continuous interval scale since the items used to evaluate each construct were combined to provide a composite score for each construct in a single summative score (Mishra et al., 2021)

The questionnaire's Section A gathered information about the respondents' demographic characteristics. This section had six items Section B began by ranking the supply chain resilience strategies used by the region's food processing firms. Sections C, E, and F additionally included 33 questions to assess the top four supply chain resilience methods. Section D assessed food processing companies' operational performance. The instrument is

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included in the study report's Appendix section. The use of structured questionnaires simplified and accelerated data collecting and processing (Nyarku & Oduro, 2018) To assist with data gathering from the food processing businesses, four Field Assistants would be hired.

To guarantee that the surveys are properly administered, Field Assistants will be given training to ensure that they understand the study's purpose as well as how the questionnaire should be administered and retrieved. The training will take place during the last week of June in the year 2021. The Field Assistants will be given practical training so that they can administer the questionnaire to each other in turn. Also, data collection concerns such as unwillingness to reply to questions in the questionnaire, how to track down a respondent to a questionnaire, and so on. Data Processing and Analysis

The data was processed using IBM SPSS statistics software and SmartPLS3. A quantitative analysis of the data was done. The PLS-SEM method was chosen over the covariance-based (CB-SEM) method because it is more suited for small sample sizes, can handle formative and reflective indicators, and will be assessed. A statistical technique for assessing hypotheses on the connections between observable and latent variables is structural equation modelling (SEM). Give a nontechnical introduction to SEM for researchers and students who have a basic grasp of inferential statistics. Define the essential concepts of the SEM technique.

In order to rank supply chain resilience options, the Kendal's coefficient of concordance was used. In this case, the scale is 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), and 5 (agree) (strongly agree).

More individuals disagree with the average value of the rating the closer it is to "1." (2006) Tastle & Wierman However, the responses are more in agreement with the average value the closer the value is to "5". Low impact denotes that the firm does not believe that such techniques are robust, but high impact shows that a strategy significantly affects the firm's capacity for resilience. In this study, respondents were only allowed to use the alternatives 1, 2, 3, 4 and 5 in such rankings, i.e., tick the box under which the figure for the ranking is found.

A collection of statistical models used to describe correlations between various variables is known as structural equation modeling (SEM) (Hair et al., 2012). The two primary approaches to modeling structural equations are: Partial least squares or variance-based (PLS) According to Andeev, Heart, Moaze, and Pliskin, there are two options: co-variance-based SEM and SEM (2009). (CB-SEM). Due to the size of these discrepancies, CB-SEM models contain parameters that lower the variance between the computed and observed covariance matrices, resulting in goodness-of-fit indices. Instead of attempting to fully explain all of the indicator covariances, the PLS-SEM model is utilized to enhance the variance of all dependent variables (Ringle et al., 2009). Based on its capacity to minimize the residual variances of the endogenous variables, PLS-SEM parameter estimates are generated (Henseler et al., 2009; Esposito Vinzi et al., 2010). The notion of normality is defied by multivariate normalcy, but the PLS-SEM can handle it and does not need making strict assumptions about the distributional characteristics of the raw data (Hair, Sarstedt, Hopkins, Kuppelwieser, 2014).

PLS-SEM is one of the top 58 methods for applied multivariate statistical analysis, according to Al-Ansari (2014). This approach investigates the structural theory of a particular scenario using a confirmatory (hypothesis-testing) technique (Babin, Hair & Boles, 2008). Despite being a somewhat complex statistical method for examining correlations between/among components, the analysis does not always call for a large sample size (Henseler, Ringle, and Sinkovics, 2009; Hair et al., 2012; Rönkkö & Evermann, 2013). Additionally, it gives more stringent and powerful statistical tools to deal with complex models (Hair et al., 2014).

Additionally, since the PLS-SEM tool can achieve missing data and normality violations, it is not necessary to make strict assumptions about the raw data's distributional properties (2012) (Hair et al.). Regression and factor analysis are used in this statistical tool's measurement models. Ullman and Bentler (2012). The PLS-SEM model, according to Ringle Sarstedt and Straub (2009), maximizes the variances of all endogenous variables rather than accounting for all of the covariances of the indicators. Therefore, the PLS-SEM was selected to assess the study's hypotheses primarily because to its capability to deal with deviations from normality. It may also evaluate the causality of links between and among constructs using a variety of measuring items. Tables and figures were used to show and explain the results of this analytical tool. Munir and colleagues 2020.

Chapter Summary

The research design, study and target population, sampling methods and sample size, data collecting instrument and methodology were all mentioned in the chapter. data processing and mode of analysis. A signed

authorization letter has to be approved by all of the affected Heads before the data collection could start. Additionally, privacy and anonymity were assured to poll participants.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter included the analyses' findings and a discussion of how they related to the study's objectives. It specifically addressed the respondents' sociodemographic information and displayed the findings of the tested hypotheses.

Socio-Demographic Characteristics of Respondents

The respondents' sociodemographic details were reported in this section. It clearly included their job titles, levels of experience, number of workers, kind of business, mode of ownership, and duration of operation. The outcomes were displayed in Table 1. Based on the 150 valid replies acquired during the data collecting exercise, Table 1 displayed this result. According to the respondents' current employment status, 20.7% of them were administrators, 36.7% were owner-managers, and 42.7% were operations or production supervisors. This indicates that all of the respondents held crucial positions within their companies, making it possible to depend on their comments in order to gather reliable and pertinent data.

The respondents' level of experience was also presented in Table 1. It was revealed that 37.3 percent of them have worked for 1 to 5 years; 38.0 percent of them have 6 to 10 years' experience; 20.0 percent have 10-15 years and finally, 4.7 percent of them have over 15 years of working skill. This finding indicates that most of respondents have sufficient job experience and may, therefore, offer pertinent information based on their degree of experience to meet the purposes of the study.

Table 1: Socio-demographic Characteristics of Respondents

Item	Frequency	Percent (%)
Job Position		
Owner-Manager	55	36.7
Operations/Production Manager	64	42.7
Administrator	31	20.7
Level of Experience		
1-5 years	61	37.3
6-10 years	57	38.0
11-15 years	25	20.0
Over 15 years	7	4.7
Number of Employees		
0-9	53	35.3
10-39	52	34.7
40-79	27	18.0
80-100	18	12.0
Core Competence		
Suppliers	58	38.7
Manufacturing	62	41.3
Distributors	30	20.0
Number of Years in Operation		
Below 6 years	63	42.0
6– 10 years	56	37.3
Over 10 years	31	20.7
Total	150	100.0

Source: Field data (2022)

The number of employees in various SMEs engaged in food processing were also reported in Table 1. In particular, it was shown that 35.3% of food processing SMEs employ less than 10 people.; 34.7 percent of them have about 10 to 39 employees; 18 percent of them have about 40 to 79 employees and finally, 12 percent of them have about 80 to 100 employees. This result

means that a reasonable number of the Food processing SMEs contribute to reducing unemployment in the country by employing more than one employee. Thus, continuous investment in Food processing SMEs could help further minimise the unemployment rate in the country.

The core competencies of the Food processing SMEs were also presented in Table 1. It revealed that 38.7 percent are into supply of inventories, 41.3 percent of them are into manufacturing while 20 percent of them are into distribution, wholesaling and retailing. This means that all the respondents perform varied roles within their SC networks; thus, obtaining information from people with differing core competences could be key to improving the quality of the study's findings. Lastly, the duration of the businesses' operations was also reported. It was found that 22 percent of them have operated for less than 6 years; 47.3 percent have operated for between 6 to 10 years and finally, 30.7 percent have operated for over 10 years. This outcome indicates that the majority of theSMEs have been operating for a reasonable number of years; thus, fetching data with respect to supply chain resilience from them is justifiable.

Supply Chain Resilience Strategies before and during the COVID-19 Pandemic

This section looked into research goal one's rating of SCR tactics prior to and following the Covid-19 epidemic. It specifically aimed at comparing the strategies food processing firms in Ghana adopted before and during the global pandemic which severely impacted supply chains. This objective was achieved by dividing the analysis into three sub-sections: (a) ranking the

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strategies before the pandemic (b) ranking the strategies during the pandemic and (c) comparing the strategies based on the rankings.

Ranking the SCR Strategies Before the Covid-19 Pandemic

This section ranked the various SCR strategies adopted by the food processing SMEs before the Covid-19 pandemic. It specifically aimed at ranking the firms' SCR strategies prior to the pandemic in 2019 and it was achieved via the Kendall's coefficient of concordance (Kendall's Tau or W). The result was presented in two tables: Table 2 specifically contained the test statistics of Kendall's W.

Table 2: Test Statistics of Kendall's W

N	150
Kendall's W[a]	.881
Chi-Square	261.008
Df	9
Asymp. Sig.	.000

a. Kendall's Coefficient of Concordance
Source: Field Data (2021)

To check for Kendall's W, two key issues are addressed: (1) hypothesis should be developed and tested using the asymp. Sig and (2) the reliability score should be checked. In view of this, the study first hypothesised that, "there is a significant agreement among the respondents on the ranking of the SCR strategies". Legendre (2005) suggested that the hypothesis should be rejected if the asymp. Sig. value is > 0.005; thus, the sig. value should be <0.05. With respect to Table 2, the hypothesis was supported because the sig. value was 0.00 (i.e., <0.05) and this means that the ranking of the SCR strategies by the respondents correlate with each other. This implies that the ranking can be done since the respondents' views correlate with each other.

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The study finally checked for reliability using Kendall's W score. The rule proposes that Kendall's W is reliable if its value is > 0.70; thus, values < 0.7 implies unreliability of the test scores. From Table 2, Kendall's W of 0.881>0.70 was obtained and this indicates that the respondents' responses are reliable and thus, the researcher could proceed with the ranking. In view of this, Table 3 presented the rankings of the SCR strategies prior to the Covid-19 pandemic.

Table 3: Ranking of Supply Chain Resilience Strategies Before the Covid-19 Pandemic

SCR Strategies	Mean Rank	Ranking
Collaboration	5.98	1st
Agility	5.95	2nd
Information technology	5.74	3rd
Risk management	5.71	4th
Integration	5.44	5th
Communication	5.41	6th
Re-engineering	5.27	7th
Visibility	5.26	8th
Adaptive capability	5.20	9th
Contingency	5.19	10th

Source: Field Data (2022)

Using Kendall's W, the ten key SCR strategies used by the food processing firms before the Covid-19 were ranked using the mean rank which ranged from 0 to 1. (Howell, 2002) proposed that a mean rank of 0 suggests perfect disagreement whereas a rank of 1 suggests perfect agreement; thus, the closer the value to 1, the higher the ranking. (Legendre, 2005) also proposed the following, "mean values between 0.1 and 2.94 suggest 'low rating', 2.95 to 5.0 suggest 'high rating' and finally, values above 5.0 suggest very high rating". in relation to the study, the SCR strategies were ranked using both

Howell (2002) and Legendre's (2005) criteria. From Table 5, all the SCR strategies had very high ranking because their mean scores were > 5. This means that, prior to the Covid-19 pandemic, all the food processing firms relied on all the ten strategies to ensure resilient supply chains.

Among the SCR strategies, collaboration had the highest mean rank of 5.98; implying that the respondents agreed that they had more collaborations with their supply chain actors prior to the pandemic. Thus, the firms developed close ties with their partners in order to achieve resilience before the pandemic occurred. The study is supported by the resource-based view theory which suggests that resources are increasingly becoming scarce and their ownership lie in the hands of external actors; thus, the need for collaborations in order to obtain such resources. When firms collaborate with their SC actors especially key suppliers, it helps them to share valuable resource which is crucial to attaining operational efficiency.

The study's result was followed by agility (5.95) and information technology (IT) (5.74); implying that the firms placed much emphasis on establishing agile SCs and also invested in IT prior to the pandemic. In terms of agility, the respondents agreed that they find ways to quickly respond to production delays in order to meet customers' expectations. Also, the firms embraced information technology which facilitated production during this period. The study's findings are supported by the resource-based view theory which suggests that firms need to obtain valuable resources like information technology in order to become resilient.

Also, risk management (RM) was the 4th ranked with a mean rank of 5.71; implying that, food processors, prior to the pandemic, had plans and

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strategies which aimed at minimising the occurrence of business risks. Thus, the respondents agreed that risk such as natural disasters like the Covid-19 pandemic is inevitable in modern-day businesses and thus have developed measures to minimise its propensity to occur and associated severity. Also, the respondents agreed that other SCR strategies such as integration (5.44, 5th), communication (5.41, 6th), re-engineering (5.27, 7th) and visibility (5.26, 8th) were in place before the coronavirus. These findings clearly indicate that food processing firms adopted these strategies in order to ensure supply chain resilience and invariably achieve operational efficiency before the pandemic.

Finally, adaptive capability (AC) (5.20, 9th) and contingency (C) (5.19, 10th) had the lowest mean ranking among the ten SCR strategies. These results mean that, although food processing firms in Ghana relied on the ten strategies, however, minimal emphasise was given to AC and C to attain SCR. Conclusively, food processing firms, prior to the Covid-19 pandemic, placed much emphasis on collaboration but had minimal focus on contingency. This could be because, contingency focuses on "just in case"; and as such, is not carried out on a daily basis as compared to collaboration.

The study's results are in line with related studies by Mandal (2017), Orji et al. (2020) and von Falkenhausen et al. (2019) who asserted that firms can ensure SCR through collaboration, visibility, risk management and adaptive capabilities. Gu et al. (2021) also added that IT, in recent times, has grown in importance among the strategies that firms adopt to ensure resilient suppply chains. They concluded that investment in technologies is a key approach to improving resilience through quick production and delivery of quality products to customers. Brandon-Jones et al. (2014) also concluded that

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collaborations with supply chains are key to promoting SCR through resource sharing, information exchange and full participation in decision making processes.

Ranking the Supply Chain Resilience Strategies during the Covid-19 Pandemic

This sub-section also ranked the various SCR strategies adopted by Food processing SMEs within the Greater Accra region using the Kendall's W. Table 4 showed the test statistics of the Kendall's W.

Table 4: Test Statistics of Kendall's W

N	150
Kendall's W[a]	.842
Chi-Square	266.450
Df	9
Asymp. Sig.	.000

a. Kendall's Coefficient of Concordance
b. N = number of respondents or raters

Source: Field Data (2022)

The study hypothesised that, "there is a significant agreement among the respondents on the ranking of the supply chain resilience strategies". From Table 4, the sig. value was 0.00<0.05; thereby, suggesting that the hypothesis can be supported. Simply put the respondents' level of agreement with respect to the ranking of the SCR strategies correlate with each other. Also, with respect to reliability, Kendall's W value was 0.842>0.70; indicating that the respondents' responses are reliable and could be relied upon to develop policies and improve current practices. Table 5, therefore, presented the rankings of the strategies.

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Table 5: Ranking of Supply Chain Resilience Strategies During the Covid-19 Pandemic

Strategy	Mean Rank	Rank
Information Technology	5.89	1st
Risk Management	5.78	2nd
Agility	5.77	3rd
Collaboration	5.61	4th
Integration	5.48	5th
Communication	5.41	6th
Re-engineering	5.31	7th
Visibility	5.26	8th
Contingency	5.25	9th
Adaptive Capability	5.24	10th

Source: Field Data (2022)

Using the rules of Howell (2002) and Legendre (2005), it could be deduced that all the SCR strategies had very high ratings based on the mean scaling (i.e., >5.0). This means that the respondents of the Food processing SMEs strongly agreed that, during the Covid-19 pandemic, they continue to rely on all the ten key strategies to ensure resilient SCs. Simply put, food processing SMEs within the Greater Accra region continue to promote resilience during the global pandemic by implementing agility, collaboration, adaptive capability, re-engineering, communications, among others.

Among these strategies, information technology had the highest mean rank of 5.89; thus, the most adopted SCR strategies during the Covid-19 pandemic. As such, the food processing SMEs continue to ensure resilience of their SCs by embracing and investing heavily in technology. The respondents generally agreed that technology has played a crucial role in helping them survive the adverse effects of the covid-19 pandemic. The resource-based

view theory asserts that food processing SMEs can achieve resilient SC by investing heavily in IT. This is because, IT is considered as a valuable resource that food processing firms need in order to resist and quickly recover from SC disruptions such as the Covid-19 pandemic.

The respondents also generally agreed to the adoption of RM (5.78) to achieve SCR; representing the second highest mean rank. The respondents agreed that risk is inevitable in their operational activities; thus, the need to identify and manage it. The respondents agreed that they place much emphasis on RM during the Covid-19 pandemic in order to ensure that it does not continue to negatively affect their operational outcomes. Also, RM helps the firms to ensure that any other risk that could negatively affect operational efficiency are identified and controlled. According to Agyapong (2020), food processing firms in Ghana are generally exposed to financial risks such as market risk, operational risk and technology risk which affect the resilience of their SCs. Similarly, Nyamah et al., (2022) concluded that manufacturing SMEs are regularly exposed to procurement process risk which could have severe rippling effects. The study proposed that firms can overcome possible risks by promoting RM.

Also, agility had the third highest mean rating of 5.78; indicating that the respondents have reasonable level of agreement with each other in terms of promoting agility in order to ensure SC resilience. The result also implies that, during the Covid-19 pandemic, the food processing firms ensure that they quickly respond or react to production delays, changes or any other unforeseen events in order to meet customers' expectations, remain competitive and in turn expand their businesses. According to Al Humdan (2020), organisations

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can achieve resilience by embracing agility; thus, efficiently and quickly responding or adjusting to changes that occur in the ever-changing business environment. The author added that, agility is among the key dimensions of SCR.

Moreover, the respondents agreed that they continue to adopt other strategies such as collaboration (4th), integration (5th), communication (6th), re-engineering (7th), visibility (8th), contingency (9th) and adaptive capability (10th) to achieve supply chain resilience. The result means that, among all the various strategies to achieving supply chain resilience, adaptive capability had the lowest ranking with mean score of 5.24. Adaptive capability, for instance, focuses on a firm's capacity to adjust to potential damages, respond to consequences while taking advantage of opportunities. Thus, the Food processing SMEs prefer the other strategies to managing supply chain resilience to adaptive capacity. However, adaptive capacity had a mean ranking of over 5.0; suggesting that it is among the key strategies adopted by food processing firms in Ghana to ensure resilience during the global pandemic.

The study's results are in line with related studies by Orji et al. (2020), von Falkenhausen et al., (2019) and Mandal (2017) who asserted that firms can ensure supply chain resilience through collaboration, visibility, risk management and adaptive capabilities. Gu et al., (2021) also added that infromation technology, in recent times, has been regarded among the key strategies to achieving resilient supply chains. They concluded that investment in technologies is the most improtant approach to improving resilience through quick production and delivery of quality products to customers. Brandon-

Jones et al. (2014) also concluded that collaborations with SCs are key to promoting SCR through resource sharing, information exchange and full participation in decision making processes.

Comparing the SCR strategies before and during the Covid-19 pandemic

This section finally compared the mean ranking of the SCR strategies before and during the Covid-19 pandemic. After comparing the results, it could be seen that collaboration, agility, information technology where the three high ranking SCR strategies adopted the food processing firms before and during the pandemic. This result implies that food processing firms in the study area have consistently relied on the four strategies to achieve resilience pre and post the pandemic. However, prior to the pandemic, collaboration had the highest mean rank; followed by agility, IT and RM. However, during the pandemic, IT had the highest mean rank; followed by RM, agility and collaboration respectively. This result implies that Ghana's food SCs have placed much emphasis on IT in order to achieve quickly recover from the pandemic.

It is to note that, although the food processing firms placed much emphasis on collaboration prior to the covid-19, the need to overcome this pandemic pushed them to invest heavily in technology. Evidently, during the pandemic, global SCs were pushed to rely on technologies due to extreme limitations on direct human contacts. More precisely, the pandemic has strengthened the need for IT in carrying out their business activities. Also, in times of information exchange to achieve collaboration, food processing SCs required technologies during the pandemic and this key SCR strategy has maintained its relevance even during the pandemic.

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Results from the PLS-SEM

This section presented the discussion of the study's results based on the PLS-SEM output. Hair et al., (2021) stressed that, prior to hypotheses testing using PLS-SEM, the model needs to pass the quality criteria by undergoing a comprehensive assessment. This section, therefore, presented the model assessment of the data (i.e., before and during Covid-19) before testing the hypotheses.

Initial Model Assessment (Before the Covid-19)

Prior to the actual hypotheses testing, the qualities of the model were first assessed under the following dimensions: item loadings, reliability (indicator, construct), validity (convergent, discriminant) and multicollinearity using inner VIF values. Scholars have revealed that these model attributes are evaluated and reported in order to make meaning out of the structural model outcomes (Hair et al., 2019; Henseler et al., 2018). In view of this, the model obtained prior to the Covid-19 pandemic was first assessed and discussed.

Item Loadings (Structural and Measurement)

This section presented the constructs' item loadings where each item should have a loading of not less than 0.70 (Hair et al., 2021). The model was developed using four exogenous variables under supply chain resilience strategies (SCRS) comprising risk management (RM) with 6 items, agility (A) with 8 items, information technology (IT) with 9 items and collaboration (C) with 10 items and operational performance (OP) represented the endogenous variable with 11 items. The model's structure which comprised the study's constructs and their indicator loadings were shown in Figure 2.

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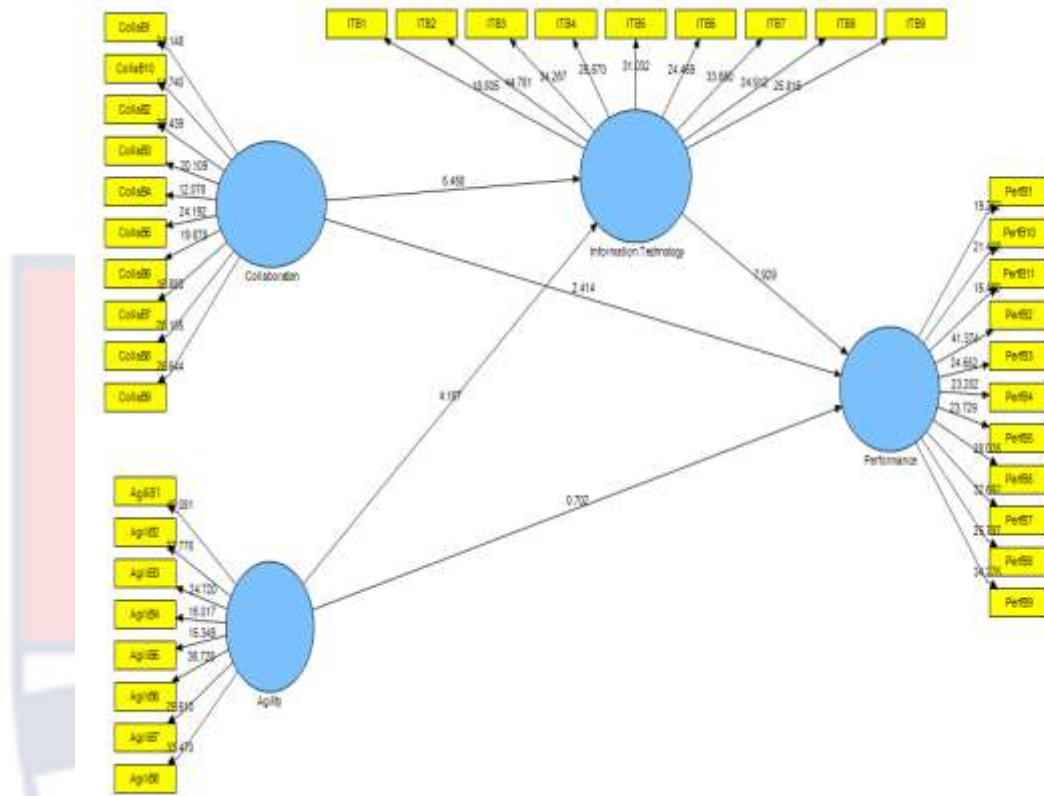
Figure 2: Inner and Outer Model Output (Before the Covid-19)

Source: Field Survey (2022)

From Figure 2, Collaboration (C) comprised C1, C2, C3, C4, C5, C6, C7, C8, C9 and C10; agility (A) comprised A1, A2, A3, A4, A55, A6, A7 and A8; information technology (IT) contained IT1, IT2, IT3, IT4, IT5, IT6, IT7, IT8 and IT9; and operational performance (OP) consisted of OP1, OP2, OP3, OP4, OP5, OP6, OP7, OP8, OP9, OP10 and OP11 respectively. It is to note that, the actual questions for each item can be found in Appendix 1. These constructs together with their indicators were used to draw four paths using arrows to signify relationships. This model was then assessed and items with loadings below 0.70 were removed (Figure 3).

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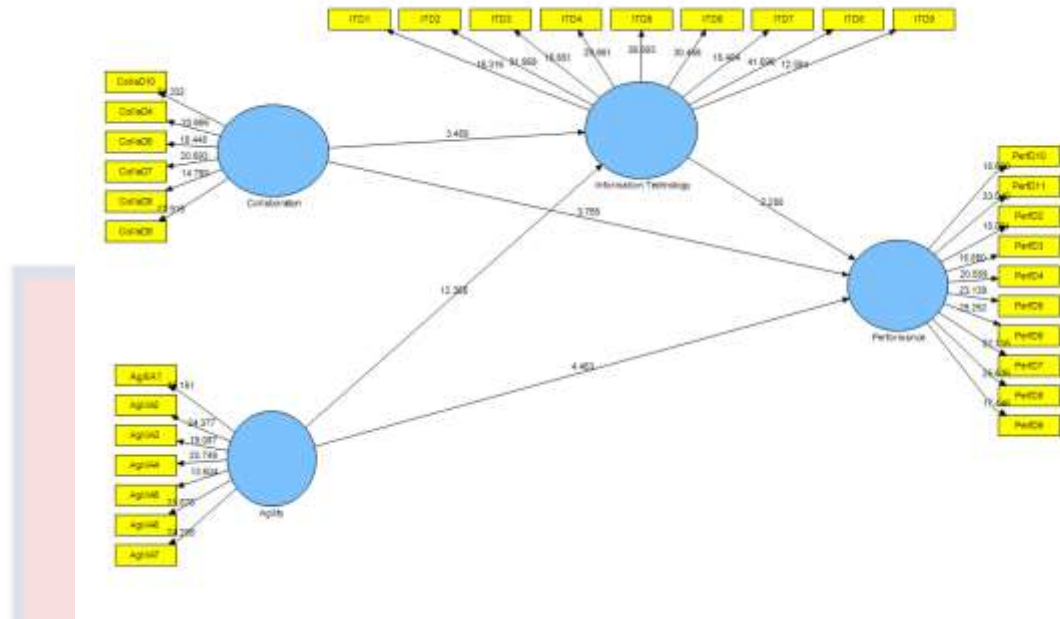
Figure 3: Final Model Structure

Source: Field Survey (2022)

It could be seen from Figure that, all items with loadings less than 0.7 were removed from the initial model. According to Hair et al. (2021), items with loadings less than 0.70 are deemed inferior and thus, do not truly measure their assigned construct within the context of a given study. Therefore, items loadings are assessed to ensure that they offer quality and true measures of their constructs in order to obtain relevant outcomes. In view of this, Agility had A2, A4 and A5 removed; collaboration had C4, C5 and C10 removed and finally, operational performance had OP5, OP7, OP10 and OP11 removed. As such, the study's results were discussed based on the final model.

Assessment of Measurement Model

After the model assessment using the item loadings, Table 6 presented the model's quality output comprising indicator reliability (IR) based on rho_A scores; composite reliability (CR), Convergent validity (CV) using the

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Average Variance Extracted (AVE) and multicollinearity based on the inner

VIF values.

Table 6: Assessment of Indicator and Construct Reliability and Validity

Items	rho_A	CR	CV	Inner VIF values
C	0.904	0.927	0.718	2.489
A	0.908	0.921	0.625	2.951
IT	0.940	0.949	0.673	2.861
OP	0.926	0.938	0.682	

"Indicator Reliability (IR using rho_A); Composite Reliability (CR); Convergent validity (CV) using AVE and Multicollinearity using VIF values"
Source: Field Survey (2022)

Indicator Reliability (IR)

Table 6 presented the model's indicator reliability (IR) using the rho_A

scores. IR represents the aspect of an indicator's variance that is explained by

its associated construct (Hair et al. (2017). Hair, Risher, Sarstedt and Ringle

(2019) added that IR provides a vital tool for evaluating the uni-

dimensionality of scale items to ensure reliability. It is assessed using either

Cronbach's Alpha (CA) scores or rho_A values; however, this study reported

the latter because it provides a better and reliable outcome as compared to the

former (Henseler, Hubona & Ray, 2016; Hair et al., 2014). The rule for

assessing IR suggests that rho_A values should be > 0.70 (Hair et al., 2017,

2021). From the model's rho-A scores, all the constructs had values > 0.7;

thus, suggesting IR. Collaboration had the lowest rho_A value of 0.904 while

IT had the highest score of 0.940.

Composite Reliability

The composite reliability (CR) scores of each construct were also

reported in Table 6. CR explains the degree to which a particular variable is

better measured when its assigned items loadings are combined (Henseler et

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al., 2015). According to Hair et al. (2017), attaining CR means that all the indicators of a specific construct have strong correlations among them. The decision rule is that a construct's CR score should be > 0.70 (Ringle et al., 2015; Henseler et al., 2015). From Table 6, all the constructs had CR scores > 0.70; with IT having the highest CR of 0.949 while Agility (A) had the lowest value of 0.921. Thus, all the constructs' indicators had strong correlations among them.

Convergent Validity

The model's convergent validity (CV) was also assessed by reporting the AVE scores (Hair et al., 2017; Henseler et al., 2015). The AVE values show the degree to which an indicator's variance is captured by its construct with respect to the sum of variance and its resulting measurement error. The study complied with the rule that all AVE values should be > 0.50 for CV to occur (Bagozzi & Yi, 1988). Deductively, all the AVE scores were > 0.50 with the lowest value of 0.625 (A) and the highest value of 0.718 (C). Simply put, the model's validity was convergent; thus, meets the quality criteria.

Multicollinearity

Table 6 further reported the inner VIF scores to specifically help in testing for possible multicollinearity. Hair et al., (2021) asserted that multicollinearity is evaluated to check whether the path coefficients are free from bias. It also ensures that the significant levels of possible collinearity among the exogenous variables are minimised drastically. The rule for checking for multicollinearity using VIF is that all its values should be < 10 (Pallant & Manuel, 2007). According to Tabachnick, Fidell and Ullman (2007), multicollinearity exists when the VIF scores are > 10 and this could

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affect the model's quality. From Table 6, all the VIF scores ranged between 1.490 and 2.951; thus, were well below 10 and this suggest the absence of multicollinearity. Table 7 presented the outer VIF values to further check for multicollinearity using the same threshold of < 10.

Table 7: Outer VIF Scores

Indicator	VIF
AB1	2.475
AB3	2.033
AB6	3.138
AB7	3.745
AB8	2.663
CB1	2.770
CB2	4.095
CB3	2.546
CB6	1.888
CB7	2.520
CB9	2.719
ITB1	2.167
ITB2	4.291
ITB3	4.080
ITB4	2.586
ITB5	3.966
ITB6	3.178
ITB7	3.291
ITB8	3.690
ITB9	2.846
OPB1	2.172
OPB2	3.388
OPB3	2.470
OPB4	2.290
OPB6	2.941
OPB8	2.408
OPB9	2.550

Source: Field data (2022)

From Table 7, all the VIF values were < 10; thus, suggesting absence of multicollinearity. More precisely, the VIFs ranged between 1.888 and 4.291; implying that there is no multicollinearity among the indicators.

Discriminant Validity

The study also assessed the model's quality by testing for discriminant validity (DV) as proposed by Henseler et al. (2015). DV is basically used to check for possible collinearity issues in a model (Hair et al., 2021). Previous studies have offered three major approaches for checking for DV in a PLS-SEM model (Hair et al., 2021; Henseler et al., 2015; Wetzels, Odekerken-Schröder & Vab Oppen, 2009). These approaches included Fornell and Larcker (1981), cross loadings and Heterotrait-Monotrait (HTMT) ratio. Given these approaches, the HTMT approach was employed because it shows superior output due to its strength in easily detecting absence of DV as compared to the others (Henseler et al., 2015; Ringle et al., 2015). Table 8 presented the HTMT's result.

Table 8: Heterotrait-Monotrait (HTMT) Ratio

	Agiliy	Collaboration	Information Technology	Performance
Agility	0.8062			
Collaboration	0.7551	0.7576		
Information Technology	0.7462	0.7738	0.8202	
Performance	0.6451	0.6966	0.7824	0.8082

Source: Field data (2022)

The rule of thumb for assessing the HTMT ratio is that the correlation values among the constructs should be < 0.90 (Wetzels, et al., 2009). Simply put, DV is achieved if the HTMT values are < 0.90. Deductively, all the HTMT values for the constructs were < 0.90 with the highest value of 0.823 in the relationship between IT and C; suggesting that the constructs are clearly different from each other.

Explanation of Target Endogenous Variable Variance

This section reported the model's predictive accuracy by reporting the coefficient of determination (R^2) score, predictive relevance (Q^2) based on the Stone-Giesser's test, effect size (f) and the model's relative impact score (q^2). The output of these elements was presented in Table 9.

Table 9: Explanation of Target Endogenous Variable Variance

L.V	R^2	f^2	Q2	q2
Agility		0.024	0.439	0.072
Collaboration		0.025	0.439	0.072
Info. Tech		0.239	0.390	0.095
Op. Perf			0.443	

Note: "L.V. = latent variable, R^2 = R squared, f^2 = effect size, Q^2 = predictive relevance, q^2 = model's relative impact"
Source: Field survey (2022)

Coefficient of Determination (R^2)

The target endogenous variable's variance was explained using the coefficient of determination (R^2) value. Hair et al., (2017) suggested that, the R^2 represents the collective contributions of the independent constructs (i.e., C, A, IT and RM) to the dependent construct (i.e., OP). Simply put, R^2 suggests that any change in OP is linearly accounted for by totalling the four independent constructs. From Table 9, combining the four dimensions of SCR linearly account for about 55.7 percent of change in OP. Henseler et al. (2009) opined that R^2 values <0.29, 0.29 - 0.67 and >0.67 signify weak, moderate and strong contributions of the predictor constructs to the endogenous variable. Therefore, prior to the Covid-19 pandemic, SCR practices combine to

contribute about 66.7 percent of any change in the firms' operational performance.

Effect Size (f²)

Table 9 also reported the f^2 of each independent construct by adopting Cohen's (1988) impact criterion. Sawilowsky (2009) suggested that values of 0.02 signify small, 0.15 signify medium and 0.35 indicates large effect size (f^2) respectively. Deductively, prior to the Covid-19, A had the lowest f^2 value of 0.024 (small); while, IT had the highest f^2 value of 0.239 (medium). Therefore, based on Sawilowsky's (2009) criterion, A, C and RM had small f^2s since they were > 0.15 while IT had a medium size. Therefore, when firms implemented SCR prior to the Covid, IT had the highest effect on OP.

Predictive Relevance (Q²)

The next element discussed was the model's predictive relevance based on Stone-Geisser's (Q^2) test (Roldán & Sanchez-Franco, 2012). Hair et al. (2014) revealed that Q^2 is analysed by removing a portion of the data matrix, analyse the model and predict the removed part based on the estimations. Marcoulides, Chin and Saunders, (2009) suggested that Q^2 is achieved if a construct's value is > 0. Henseler et al. (2015, p.38) asserted that, "$0.02 \leq Q^2 < 0.15$ shows weak effect, $0.15 \leq Q^2 < 0.35$ indicates moderate effect and $Q^2 > 0.35$ signifies strong effect". Sarstedt, Ringle, Henseler and Hair (2014) also revealed that Q^2 is only used for prediction purposes but does not show the quality of the prediction. Deductively, all the constructs' Q^2 values were strong with A and C having the strongest Q^2 of 0.439 each while IT had the lowest Q^2 f 0.390

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Quality of Predictive Relevance

Finally, the quality of the constructs' predictive relevance was assessed by reporting the q^2 values. The rule proposes that all q^2 scores should be > 0 to show that the construct is a quality predictor (Henseler et al., 2015; Ringle et al., 2015). The q^2 value was achieved by relying on the formula: "$q^2 = (Q^2$ included - Q^2 excluded) / (1 - Q^2 included)". The results were also interpreted based Henseler et al.'s (2015) criterion. From Table 9, all the q^2 values (A=0.072, C=0.072, IT=0.095 and RM=0.025) were >0 but < 0.15. These results suggest that the model's quality was weak. However, the q^2 values were generally good since all the endogenous variables were > 0; thus, can clearly explain OP.

Initial Model Assessment (During the Covid-19 Pandemic)

This study also presented the model's assessment during the Covid-19. This was done to assess the data obtained from the respondents during the pandemic before the hypotheses were finally tested and discussed. It is to note that; the model was assessed using the same quality criteria prior to the Covid-19 pandemic. As such, assessment tools comprising item loadings, IR, CV, CR, multicollinearity (i.e., inner and outer VIFs) and DV (i.e., HTMT) (Hair et al., 2021; Henseler et al., 2015; Ringle et al., 2015). The model's qualities were evaluated to make meaning out of the structural model results (Hair et al., 2021).

Item Loadings (Structural and Measurement)

This section first presented the variables' item loadings in Figure 4. This model contained all the constructs and their indicators' loadings.
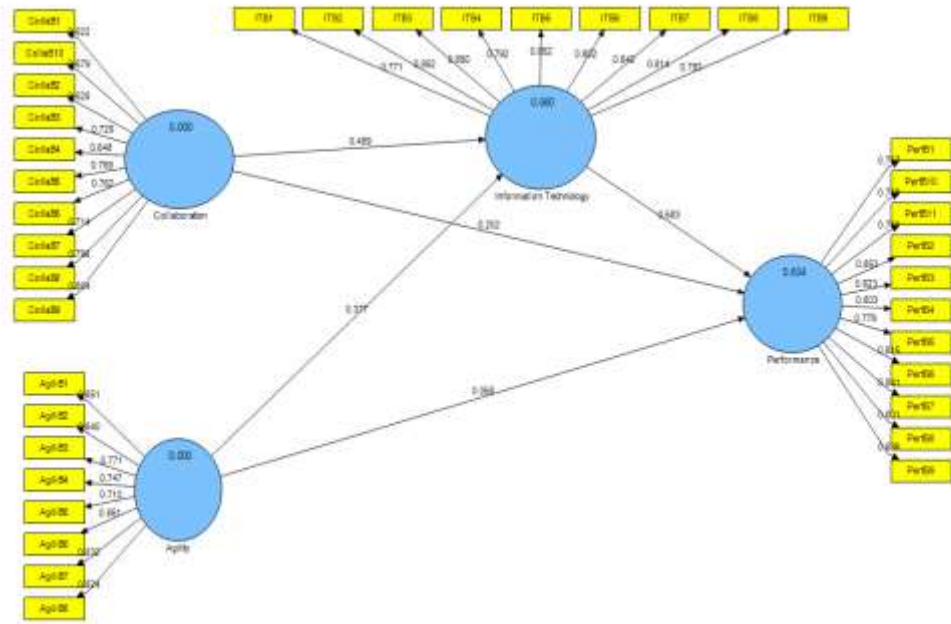
Figure 4: Inner and Outer Model Output

Source: Field Survey (2022)

From Figure 4, Collaboration (C), as was the case in the Figure 2 had

collaboration (C) with 10 items (i.e., C1 to C10); agility (A) had 8 items (A1

to A8); information technology (IT) contained 9 items (IT1 to IT9); risk

management (RM) had 6 items (RM1 to RM6) and operational performance

(OP) had 11 items (OP1 to OP11) respectively. These five constructs were

used to create four paths where C, A, IT and RM moved to OP.

Simply put, the path arrows suggested the following corelations: C and

OP; A and OP; IT and OP; and RM and OP. The model was first assessed by

evaluating the item loadings of each construct to check whether they are true

measures (Hair et al., 2021; Henseler et al., 2015). The items in Figure 4 were

assessed with the rule that the loadings should not be < 0.70. As such,

indicators with loadings > 0.70 signify quality and relevance to their specific

constructs (Ringle et al., 2015). Therefore, item loadings < 0.70 should be

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removed from the model (Hair et al., 2021). This is because, indicators with loadings < 0.70 do not provide true and quality measures of their assigned constructs. As such, failure to remove such items could affect the quality of the model's outcome. In view of this, all item loadings < 0.70 in Figure 4 were duly removed and Figure 5 was, therefore, created.
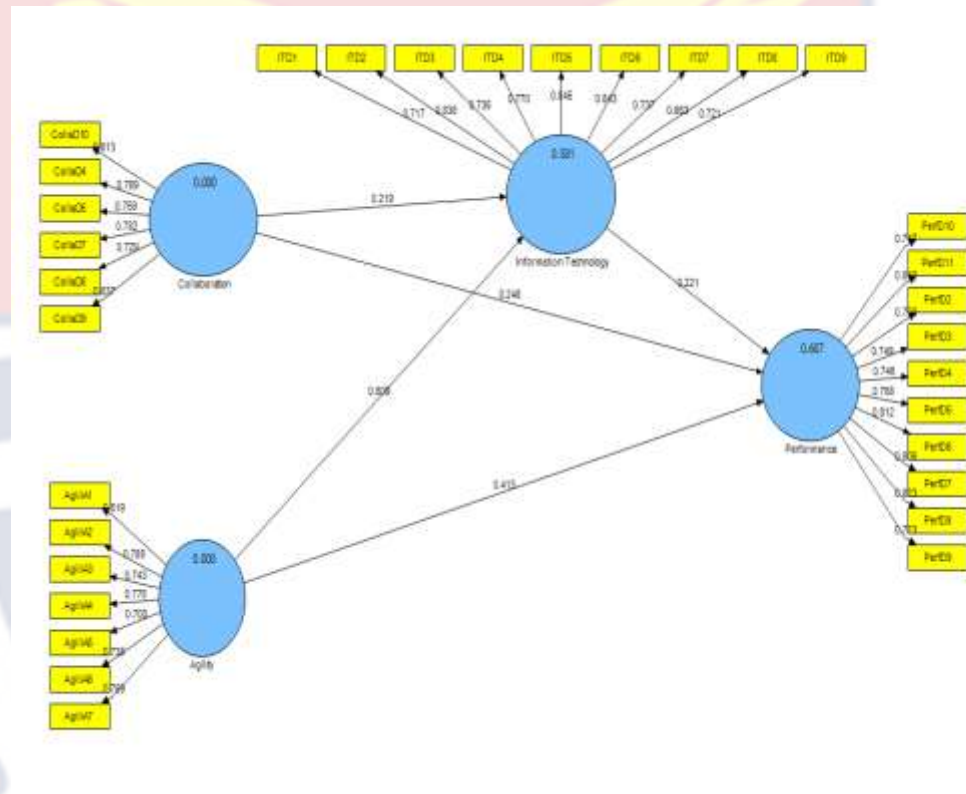
Figure 5: Final Model Structure
Source: Field Survey (2022)

Deductively, items with loadings < 0.70 were all removed from the model to ensure that all the constructs' indicators are quality and true measures. In terms of C, items such as C1, C2, C3 and C6 were removed; A had A8 removed; IT had IT9 removed and finally, OP had OP1 to OP4 removed. Therefore, the study's hypotheses were tested based on the final model structure.

Assessment of Measurement Model

Table 10 presented the model's quality output comprising indicator reliability (IR) based on rho_A scores; CR, CV using the Average Variance Extracted (AVE) and multicollinearity based on the VIF values.

Table 10: Assessment of Indicator and Construct Reliability and Validity

Items	rho_A	CR	CV	Inner VIF values
C	0.884	0.905	0.614	2.419
A	0.877	0.904	0.612	1.736
IT	0.921	0.933	0.638	2.520
OP	0.915	0.929	0.652	

"Indicator Reliability (IR using rho_A); Composite Reliability (CR); Convergent validity (CV) using AVE and Multicollinearity using VIF values"
Source: Field Survey (2022)

Indicator Reliability (IR)

Table 10 presented the model's IR using the rho_A scores in order to check for uni-dimensionality of scale items. The rule for assessing IR suggests that rho_A values should be > 0.70 (Hair et al., 2017, 2021). From the model's rho-A scores, all the constructs had values > 0.7; thus, suggesting IR. More precisely, A had the lowest rho_A value of 0.877 while IT had the highest rho_A score of 0.921.

Composite Reliability

The CR scores of each construct were also reported in Table 10. According to Hair et al. (2017), attaining CR means that all the constructs' indicators have strong correlations among them and this can be achieved when the constructs' CR scores are > 0.70 (Ringle et al., 2015; Henseler et al., 2015). From Table 10, all the constructs had CR scores > 0.70; with A having the lowest value of 0.904; whereas, IT and RM had the highest values of

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0.933 apiece. Therefore, all the indicators had strong correlations among them; thus, are good measures when combined.

Convergent Validity

The model's CV was also assessed using the AVE scores (Hair et al., 2017; Henseler et al., 2015). The study complied with the rule that all AVE values should be > 0.50 for CV to occur (Bagozzi & Yi, 1988). From Table 10 all the AVE scores were > 0.50; with A recording the lowest value of 0.612. Simply put, the model's validity was convergent; thus, meets the quality criteria.

Multicollinearity

Table 10 and 9 further reported the VIF scores to specifically help in testing for possible multicollinearity. The rule suggests that all VIF values should be < 10 (Tabachnick et al., 2007) to indicate absence of multicollinearity. From Table 10, for instance, all the inner VIF scores ranged between 1.617 and 2.520; thus, were well below the threshold of 10; implying that the model showed no multicollinearity among the constructs. Table 11 presented the outer VIF values to further check for multicollinearity.

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Table 11: Outer VIF Scores

Indicator	VIF
A1	2.493
A2	2.159
A3	1.829
A4	2.106
A6	1.879
A7	2.438
C10	2.166
C4	1.780
C5	1.803
C7	1.957
C8	1.669
C9	2.342
IT1	2.145
IT2	3.087
IT3	2.495
IT4	2.412
IT5	3.009
IT6	3.033
IT7	2.126
IT8	2.902
OP10	2.297
OP11	3.038
OP5	2.219
OP6	2.668
OP7	2.595
OP8	2.586
OP9	1.937

Source: Field data (2022)

Deductively, all the VIF values were > 10 to indicate absence of multicollinearity. IT2, for instance, had the highest outer VIF value of 3.087

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while C8 had the lowest VIF value of 1.669. The implication is that the indicators had no multicollinearity among them.

Discriminant Validity (DV)

DV was used to check for collinearity issues in the model using the HTMT approach (Hair et al., 2021). Table 12 presented the HTMT's result.

Table 12: Heterotrait-Monotrait (HTMT) Ratio

	Agility	Collaboration	Info. Tech	OP	Risk Magt
Agility					
Collaboration	0.667				
Info. Tech	0.808	0.657			
Op. Perf	0.781	0.652	0.732		

Source: Field data (2021)

From Table 12, the relationships among the constructs were discriminantly valid because their values were less than 0.90 as proposed by (Wetzels, et al., 2009). More precisely, the highest value of 0.808 was obtained in the relationship between IT and A; while the lowest value of 0.552 was obtained in the correlation between RM and C.

Explanation of Target Endogenous Variable Variance

Table 13 reported the model's predictive accuracy using R^2 scores, Q^2 based on the Stone-Giesser's test, f^2 and the model's q^2.

Table 13: Explanation of Target Endogenous Variable Variance

L.V	R^2	f^2	Q2	q2
Agility		0.137	0.318	0.051
Collaboration		0.033	0.337	0.022
Info. Tech		0.040	0.344	0.011
Op. Perf			0.343	0.012

Note: "L.V. = latent variable, R^2 = R squared, f^2 = effect size, Q^2 = predictive relevance, q^2 = model's relative impact"
Source: Field survey (2022).

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Coefficient of Determination (R^2)

From Table 13, R^2 value was reported to that about 61.9 percent of any change in OP is linearly accounted for by combining the four SCR practices. This result implies that the SCR practices comprising A, C, IT and RM combine to account for about 61.9 percent of change in OP of the firms' studied. The result also implies that SCR practices combine to moderately predict any change in OP. Therefore, other independent constructs including inventory management, green procurement and lean practices could combine to account for the remaining 39.2 percent.

Effect Size (f^2)

Table 13 also reported the construct's f^2 based on Cohen's (1988) impact criterion. C had the lowest f^2 value of 0.040 (small); while, A had the highest f^2 value of 0.137 (small). With respect to the other predictor variables, IT had f^2 value of 0.040 (small) and RM had a value of 0.091 (small). Therefore, based on Sawilowsky's (2009) criterion, all the constructs had small f^2 since they were all > 0.15. However, SCR in terms of A had the highest effect among them; suggesting that having an agile SCs during the covid-19 pandemic is key to achieving higher operational performance. Collaboration, on the other hand, had the lowest effect; suggesting that paying too much attention to developing collaborations with SC actors would only have minimal effect on OP.

Predictive Relevance (Q^2)

This section also presented the model's predictive relevance with the rule that "$0.02 \leq Q^2 < 0.15$ shows weak effect, $0.15 \leq Q^2 < 0.35$ indicates moderate effect and $Q^2 > 0.35$ signifies strong effect". Deductively, the

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constructs' Q^2 were all > 0 and also moderate predictors with IT (0.344), C (0.337) and A (0.318) respectively.

Quality of Predictive Relevance

In terms of q^2, the rule proposes that its scores should be > 0 (Ringle et al., 2015). From Table 14, all the q^2 values (A=0.051; C=0.022; IT=0.011 and RM=0.012) were >0 but < 0.15. These results suggest that the model's quality was weak; however, the results show that the q^2 values were generally good since all the endogenous variables were > 0.

Significance of Path Coefficients Before and during the Covid-19 Pandemic

The study subsequently provided the outcomes of the hypotheses after the PLS-SEM analysis. The hypotheses were more specifically concerned with analyzing how supply chain resilience tactics affected the operational effectiveness of food processing SMEs in Ghana's Greater Accra region before and during the Covid19 epidemic. The results of testing the hypotheses were provided in order to demonstrate if these linkages had any meaningful consequences. According to Hair et al. (2017) and Ringle et al. (2018), the results also included the strengths and directions of each link using 5000 bootstraps (2015). For each hypothesis, Table 14 showed the structure routes, path coefficients, t-statistics, p-values, and decision rule (before and during the covid-19 pandemic).

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Table 14: Structural Equation Model Output and Decision Rule

S.P	Before the Pandemic			During the Pandemic			
	(β)	t-stats	P	(β)	t-stats	p	Decision Rule
C -> OP	0.157	2.206	0.027	0.147	2.540	0.011	H1$_{a,b}$ (supported)
A -> OP	0.141	2.062	0.039	0.356	4.679	0.000	H2$_{a. b}$ (supported)
IT -> OP	0.196	2.160	0.031	0.477	6.465	0.000	H3$_{a,b}$ (supported)

Note: * = t > 1.96; p < 0.05
Source: Field Survey (2022)

It is to note that, the hypotheses were tested by reporting the t-stats values as recommended by Henseler et al. (2015) and Hair et al. (2014). The rule of thumb is that, "a significant relationship between the variables" exists if the model's t-stat is > 1.96 (p<0.05). This rule means that the directional hypothesis (as shown in the study) is supported if its t-stat is > 1.96; indicating that the correlation between the variables is significant. The hypotheses results were reported and discussed in sections. The strength of the association was analysed based on Sawilowsky's (2009) criteria which suggest that β values < 0.15 suggest weak, 0.15-0.35 suggest medium, 0.36-0.70 suggests moderate and finally, those > 0.70 suggests strong.

Effect of Collaboration on Operational Performance Before and during the Covid-19 Pandemic.

The study's objective two analysed the effect of collaboration (C) as a SCR strategy on operational performance (OP) of Food processing SMEs. The objective had two hypotheses where H1a proposed that C had a significant positive effect on operational performance before the covid-19 pandemic while H1b hypothesised that collaboration had a significant effect on operational performance during the pandemic. With respect to H1a, the result

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in Table 14 revealed the following t=2.206, p=0.027 and β=0.157. Given a t-stat of 2.206>1.96 threshold, the hypothesis was supported. This result means that, prior to the Covid-19 pandemic, collaboration had a significant positive effect on OP; thus, any unit improvement in collaboration led to a significant improvement in OP by 15.7 percent. Simply put, food processing firms that applied collaboration witnessed about 15.7 percent improvement in their OP before the Covid-19 pandemic.

In terms of H1b, t-stat of 2.540 with p value of 0.005 were obtained; thus, the hypothesis was supported. Table 14 also revealed a β value of 0.147, asserting that a positive significant relationship exists between collaboration and operational performance during the Covid-19 pandemic. The result specifically means that during the covid-19, collaboration among supply chain actors continued to improve the OP of the food processing firms. However, its contribution reduced from 15.7 percent to 14.7 percent; implying that during the pandemic, collaboration among the actors reduced the food processing firms' operational performance by 1 percent. This reduction in OP could be as result of the severe rippling effects of the pandemic to global food supply chains during its peak period. During the pandemic, it was evident that collaborations among supply chain actors were distorted; thereby, affecting overall productivity.

Supply chain resilience is associated with minimising any disruption that could affect the ability of supply chains to operate efficiently. As such, the study found that Food processing SMEs which ensured resilience by developing strong and long-lasting collaborations with supply chain actors notably suppliers and customers were able to achieve operational performance

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by over 14 percent before and during the Covid-19 pandemic. Collaboration specifically ensured that food processing SMEs exchanged valuable information, shared decisions and other resources in order to achieve value addition. It, therefore, played a crucial role in ensuring that food supply chains in Ghana remain resilient during the disruptions caused by the pandemic and subsequently reduced the firms' OP by one percent.

The study's outcome is in line with a previous study by Shahbaz et al. (2018) who found collaboration comprising shared decision making, information exchange and electronic data exchange to significantly improve organisational efficiency. Similarly, Scholten and Scheilder (2015) found that any unit increment in collaboration practices such as collective cooperation, resource sharing, goal congruence and opportunity coordination would significantly promote organisational efficiency. The authors concluded that collaboration, as an antecedent of supply chain stability, improves organisational performance. Other studies by Cao and Zhang, (2011) and Gu et al., (2021) concluded that collaboration plays a crucial role in improving firm performance. However, this study expands current literature by conducting a comparative study which revealed that collaboration improved food processing firms' operational performance before and during the COVID-19 pandemic.

Effect of Agility on Operational Performance before and during the COVID-19 Pandemic

The effect of agility (A) on the operational performance (OP) of the Food processing SMEs within the Greater Accra region was examined. This section tested two hypotheses (H2a and H2b) where H2a proposed that A

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significantly and positively affects OP before the Covid-19 pandemic. The model revealed a t-stat of 2.206 (p=0.027) with β of 0.151 to indicate that A, prior to the covid-19, had significant positive effect on OP by 15.1 percent. The result implies that agility played a weak significant role in improving the food processing firms' operational performance before the pandemic occurred in 2019.

In terms of H2b, the study hypothesised that agility significantly and positively affects operational performance which was accepted. This is because, the model had a t-stat of 4.679 (i.e., > 1.96) with β of 0.356. The result implies that A contributes about 35.6 percent (medium) of any change in OP; thus, for any unit change in A, OP significantly changes by 35.6 percent. In comparison with the H2a, it could be seen that, during the Covid-19 pandemic, the operational performance of food processing firms that emphasise on agility has increased by 20.5 percent (i.e., from 15.1% to 35.6%). This result implies that Ghanaian food processing firms that emphasised agility during the pandemic have witnessed over 20 percent of improvement in their operational performance.

Practically, the study's finding revealed that, food processing firms in Ghana that were able to manufacture and distribute variety of high-quality products with differing volumes within short lead times to their customers during the Covid-19 pandemic were able to achieve higher OP. Also, the increment in the food processing firms' OP could be attributed to the innovative strategies they developed to quickly respond to the volatile environment that arose during the peak of the pandemic. Therefore, agility has become more crucial to improving the operational performance (i.e., product

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quality, operational efficiency, dependability and flexibility) of food processing firms during the Covid-19 pandemic.

This study's finding is in line with that of Queiroz et al. (2020) who revealed that epidemic outbreaks in recent times have affected supply chains; thereby, pushing them to embrace agility. They concluded that agile supply chains play crucial roles in improving operational performance during pandemics. Similarly, Jermsittiparsert et al. (2019) concluded that building agile networks can help firms to respond swiftly to changing situations; thereby, promoting supply chain stability and customer responsiveness. Wieland and Wallenburg (2013) and AlKahtani et al. (2019) similarly opined that agile supply chains emphasise both proactiveness and reactiveness to changing situations in order to promote supply chain responsiveness and invariably operational performance.

Effect of Information Technology on Operational Performance before and during the Covid-19 Pandemic

The third research objective examined how information technology (IT) affects the OP of food processing firms in Ghana. To achieve this objective, two hypotheses were proposed; H3a suggested that IT significantly and positively improves food processing firms' OP prior to the Covid-19 pandemic. After the PLS analysis, the following results were obtained: t= 0. 216, p=0.031 and β=0.196. With t=0.216>1.96, it could be seen that IT had a significant positive effect on OP of the food processing firms before the Covid-19 pandemic. More precisely, the study revealed that IT contributed about 19.6 percent of change in OP before the pandemic occurred. The result implies that IT had a medium significant effect on OP of Ghana's food processing firms.

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The study also hypothesised that IT significantly improves OP of food processing firms during the Covid-19 pandemic. The t-stat from the PLS-SEM was 6.455>1.96 (p=0.000) with β of 0.477; thus, supporting the hypothesis. This result means that, during the global pandemic, IT improved food processing firms' OP by 47.7 percent. This implies that IT plays a significant moderate role in improving the food processing firms' OP during the advent of the Covid-19 pandemic in 2019. In comparison with the earlier finding, the study revealed that IT has played better roles in improving the food processing firms' OP during the pandemic. More precisely, IT has improved OP by 28.1 percent (i.e., from 19.6% to 47.7%) during the Covid-19 pandemic.

The increment in the food processing firms' OP during the pandemic, as against before the pandemic, could emanate from their increased reliance on information technology during the pandemic. During this period, for instance, firms begun to invest heavily in IT due to the strict rules regarding direct human contacts. Also, businesses including food processing SMEs could only survive and remain competitive by embracing IT; thereby, accounting for the increment in OP during the pandemic. Therefore, the food processing firm's continuous reliance and investment in information technology have improved their operational performance; thus, any unit increase in IT would result in a significant unit increase in operational performance by 47.7 percent.

This result also implies that Food processing SMEs in Ghana would continue to enjoy over 47 percent in their operational performance if they continue to invest in information technology. In our modern competitive and turbulent business environment, previous studies (von Falkenhausen et al., 2019; Mandal, 2017; Beske-Janssen et al., 2015) have asserted that embracing

IT in all business activities is the key to achieving higher performance targets. They added that IT ensures that firms can quickly respond to changing circumstances without compromising the production and delivery of quality products. Beske-Janssen et al. (2015), for instance, concluded that firms can address operatinal interruptions by investing in IT. von Falkenhausen et al. (2019) also concluded that firms can overcome suply chain disruptions and achieve production efficinecy by embracing IT.

SCR measures, it may be concluded, are essential for enhancing the operational performance of food processing SMEs in the Greater Accra area both before and during the COVID-19 pandemic. More precisely, this study focused on strategies such as agility (A), collaboration (C), information technology (IT) and risk management (RM). Among these strategies, IT had the highest signifcant effect on OP before and during the pandemic. Collaboration, however, had a higher effect on OP before the pandemic than during the pandemic. Simply put, although C improved OP during the pandemic, its total effect reduced by 1 percent as compared to before the pandemic. Risk management had the third highest effect on OP before and during the Covid-19 pandemic; however, its effect on OP during the pandemic improved by 8.1 percent. Finally, agility had the lowest direct effect on OP before the pandemic; but, this effect increased tremendously by 21 percent during the pandemic; subsequently, having the second highest effect.

Chapter Summary

The chapter entailed the results during hypotheses testing using the PLS-SEM analytical tool. The model was first assessed for quality purposes and its outcomes were extensively discussed. After meeting all the quality

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criteria, the hypotheses were then tested and the findings were extensively discussed with support from relevant literature. According to the study, the Greater Accra region's food processing SMEs considerably improved their operational performance before and throughout the COVID-19 pandemic using all four supply chain resilience measures. The study's summary and recommendations for further research, practice, and policy were presented in chapter five.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

The chapter summarized the study's major conclusions, recommendations for future policy, and noteworthy findings. It offered pertinent recommendations for more investigation at the end.

Summary

The study's objective was to ascertain the impact of supply chain resilience strategies on the operation of SMEs engaged in food processing in Ghana's Greater Accra Region. To do this, the study was driven by the following specific objectives:

1. Compare the supply chain resilience strategies of food processing industries before and during the Covid-19 pandemic.

2. Assess the effect of collaboration as a supply chain resilience strategy on operational performance.

3. Examine the effect of agility as a supply chain resilience strategy on operational performance.

4. Analyse the effect of Information technology as a supply chain resilience strategy on operational performance.

Regarding the objective of the study, the positivist paradigm, quantitative strategy, and explanatory research design were used. 217 key participants, including owner-managers, administrators, and operations/production managers of the food processing SMEs, were surveyed to acquire primary data for the study. A 150-person valid data set with a response rate of 69.12 percent was obtained specifically for the study. The

study employed the Smart-PLS 3 and IBM SPSS Statistics version 26 software tools to process the data gathered through structured questionnaires. In Chapter 4, the results of a PLS-SEM approach to further analyse the processed data were presented. The focus of the following sections was an overview of the study's main conclusions.

With regard to goal one, the study evaluated the SCR tactics used by SMEs in the food processing industry prior to and during the COVID-19 pandemic. This objective was achieved by ranking the strategies using Kendall's W. The study revealed ten SCR strategies to include agility, risk management, collaboration, re-engineering, integration, adaptive capability, information technology, communication, contingency and visibility. Among these strategies, the respondents agreed that collaboration was the most important strategy for achieving SCR prior to the pandemic. However, during the pandemic, information technology (IT) has become the most preferred. Therefore, the study found that IT is currently the most important and used strategy to ensure SC resilience of the Ghanaian companies that process food.

The study also examined how the operational performance of SMEs engaged in food processing in the Greater Accra region was impacted by supply chain cooperation, a technique for creating resilient supply chains. Using the PLS-SEM analytical method, two hypotheses were investigated, and the results showed that cooperation among SC actors has a substantial and beneficial effect in enhancing both before and during the Covid-19 pandemic, operational effectiveness. The results suggest that, despite the negative effects of the Covid-19 pandemic, establishing strong, long-lasting bonds between SC players has a significant positive influence on the operational performance of

Ghanaian food producers in terms of product quality, operational speed, flexibility, and dependability.

Regarding goal three, the research investigated two hypotheses and looked at how agility affected the operational performance of food processing SMEs. It was discovered that agility significantly improves the operational effectiveness of the businesses both before and during the pandemic. This result suggests that food processing SMEs may increase operational performance in areas such as quality products, operational flexibility, efficiency, reliability, and speed by ensuring agility within their SCs. Simply said, SMEs in the food processing industry who are proactive and promptly positively respond to unanticipated situations like the Covid-19 epidemic achieve superior operational performance.

Research objective four also examined whether information technology affected food processing firms' operational performance before and during the pandemic. The research showed that IT had a big impact positive influence on the firms' OP before the pandemic. Also, during the pandemic, IT continues to play key roles in improving OP of the firms. As such, the study's result implies that the firms' OP improves if IT is employed. The study also found that, before and during the pandemic, IT had the most significant effect on the food processing firms' OP within the Greater Accra region. Simply put, the study found IT represent the most important SCR strategy that ensures that food processing SMEs are able to improve product quality, business process innovation, waste minimisation and reduced production and delivery costs.

The impact of risk management on the businesses' operational performance both before and during the Covid-19 epidemic was examined in

study goal five. The study found that risk management had a considerable beneficial impact on operational performance during these two times. The implication is that food processing SMEs that ensure proper risk management before the Covid-19 were able to improve upon their OP levels. Similarly, firms that continued to implement risk management during the pandemic have been able to achieve higher OP in areas of reduced production and delivery wastes, quick response to fluctuating customers' demands without compromising cost effectiveness.

Conclusions

The study investigated the impact of SCR techniques on the OP of SMEs engaged in food processing in Ghana. This objective was fulfilled by the study by formulating five major goals and eight mainly successful hypotheses. The following deductions were made from the main findings:

Information technology is the top-ranked approach for assuring SCR among food processing SMEs during the COVID-19 pandemic with regard to goal one. Existing research that claimed that IT has emerged as the most important instrument or strategy in contemporary company contexts have mainly corroborated this conclusion. These studies have in particular found that current supply chains cannot function well during a pandemic without adopting technology and making significant investments in it. As a result, the study came to the conclusion that information technology is the best method for increasing the SC resilience of food manufacturing companies.

Regarding research aim number two, it was discovered that collaboration considerably and favourably boosted the businesses' operational performance both before and after the epidemic. This result has also been in line with

related studies that established the relevance of collaborations in OPs. These studies revealed that collaboration is a key element of SCR which helps the food processing SMEs to provide quality products at competitive prices devoid of wastes and high production costs. The RBT also supported this finding by suggesting that Food processing SMEs need to collaborate with key actors within their networks in order to easily obtain valuable resources from them. In view of this, it was concluded that collaboration is a key predictor of the performance of the Greater Accra Region's food processing SMEs in terms of operations.

The study also discovered that previous to and during the Covid-19, agility helped OP of SMEs engaged in food processing. Related studies have supported this finding by asserting that firms that are able to quickly respond to changing events such as fluctuating customer demands, supply delays and long lead times are highly likely to perform better and vice versa. Similarly, the contingency theory suggests that SCs can achieve resilience by developing contingency plans that would help them in times of difficulties arising from unforeseen situations. It was concluded that agility is a crucial SCR strategy that positively predicts any change in food processing SMEs OP within the Greater Accra Region.

The operations of small and medium-sized food processing businesses in Ghana's Greater Accra region also benefited significantly from IT. This strategy had the highest significant effect on the firms' OP before and during the pandemic. This finding was buttressed by previous studies that revealed that IT is needed in modern day businesses to ensure SCR and consequently achieve better OP. They added that food processing SMEs would struggle to

survive if they fail to invest adequately in IT, especially during the global pandemic. According to RBT, IT is an important resource that firms need to obtain from their environment in order to survive unhealthy competitions. In view of this, the study concluded that IT is the most crucial predictor of the OP of Ghana's food processing SMEs.

Regarding goal number five, the study discovered that risk management greatly increased the enterprises' operating profits (OP) both before and after the worldwide pandemic. Related research that showed that risk is unavoidable in every business setting and that its presence might have serious negative knock-on impacts on company performance, survival, and competitiveness have validated this conclusion. They also stated that adopting RM, which entails planning, managing, monitoring, and assessing the possibility and severity of the occurrence of an unexpected event, is the only way for businesses to eliminate or minimize risk. In light of this, the study came to the conclusion that RM is a significant SCR factor, playing a significant influence in raising OP for Ghanaian food processing companies.

In conclusion, the research showed that key representatives of the Food processing SMEs investigated are aware of ten key supply chain resilient strategies. However, among these strategies, IT was considered the most important due to its high mean ranking. Also, all the SCR strategies comprising collaboration, IT, agility and RM had significant positive effects on OP. Simply put, SCR is an important predictor of food processing SMEs OP in areas of price competitiveness, product quality, labour efficiency, on-time delivery, business process innovation and operational flexibility and

speed. The recommendations for further research based on the findings were offered in the next section.

Recommendations

Based on the findings, the study made the following recommendations:

In the food manufacturing SMEs under review, the study discovered that IT represented the most significant SCR approach, particularly during the Covid-19 epidemic. Therefore, the research advised management of the food processing SMEs to keep emphasizing IT when maintaining supply chain resilience. This is practically possible by emphasizing IT as the key approach for building a resilient SC in the post-Covid-19 age. As a result, management of the food processing companies should make significant investments in the purchase, use, and maintenance of cutting-edge technology in order to achieve resilience. In order to help their SC actors purchase and utilize IT in their different enterprises, focal corporations must also offer support packages to them.

This study also discovered cooperation amongst important SC partners to enhance the OP of SMEs engaged in food processing in Ghana. So far as SCR is concerned, it was advised that management of the food processing SMEs consistently forge strong and enduring partnerships with key partners within their supply chain network. This can be attained by developing appropriate methods of pre-qualifying potential suppliers and also evaluating the performance of existing suppliers. By doing these, food processing SMEs can easily collaborate with actors who meet expected performance standards; thereby, achieving improved operational performance.

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Regarding goal 3, the study came to the conclusion that agility is crucial to enhancing OP in Ghanaian food processing companies. As such, it was recommended that policy makers such as Ministry of Trade and Industry should develop comprehensive policies that serve as a framework to assist food processing firms to easily and quickly respond to changing circumstances, as was the case of the pandemic. Also, management of these firms should continue to develop innovative ways of responding quickly to changing situations within the shortest time frame in order to continuously enjoy improved operational performance. To do this, management of the SMEs engaged in food processing needs to become more proactive and responsive while investing heavily in technologies that would help them to easily detect and respond to changing circumstances arising from fluctuating demand and supply, among others.

The study also found IT to predict changes in operational performance of the SMEs that process food before and during the pandemic. It was recommended that policy makers including Ghana Enterprises Agency, Ministry of Trade and Industry, and Ministry of Food and Agriculture (GEA) should focus on developing policies that mandate SMEs that process food in Ghana to invest in technologies. Also, these bodies should provide financial and other support services to SMEs that are ready to invest in IT. Also, management of the firms should continue to invest in IT in carrying out their business operations, especially during this period of turbulence.

Moreover, the study concluded that RM plays a significant role in improving OP of the food processing SMEs. According to the report, policymakers in Ghana's food sector should create RM frameworks and rules

to help management of the food processing enterprises manage risks. Also, bodies like GEA should establish clear policies and guidelines that would induce all food processing SMEs to develop RM plans even during their registration processes. As such, firms that fail to develop RM plans should be denied certificate to commence business. Finally, management of the firms should realise that risk is inevitable; thereby, ensuring RM along their SCs is key to achieving resilience and consequently improving operational performance.

Suggestions for Further Research

This study determined if SCR techniques had an impact on the operational effectiveness of SMEs engaged in food processing in Ghana's Greater Accra area. Despite the fact that the study's goals were generally met, was still area biased. It was suggested that future researchers should expand the study's scope by either concentrating on or including other Food processing SMEs across the sixteen regions in Ghana and/or other developing economies. Also, the mixed methods approach could be considered to expand the study's findings where the qualitative aspect could support or disapprove the quantitative outcomes. Finally, future researchers could consider the influence of the strategies on other firm performance dimensions such as financial, market or sustainable performance. Achieving this could help improve current literature on supply chain resilience of developing economies, especially during the pandemic.

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APENDIX

UNIVERSITY OF CAPE COAST

SCHOOL OF BUSINESS

DEPARTMENT OF MARKETING AND SUPPLY CHAIN

MANAGEMENT

RESEARCH QUESTIONNAIRE

Dear Sir/Madam

I am a postgraduate student offering Procurement and Supply Chain Management in the University of Cape Coast. I am conducting a study on the effect of Supply Chain Resilience Strategies and Operational Performance: The Case of Small and Medium Enterprises in the Greater Accra Region. The unit in your organisation and employees responsible for supply chain or operations management activities are invited to be respondent to this study. With your experience and knowledge in resilience strategies on the firm's operational performance, I humbly ask for your valuable effort and time to complete this questionnaire as accurately as possible. It is therefore assured that, any information provided would be confidential and would be used for academic purposes only. Thank you.

Instructions: Kindly tick (√) where appropriate

SECTION A: DEMOGRAPHICS

1. What position do you hold in this enterprise?

    a. Owner/Manager [ ]

    b. Operations Manager [ ]

    c. Administrator[ ]

2. What is your level of experience?

    a. 2-5 years [ ]

    b. 6-9 years [ ]

    c. 10-12 years [ ]

    d. 11 years above[ ]

3. What is the number of employees in the enterprise?

    a. 0-9[ ]

    b. 10-49 [ ]

    c. 50-99 [ ]

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d. 100-149 [ ]

4. What is the core competencies of the enterprise?

    a. Supplier[ ]

    b. Manufacturing[ ]

    c. Distributor[ ]

5. Type of ownership

    a. Publicly owned [ ]

    b. Privately owned [ ]

    c. Public-private partnerships [ ]

6. How many years has the business been in operation?

    a. Below 1-5 years [ ]

    b. 6-10 years[ ]

    c. 10 years above[ ]

SECTION B:

Kindly rank the following supply chain resilience strategies of the firm in order of their importance before the COVID-19 pandemic on a scale of 1=Very Low, 2=Low, 3=Medium and 4=High

	Ranking the supply chain resilience strategies of SMEs.	**Before COVID-19**	**During COVID-19**
R1	Collaboration		
R2	Agility		
R3	Information Technology		
R4	Risk Management Culture		
R5	Re-engineering		
R6	Integration		
R7	Adaptive Capability		
R8	Communication		
R9	Contingency		
R10	Visibilty		

SECTION C:

The following questions seek to measure Collaboration as a supply chain resilience strategies before and during COVID-19 using a scale of 1 to 5. SCALE: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree and 5= Strongly Agree

		Before COVID-19						During COVID-19				
	Collaboration as a supply chain resilience strategy	**1**	**2**	**3**	**4**	**5**		**1**	**2**	**3**	**4**	**5**
C1	Does firm maintains an integrated database and access method to facilitate information sharing?											
C2	Does the firm effectively shares operational information between departments?											
C3	The firm has adequate ability to share both standardized and customized information internally.											
C4	The firm's compensation, incentive, and reward systems encourage collaboration.											
C5	The firm effectively shares operational information externally with selected suppliers and customers.											
C6	The firm has developed performance measures that extend across supply chain relationships.											
C7	The firm experiences improved performance by integrating operations with supply chain partners.											
C8	The firm has supply chain arrangements with suppliers and customers that operate under shared rewards and risks.											
C9	The firm has increased operational flexibility through supply chain collaboration.											
C10	The firm benchmarks best practices/processes and shares results with suppliers.											

SECTION D:

The following questions seek to measure Agility as a supply chain resilience strategies before and during COVID-19 using a scale of 1 to 5. SCALE: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Strongly Agree and 5= Strongly Agree

		Before COVID-19						During COVID-19				
	Agility as a supply chain resilience strategy	**1**	**2**	**3**	**4**	**5**		**1**	**2**	**3**	**4**	**5**
A1	The firm is reasonably sensitive to the opportunities and threats in the business environment											
A2	The firm can rapidly respond to the changing market.											
A3	The firm reserves extra service capacity in response to the rapidly changing market.											
A4	One of the firm's essential criteria for finding collaborative partners is its agility and ability to react.											
A5	The firm's employees are capable of executing multiple kinds of tasks and jobs.											
A6	The firm frequently adjusts the course of its production in response to the rapid changes in the market before Covid-19.											
A7	The firm frequently adjusts the course of its production in response to the rapid changes in the market during Covid-19											
A8	The firm believes that "Agility" and "job performance" are equally important											

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SECTION E:

The following questions seek to measure Information Technology as a supply

chain resilience strategies before and during COVID-19 using a scale of 1 to 5.

SCALE: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Strongly Agree

and 5= Strongly Agree

		Before COVID-19						During COVID-19				
	Information Technology as a supply chain resilience strategy	1	2	3	4	5		1	2	3	4	5
IT1	The firm uses specific IT-based support for order processing, invoicing, and settling accounts with our primary customer.											
IT2	The firm-specific IT-based support for managing warehouse stock and inventories with our primary customer.											
IT3	The firm uses specific IT-based support for integrating the company and significant suppliers											
IT4	The firm uses specific IT-based support to coordinate with major suppliers											
IT5	The firm uses specific IT-based support for leveraging our supplier's expertise to create new business opportunities											
IT6	And our leading supplier can provide a quick response to the supply chain disruption											
IT7	The firm and our leading supplier can cope with changes brought by the supply chain disruption											
IT8	Our leading supplier and we can adapt to the supply chain disruption easily											
IT9	The firm and suppliers can recover to normal operations speedily after the supply chain disruption											

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SECTION F:

The following questions seek to measure Risk Management Culture a supply chain resilience strategy before and during COVID-19 using a scale of 1 to 5.
SCALE: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Strongly Agree and 5= Strongly Agree

	Risk management culture as a supply chain resilience strategy	Before COVID-19						During COVID-19				
		1	2	3	4	5		1	2	3	4	5
RMC 1	The firm uses different means to encourage its employees to share their knowledge about risk management.											
RMC 2	The firm included risk management as an essential topic in new personnel training.											
RMC 3	The firm provides training to its employees regarding the necessary measures to take in a risk incident.											
RMC 4	Ensuring the proper functioning of the supply chain is every employee's top priority.											
RMC 5	Risk awareness is every day in our firm.											
RMC 6	The firm believes that "risk management" and "job performance" are equally Important											

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SECTION G:

The following questions seek to measure the operational performance of the supply chain resilience strategies on the firm before and during COVID-19 using a scale of 1 to 5. SCALE: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Strongly Agree and 5= Strongly Agree

		Before COVID-19						During COVID-19				
	Operational Performance	**1**	**2**	**3**	**4**	**5**		**1**	**2**	**3**	**4**	**5**
OP1	Quick response to changes in demands											
OP2	Business process innovation											
OP3	Product delivery reliability											
OP4	Outstanding on-time delivery to customers											
OP5	Reduction in waste in the production process											
OP6	Operating capacity											
OP7	Operating cycle											
OP8	Inventory turns											
OP9	Price competitiveness											
OP10	Cost-effectiveness											
OP11	Labor productivity											

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