SUPPLY CHAIN RESILIENCE STRATEGIES AND PERFORMANCE OF FLORICULTURAL FIRMS IN NAKURU COUNTY, KENYA.

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DECLARATION

This research thesis is my original work and has not been presented for a degree in any other University

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DEDICATION

I dedicate this work to my children: Nyaboke, Kerubo, Motari and Menge II.

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ABBREVIATIONS AND ACRONYMS

B-2-B	Business-to-Business
CAS	Complex Adaptive System Theory
EACC	Ethics and Anti-Corruption Commission
EU	European Union
ICT	Information Communication Technology
IT	Information Technology
JIT	Just In Time
KFC	Kenya Flower Council
PPDA	Public Procurement and Disposal
PPOA	Public Procurement and Oversight Authority
SC	Supply Chain
SCAS	Supply Chain Agility Strategies
SCCS	Supply Chain Collaboration Strategies
SCFS	Supply Chain Flexibility Strategies
SCRM	Supply Chain Risk Management
SCRMS	Supply Chain Risk Management Strategies
SCT	Supply Chain Technology
TOE	Technology Organization Environment Model
UK	United Kingdom

DEFINITION OF OPERATIONAL TERMS

Floriculture: floriculture has been used in this study to identify with the cultivation, management and marketing of flowering and ornamental plants for direct sale or use.

Floricultural firms: these are businesses that focused on cultivating and selling various flowers and ornamental plants.

Supply Chain Agility: this is used in this study to describe how fast and rapid a floricultural supply chain is able to smoothly respond to sudden alterations in flower supply and/or demand.

Supply Chain Collaboration: was used in this study to describe the arrangement of secure long-term affiliation with other floricultural firms and members of the supply chain in order to jointly work and share information, resources, and risk

Supply Chain Flexibility: this referred to how floricultural firm were able to adjust to variations in their environment or from stakeholders' preferences within a short time and minimal effort.

Supply Chain Resilience: the term was used to describe a floricultural supply chain with a capability to renovate, settle in, or endure in the facade of change

Supply Chain Risk Management: these are practices that focus on spotting, appraisal, and supervision of all likely sources of risks within the flower industry.

Supply Chain Technology: these are emerging supply chain technologies in flower farming that focus on using advanced and evolving capabilities such as geo-location, Artificial Intelligence, Data Analytics, robotics, Internet of Things, Time-Temperature Indicator (TTI) technology, RFID, among others, to make it easier to mitigate supply chain challenges, enhance visibility and speed delivery, and also optimize production.

Supply Chain disruption: the term was used to describe the continuous, seasonal or unexpected disturbances and risks in the floricultural supply chain which halt or severely affect operations.

Performance: Performance in this study involves a comprehensive assessment of operational efficiency (reduced costs), operational stability (continuity) and market responsiveness to provide a holistic view of how well floricultural firms are performing and managing supply chain resilience strategies.

ABSTRACT

The industry of floriculture has a myriad of diverse and continuous challenges which must be counteracted, failure to which will lead to great losses, business closure, and recovery challenges. There is no exception in the Kenyan floricultural supply chain environment. It is important that firms adopt relevant strategies to guarantee resilience against unforeseen interferences by enhancing robustness and business continuity. Nevertheless how, whether, and which resilience strategies affect performance in floricultural firms is a topic that is under-explored. Using the theories of Contingency, Complex Adaptive System, Agency, Relational, and Technology Organization Environment Model collectively with the empirical literature, this study illuminates the association between supply chain resilience strategies and firm performance**.** The goals of the study were to investigate the effects of supply chain agility, collaboration, risk management and flexibility strategies, on the performance of floriculture firms. Moreover, the moderating effect of supply chain technology between these strategies and performance of floricultural firms was investigated. Cross-sectional survey research design was employed. Target population was 101 flower firms in Nakuru County, Kenya. Purposive sampling was used to pick 255 respondents. Primary data were collected using questionnaires. A pilot study was conducted on 5 flower firms in Nakuru and Nairobi County that were not part of the sample. Descriptive correlation and ordinal regression analyses were conducted. Results revealed that supply chain agility, collaboration, and risk management strategies significantly improved the performance of floricultural firms. Results further showed that, risk management, agility, and collaboration significantly contributed to floricultural firms' performance while flexibility was insignificant. Further it was evident that the interaction between supply chain technology and collaboration significantly reduced the effect on performance, as did the interaction between agility and supply chain technology. Conversely, the interaction between flexibility and supply chain technology significantly increased the effect on performance. However, risk management had no effect on performance upon the introduction of the interaction term. In conclusion, floricultural firms require current information regarding uncertainties in market dynamism to effectively mitigate supply chain risks and forecast demand. Achieving this requires agility, flexibility, and enhanced collaboration across the floricultural supply chain. Collaboration can be enhanced by proactively addressing supply chain issues and sharing information with partners in anticipation of disruptions and demand fluctuations. Flexibility and agility can spearhead and perk up responsiveness to production and transportation challenges. Risk management can be strengthened by transferring risks to third parties like insurance, to reduce their impact and build resilience. Finally, investing in technologies like IoT, Blockchain, and big data analytics can improve collaboration and visibility of market information, thereby boosting performance and resilience. Supply chain cloud technologies further aid decision-making by enabling re-engineering of supply chains to adapt to variations in flower production and transportation challenges. Future research should explore additional supply chain resilience strategies not covered in this study, focusing on cross-sector comparisons and diverse research methodologies to uncover sector-specific challenges and opportunities and refine resilience approaches.

CHAPTER ONE

INTRODUCTION

The chapter covers an overview of the background of the study, statement of the problem, research objectives, research hypotheses, significance, scope and study delimitations.

1.1 Background of the Study

Firms are disrupted by unanticipated incidences in diverse supply chain parts in the present day's vulnerable business environment and it worsened with COVID-19 effects (World Bank, 2020). Covid-19 shock on the economy combined supply shock—where the production capacity of goods and services at a given price reduced—and demand shock—where customers' capability to buy commodities at a given price reduced (Deloitte, 2020). Supply chain resilience is crucial when preparing for such disruptions by enabling faster response and recovery critical for firm survival and performance.

Supply chain resilience describes a supply chain that is adaptive, enduring, or evolves in response to change (Wieland & Durach, 2021).Firms have to be resilient to disruption to avoid vulnerability and guarantee profitability. Pires and Barbosa (2018) posit that a supply chain exemplifying resilience prepares, responds and recovers from destructions to maintain positive stable operational state in a timely and cost effective way.

The resilience strategies a firm uses will however determine the speedy recovery and performance after any major disruption. According to Mansoor and Mahour (2021) supply chain resilience minimizes the disruptions' effects by implementing tactics that facilitate a supply chain to respond effectively and pull through to its primary state or improve upon it.

This study examined four resilience strategies in the supply chain (agility, collaboration, risk management and flexibility) and the floriculture firms' performance in Kenya, Nakuru-County. Huang et al. (2020) aver that collaboration in supply chain is the contemporary way of referring to B-2-B affiliations that differ in perspective, scale and form where partners share some goals which they jointly work to achieve. Supply chain collaboration allow partners to act quickly in response to dynamic changes in business environment by setting up and executing joint activities (Shafique et al., 2019). Thus, to respond successfully to disasters, organizations must operate and collaborate in a supply chain system to achieve resilience.

Flexibility is the firm's ability to react to lasting or basic supply chain and market alterations by adjusting the supply chain design (Parast &Shekarian, 2019). Flexibility is a strategy that is fundamental in managing process, demand, environmental, and supply disruptions (Mansoor & Mahour, 2021). Supply chain resilience can be strengthened by implementing versatile and flexible plans, along with alternative production arrangements during disruptions (Piprani et al., 2022). Hence, as flower firms embark in building flexibility to counter supply and demand instability, they will be erecting resilience.

Supply chain agility is vital for firms to navigate unpredictable environments and disruptions, allowing them to respond proactively (Naughton et al., 2020). Agility enhances resilience in supply chains and is characterized by two main factors: timely responses to changes and leveraging those changes as opportunities for growth in a competitive landscape (Nag et al., 2014).

Recent research underscores the worth of organizational agility in adapting to market dynamics and maintaining a competitive edge (Grewal &Tansuhaj, 2020). Therefore, developing supply chains that are agile is essential for firms to thrive amid environmental uncertainties.

Supply chain risk mitigation is vital to eradicate the likelihood of risk incidences, transfer risk outcome to a third party, lessening the impact of risk or likelihood of an event happening, and setting up contingency plans lessening the impact after an event occurs (Sodhi & Tang, 2021). An efficient and adaptable risk management strategy can be the deciding factor between survival, performance and closure of businesses.

Information Technology (IT) use enhances distribution and processing of information which is favorable for recoveries from disruptions (Dubey et al., 2019). Connecting business functionalities with IT is crucial through a disruption and after, ensuring a continued existence of the organization, quick reaction, adaptability, and enhanced performance (Singh, 2020; Minhao et al., 2021).

According to Van (2020) supply chains are risk prone due to their dynamic and multifaceted nature which can be mitigated by Blockchain technology's big data analytics. The merits of big data in disaster management lies in its capacity to predict, analyze, and anticipate disasters, thereby improving supply chain efficiency through increased innovation and resilience (Akter & Wamba, 2019; Mohammad et al., 2022).

This research examined supply chain resilience strategies and the performance of floriculture firms in Kenya, Nakuru-County. The aim was to provide practical recommendations for managers in supply chain and other relevant authorities to adopt relevant resilience strategies and appropriately use technology to recover and manage unanticipated disruptions.

1.1 .1 Global Perspective of Supply Chain Resilience

We are living in a VUCA world-"Volatile, Uncertain, Complex, Ambiguous" (Bennett & Lemoine, 2014). Major events in the past have shown supply chains' susceptibility to disruptions where impacts spread to other regions or industries, for example the 2011Japan earthquake which not only impacted the economy of Japan and Asia, but resulted in supply chain shortages within Europe's automobile and technology sectors.

However, businesses react differently to disruptions determining their survival. An example is the lightning strike at Philips plant in 2000, New Mexico which contaminated mobile phone chips in millions. Nokia's production line was relatively unaffected because its managing strategy permitted quick supplier switching and re-engineering some phones to accommodate American and Japanese chips. Ericsson however, lost a big market share since they took no action as they believed Philips' word that they will resume in a week.

Covid-19 pandemic impacted lives and supply chains worldwide. Initial universal supply chain disruption started on the supply side after China closed factories to curb COVID-19 (Choi et al., 2020). This resulted in parts and equipment shortages in downstream industries for computer equipment, chemicals, automotive, and textiles (de Voi, 2020).

These shortages' serial effects reverberated in many nations, prompting some companies to reduce production or stop operations (Choi et al., 2020). Sectors like Floriculture experienced the brunt of declining sales (Okumura, 2020). In Brazil, several producers, particularly smaller scale, faced challenges in bringing their flower and plant products to market and in a week lost $ 297.7M. (The Brazilian Institute of Floriculture, 2020). After the Brazilian government lifted the lockdown, opening events and points of sale, the floriculture sector started to recover, with adaptation for technology use and e-commerce allowing direct connection to final flower consumers (Okumura, 2020).

The Netherlands, known for its traditional flower industry, offers a robust supply of flowers through family-run farms. Its unique auction system streamlined marketing, while a sophisticated cold chain logistics system minimized product loss during transportation. Strict quality control measures guaranteed high standards, and strong innovation and R&D capabilities reinforced the industry. The rise of e-commerce platforms like Fleurop, Flowers, and Euroflorist, which facilitated direct sales to consumers without intermediaries, is anticipated to positively influence the Netherlands' floriculture market (Chen & Zhao, 2019).

Disruptions can paradoxically create unexpected opportunities for success. The pandemic (COVID-19) significantly increased global demand for services and various items like: toilet paper, sanitization items, canned food, video conferencing tools, headsets, delivery apps, and home entertainment (Abdelnour, 2020). Manufacturers of disposable personal protective equipment saw substantial benefits from the demand escalation (Okechukwu, 2020).

Also, the pandemic accelerated the e-commerce shift leading companies to invest in improved online capabilities and digital sales training (Guan et al., 2020).

1.1.2 Regional Perspective of Supply Chain Resilience

The more and more interdependent and interconnected worldwide economy makes countries vulnerable to external shocks. Low and middle-income countries, particularly in Africa, were especially vulnerable to the indirect impacts of Covid-19 on supply chains (Roberton, 2020). In Africa, the key areas impacted by this pandemic include shortages of finished goods and raw materials, production stoppages, stock-outs, delayed shipments, and transport disruptions (Joanna & Subramanian, 2021).

The pandemic directly interrupted agriculture distressing its produce supply (World Bank, 2020). The down beat labour supply disruption because of cross-border movement restrictions and national lockdowns led to severe supply disruptions for agricultural goods (Steele, 2020). Africa is a global supplier of cut flowers to developed countries. However, floricultural supply chains in Africa are full of challenges.

The expected demand pick-up after the Great Recession did not happen as many expected, and the arrival of Covid-19 collapsed several markets (Mutangili, 2021). This was due to lockdowns and retailer closure in export countries (Banga et al., 2020). The demand for commodities traded within the African continent reduced too. Cut flower export in Ethiopia's supply chain was hit by the global fall in travel upsetting the product's export and restraining its global supply to other industries (Otieno, 2020).

The commodity price crumple had a major blow to trade in countries in Africa which majorly depend on mineral and agricultural commodities (Africa Business, 2020). A joint survey across Africa by the International Economics Consulting Ltd., and Africa Trade Policy Centre on Covid-19 impact on businesses and trade, proved the capability of African firms to be creative and adapt to Covid-19 disruptions on the supply chain.

To survive and create medium to long term resilience, African economies are encouraged to drive and implement the agreement by African Continental Free Trade Area (AfCFTA), so as to quicken their resurgence from Covid-19 impact, at the same time minimize future exposure to similar effects and more regional shocks like the locust crisis in East Africa (African Trade Policy Centre, 2020).

1.1.3 Local Perspective of Supply Chain Resilience

Since the year 2007, Kenya has faced supply chain disruptions. Its economic growth is susceptible to insecurity, external shocks, regional instability and weather-related supply shocks (Arani et al., 2015). The export-oriented nature of floricultural industry in Kenya exposes it to worldwide macroeconomic trends and disturbances like the 2008 global economic crisis, which drastically lowered flower prices.

This was temporarily exacerbated by increased rates of air freight allied to the "Icelandic ash cloud (Kazimierczuk et al., 2018). The 2008 post-election violence in Kenya brought a huge negative supply shock reducing flower exports and demand shock as global buyers were unable to source Kenyan exporters (Christopher et al., 2021).

According to Musau (2017) challenges facing the floriculture industry in Kenya include; stiff competition in international markets, inadequate infrastructure, improper marketing system organization, limited facilities of refrigeration, high cost of production, diseases and pests, and high charges on freight.

Mwangi and Osoro (2024) evaluated the impact of supply chain complexities on the performance of flower-exporting firms in Nakuru County, and recommended that these firms adopt a proactive strategy for managing uncertainties and external risks. They highlighted the importance of implementing thorough plans of business continuity to ease disruption effects on supply chain and developing resilience by investing in research

Reforms were introduced in the public sector in Kenya to guide the supply chain process and address some of the risks. For instance: The Public Procurement and Disposal of Assets (PPDA) Act, 2005, revised 2015 reviewed in 2022, provides guidelines for public procurement to enhance the effectiveness, transparency, and accountability of procurement processes, introducing new procedures and guidelines to streamline operations and address emerging challenges. The Public Procurement Regulatory Authority (PPRA) is a key institution that was set up to oversee and regulate public procurement processes.

1.1.4 Performance of Floricultural Sector in Kenya

Kenya's economy relies heavily on the agriculture sector where the production of cut flowers is among the main foreign currency income sources, being the second after tea. According to the Kenya Flower Council (2021) the country's horticulture industry is the third-largest earner of foreign exchange, bringing in around $1.15 billion annually. Kenya's relative advantage originates from its lower trade barriers, less rigid environmental regulation, low labor costs, government controls over land rights and climate (Rikken, 2021).

A warehousing report by Tilisi Developments Ltd. (2017) point out challenges such as: poor structural planning, increased stock contamination during storage, capacity shortages, cold-chain warehousing issues, poor ventilation and power shortages; also in transport supply chain: breakdowns and congestion reduced the flowers' vase life. The worldwide lockdowns and travel restrictions to curb Covid-19 in most countries interrupted universal supply chains and acutely affected the floriculture industry in Kenya in many ways.

The cut flower and tea value chains in the Kenyan economy were harshly hit (Mutangili, 2021). Demand for flowers declined as flower shops worldwide closed due to lockdowns and event and wedding cancellations. Flight unavailability, minimal exports of fresh-cut flowers, and decreased demand compelled Equator Flower Firm to destroy millions of stems, leading to significant losses (Mwaniga, 2020). In 2019 James Finlay Limited Kenya closed-up two Kericho farms in Chemirei and Tarakwet due to decreasing flower demand resulting from Covid effect.

The Kenya Flower Council (2021) estimated a loss of approximately $300,000 per day due to COVID-19 pandemic economic effects. Presently, flower demand picked in other places, but the Kenyan floriculture industry challenges are not at ease. Some actions taken by the farms to control operations cost affected the flowers' quality and production cycle. Reduced manpower reduced attention to the flower plants and reduced fertigation and spray made them frail and at risk of pest and disease (Khan, 2020).

To reduce post-harvest losses and ease market access, the Horticultural Crops Directorate built collection depots, marketing centers and Offered stand-by availability of refrigerated trucks for farmers to rent (Mutangili, 2021). The Central Bank of Kenya (CBK) 2021survey assessed the recovery extent in the flower industry, especially following the resurgence of COVID-19 third wave and the emergence of new variants. It was discovered that export orders for flower remained robust, however some farms expressed concern about potential order cancellations if strict lockdowns were imposed again (CBK, 2021). This raises the question of preparedness and resilience in facing similar future disruptions.

1.1.5 Floricultural Farming in Nakuru County

European settlers initiated flower cultivation in Kenya in the 1960s. Globally with a 38% market share, Kenya is the third-largest cut flower exporter to the European Union. About 50% of these flowers are sold via the Dutch Auctions, even if there are rising direct sales. Supermarkets are the main outlets in United Kingdom with more than 25% of exported flowers. USA, Russia and Japan are also growing destinations (KFC, 2021).

The flowers grown are Eryngiums, roses, Carnations, Hypericum, Alstromeria, Gypsophilla, Statice, Lilies, Arabicum, a range of summer flowers among others (Mwaniga, 2020). There are about 500 flower farms found in Kenya with production areas in Nakuru, around Lake Naivasha, Nairobi, Mt. Kenya, Kiambu, Thika, Nyandarua, Athi River, Eastern Kenya, Kericho, Trans-Nzoia, Uasin-Gishu and Kitale.

Currently we have over 100 firms in the County of Nakuru with more than 53 in Naivasha (JaniFirmDirectory, 2022). Nakuru County is Kenya's floriculture center. Located 90 km from Nairobi, its flower industry is one of the biggest employers with over 500,000 people. At1880m above sea level, Naivasha is most suitable for flower farming owing to its closeness to Lake Naivasha, supplying the high water demand for irrigation and machinery maintenance.

The region's location allows for year-round production and supports the cultivation of medium-sized roses. The air freight availability: the regional cargo center is in Nairobi airport and also efficient surface transportation grants excellent connectivity to markets (Kazimierczuk et al., 2018). Technological progress has been crucial in flower production, allowing farmers to minimize losses, maximize yields, and enhance quality.

Some most frequently used technologies in the absolute cold chain of Kenya’s flower farming are: fertigation systems, drip irrigation, net shading, glasshouse ventilation systems, cold storage, pre-cooling, refrigerated trucks, and artificial lightning. Therefore, the use of advanced technologies yields high-quality flowers, thereby supporting market growth during the period of forecasting (Mordor intelligence Report, 2024).

Sian Flowers, a leading producer of summer flowers and premium roses in Kenya, has adopted sea freight to Europe, significantly reducing transport carbon emissions by up to 85%. The company is also focused on minimizing packaging and enhancing airfreight space efficiency to cut supply chain waste and costs. This includes the On-Farm Skidding initiative, which lowers labor needs throughout the supply chain, and Lean Handling, which streamlines the flower production process by minimising the steps in handling.

Additionally, Sian Flowers plans to institute a Value Addition center, allowing overseas customers to have their products customized to meet final consumer specifications (Thursd report, 2024).Coordination throughout the supply chain is essential to guarantee the availability of high-quality, fragile and perishable flowers to far-away markets.

Floriculture is a business marked by seasonality due to demand (in some dates such as Valentines' and Mother's Days) and supply factors (in winter, it is expensive to farm flowers in Europe). To some degree, this industry's success can be attributed to the private sector's ability to grow independently from the government and promptly adapt to changes (Tyce, 2020). Being Kenya's floricultural hub, Nakuru County, was suitable for this study as most firms are concentrated there yet the flowers have to be transported to Nairobi for export where the regional cargo center is located, as such coordination along the supply chain is vital.

1.2 Research Problem

Kenya's economy heavily depends on agriculture, with the horticulture sub-sector generating approximately $1 billion annually, contributing about 1.25% to GDP, and flower exports accounting for nearly 1%. The Kenyan floriculture sector has become a significant global player, supplying 40% of roses in the EU and reaching 60 other destinations (Africa Business, 2024). However, despite its economic importance, the sector's performance is declining.

A survey by HCDA (2022) indicates that 60% of floricultural firms do not meet international performance standards. Export figures have dropped significantly, with 15,000 tonnes in 2022 compared to 210,000 tonnes in 2021. This decline is largely due to various challenges, including considerable uncertainty in demand and supply. Demand unpredictability stems from weather-dependent sales, shifting consumer preferences, seasonality and intensifying global competition. Supply uncertainty arises from the nature of living, perishable flower plants, rendering supply chains susceptible to quality issues.

The deterioration in quality primarily hinges on the duration of logistical processes (transportation, storage or processing issues) coupled with the ambient temperature during these operations. Musau (2017) identifies factors contributing to disruptions in flower firms, including high costs, system failures, and natural disasters. These intensified during the pandemic- COVID-19, as travel restrictions hampered logistics and supply chains (Mwaniga, 2021). Consequently, Kenyan flower producers suffered significant daily losses of roughly $300,000 because of the declining sales and closure of some firms (KFC, 2021).

Cost-cutting measures negatively impacted the production cycle and quality, leading to frail flowers vulnerable to disease (Khan, 2020). These challenges reflect supply chains that struggle to withstand or adapt to changes, leading to declining performance. The sector urgently needs a predictable and stable business environment to thrive (KFC, 2023).This brings the concepts of preparedness and resilience to the forefront. Supply chain leaders can only create effective resilience strategies to address such disruptions.

Although COVID-19 caused global supply chain disruptions, other firms leveraged their robust global IT connections with partners to sustain production and sales (Minhao et al., 2021). There is limited literature in floricultural sector on supply chain resilience strategies. Hence, this study aimed to address the gap in knowledge by examining the impact of supply chain resilience strategies chiefly —collaboration, flexibility, agility, and risk management—along with the moderating role of supply chain technology on the relationship between these resilience strategies and the performance of floriculture firms in Nakuru-County, Kenya.

1.3 Objectives of the Study

The study's broad and specific objectives were addressed in this section.

1.3.1 General Objective

The primary objective of the study was to explore the relationship between supply chain resilience strategies and the performance of floriculture firms in Nakuru-County, Kenya.

1.3.2 Specific objectives

The study's specific objectives were as follows:

i. To establish the effect of supply chain collaboration strategies on the performance of floriculture firms in Kenya, Nakuru-County.

ii. To determine the effect of supply chain flexibility strategies on the performance of floriculture firms in Kenya, Nakuru-County.

iii. To determine the effect of supply chain agility strategies on the performance of floriculture firms in Kenya, Nakuru-County.

iv. To examine the effect of supply chain risk management strategies on the performance of floriculture firms in Kenya, Nakuru-County.

v. To assess supply chain technology moderating effect on these supply chain resilience strategies (i to iv) and the performance of floriculture firms in Kenya, Nakuru-County.

1.4 Hypothesis of the Study

This study was directed by the following null hypotheses:

$H_0$1: Supply chain collaboration strategies have no significant effect on floricultural firms' performance in Kenya-Nakuru County.

$H_0$2: Supply chain flexibility strategies have no significant effect on floricultural firms' performance in Kenya-Nakuru County.

$H_0$3: Supply chain agility strategies no significant effect on floricultural firms' performance in Kenya-Nakuru County.

$H_0$4: Supply chain risk management strategies have no significant effect on floricultural firms' performance in Kenya-Nakuru County.

$H_0$5 Supply chain technology does not significantly moderate the relationship between supply chain resilience strategies (i to iv) and the performance of floricultural firms in Kenya-Nakuru County.

1.5 Significance of the Study

The findings of this study serve as a resource for businesses reevaluating their business models and seeking solutions to navigate various disruptions, such as COVID-19. It offers insights on enhancing operations and formulating effective resilience strategies to address future unforeseen challenges. Specifically:

1.5.1 Policy Makers and Government

This study offers descriptive insights to government/regulatory bodies when formulating reforms and guidelines to address supply chain process and risks in the Kenyan floricultural industry so as to improve the opportunities for this sector by highlighting current pitfalls even in addressing pandemics. This enhances their comparative advantage and profitability and even enable the Kenyan government realize Vision 2030 goal, where it expects the agricultural sector to achieve double-digit growth annually.

1.5.2 Shareholders

The study findings are valuable to shareholders as they offer insights into managerial recommendations and underline the prospective for implementing supply chain resilience strategies within floricultural firms.

By centering on these strategies, firms can augment their operational efficiency, adapt to market fluctuations, and mitigate risks. Sequentially, this can appreciably maximize profit margins and foster competitiveness and long-term sustainability in the industry. Ultimately, shareholders can make informed decisions that align with these insights to drive better financial outcomes.

1.5.3 Floricultural Firms

Supply chain resilience is crucial for all organizations. The study assists managers in floricultural firms in effectively coordinating the flow of goods and information within their supply chains to address supply disruptions. It underscored the merits of adopting proactive measures by emphasizing critical resilience strategies for survival in unforeseen challenges, particularly, collaboration, flexibility, agility and management of risk.

This study interpreted theory into practical guidance for managers in floricultural firms to apply and create awareness on specific resilience strategies enabling adaptive ability to prepare, respond and recover from future disruptions like covid-19 pandemic. This enables management to effectively allocate and prioritize resources where they will have the greatest impact, ensuring that the organization is well-prepared to handle disruptions.

1.5.4 Academicians and Researchers

The study contributes to the literature on supply chain resilience strategies concerning organizational issues. It enhances ongoing research on disruptions in supply chains during crises and pandemics, such as COVID-19.

The literature review revealed that this research area remains underexplored, particularly within the floricultural industry in developing countries. While some studies have highlighted the importance of resilience in supply chain performance, most were conducted in developed countries or other industrial sectors. Therefore, this study serves as a valuable reference for local scholars interested in pursuing research in this field.

1.6 Scope of the Study

The concentrated on resilience strategies of supply chains and the performance of floriculture firms in Kenya, Nakuru-County guided by the following objectives under supply chain strategies: collaboration, flexibility, agility and risk management. They were believed to empower flower firms to navigate disruptions and continuously adapt to meet evolving needs and stakeholder expectations.

The study also investigated supply chain technology moderating effect on the relationship between supply chain resilience strategies as shown above and performance of floriculture firms' in Kenya, County of Nakuru. This study was done in Nakuru County, a center and home of flower farming in Kenya; it hosts over 100 firms going by the JaniFirmDirectory (2022) and Kenya Flower Council (2022).

Data was collected from 20th February 2023 to 4th April 2023 when last questionnaire was received. Cross-sectional survey design was employed with a sample of 255 respondents. The study concentrated on floricultural firms because the Kenyan government recognizes agriculture as a crucial sector in the economy under Vision 2030, contributing up to 26% of the GDP (FAO, 2021).

By 2020, the horticultural industry was one of Kenya's three largest sources of foreign exchange, generating approximately $1.15 billion per year (KFC, 2020).

1.7 Limitations of the Study

A limitation is a facet of research that may adversely affect the results, where sometimes it can be issues deemed beyond the researchers' control (Akanle et al., 2020). Some challenges were encountered during the research study; however, they did not significantly impact the outcomes. First, some flower firms did not wish to be part of the study unless they were authorised by Kenya Flower Council and some participants were reluctant to offer information.

The researcher addressed this limitation by obtaining an introduction letter from National Commission for Science, Technology and Innovation (NACOSTI) and assured the participants that the information provided would be used solely for academic purposes and will be handled with confidentiality. Secondly, accessing the senior managers targeted for the research study proved challenging because of their demanding schedules and the presence of office secretaries and guards who restricted the researcher from entering the managers' offices or premises without a formal appointment.

However, the researcher booked for appointments in such cases and used a research assistant to facilitate the exercise. Thirdly, some respondents returned the questionnaires later than the agreed two-week timeframe, while others did not submit them at all, which impeded the attainment of a 100% response rate. However, this issue was tackled by the research assistant, who followed up with the respondents and addressed any concerns.

Additionally, the deadline was extended, which greatly reduced the number of incomplete sections in the questionnaires and enhanced the overall response rate. Lastly, the researcher focused on only a few aspects of metrics under supply chain flexibility, collaboration, risk management and agility which were investigated as the strategies of supply chain resilience that influence performance during disruptive situations. There are other supply chain resilience strategies such as diversification, inventory, multi-sourcing, and capacity buffers among others, which improve performance of supply chains amid disruptions.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 Introduction

This study investigated the resilience strategies of supply chains and their impact on the performance of floricultural firms. Literature review covered theories related to the study, while empirical studies highlighted relevant scholarly work, addressing aspects of interest and identifying gaps related to this study.

2.2 Theoretical Review

According to Piirainen and Gonzalez (2015) a theory consists of a collection of systematically interconnected concepts, propositions, and definitions that aim to clarify and forecast facts. Similarly, Moser (2018) aver that it is a framework of interconnected constructs and descriptions offering a coherent understanding of facts by outlining the relationships between variables to clarify and predict outcomes.

This study was based on five theories: Relational, CAS, Contingency, Agency, and TOE Model. They examine a firm's resilience to risks and the impact on performance. The theoretical framework is depicted in Figure 2.1:

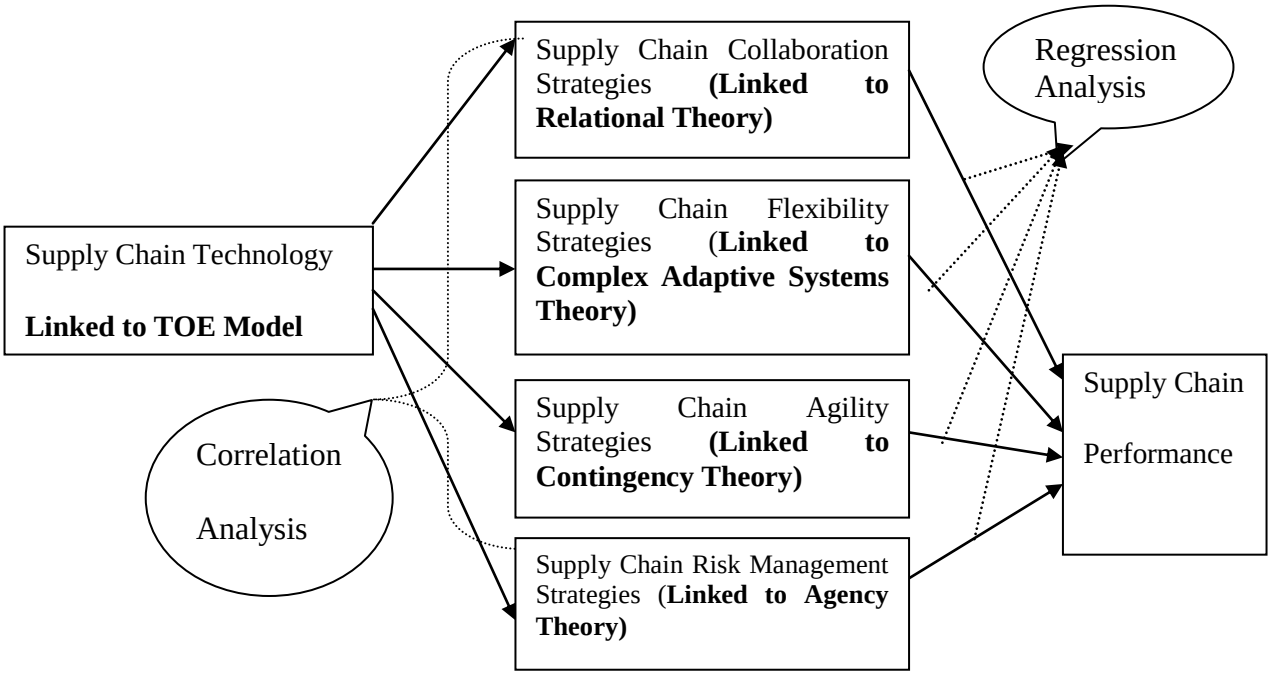

Figure 2.1: Theoretical Framework

2.2.1 Relational Theory

Emphasizing on "dyads and networks of companies as units of analysis", Dyer and Singh (1998) proposed a theory explaining superior performance and competitive advantage. The theory suggests that the more partners invest in relationship-specific assets and inter-firm knowledge-sharing practices, the greater the potential for relational rents (Dyer & Singh 1998).

The relational view theory is grounded in resource-based theory, updated by recent works (Amit & Schoemaker, 2016) which build on the foundational ideas (Wernerfelt1984; Barney 1991). Cook's (1977) insights regarding the advantages of network exchange in inter-organizational relations also serve as a backdrop for the theory, which has been extended by Lavie (2006).

A relational rent is defined as a supernormal profit collaboratively produced within an exchange relationship that cannot be achieved by either firm independently. It can only be realized through the combined efforts of the specific alliance partners and is challenging for competitors to replicate, thereby providing a competitive advantage (Dyer & Singh, 1998). These relational rents are as follows: knowledge-sharing routines, relation-specific assets, effective governance and capabilities between alliance partners, and complementary resources.

The goal is to drift from market relationships that are transactional where competitors effortlessly replicate this exchange relationship, and then the rents will be co-created and shared by the partners. Relational rents will then be part of the network/dyad. The theory of relational view encompasses seven assumptions: First, there are learning effects, where it is assumed that individuals within an alliance are enthusiastic about learning from one another, thereby enhancing their competencies and expanding their skill sets.

However, this is not always true. Individuals may act differently by prioritizing their self-interests over learning within the alliance relationship. When this occurs, the benefits of learning are not realized, resulting in cumbersome knowledge-sharing routines for the firms involved. The second assumption is the relaxed resource ownership. Traditional resource-based view (RBV) theory posits that firms need to own or have complete control over the resources that provide competitive advantages (Amit, 2016).

However, this condition fails to adequately explain competitive advantages in networked environments, where firms have enhanced access to resources and frequently exchange services. In a relational perspective, the control and ownership of these resources are more 'relaxed,' enabling a smoother flow of resources between exchange partners. The third assumption is heterogeneity of resources. The relational view considers this as a prerequisite for the exchange of complementary resources. In contrast, under conditions of complete uniformity of resources, alliances are primarily beneficial for collusion instead of seeking access to complementary resources.

The fourth assumption is imperfect mobility. Alliance formation is insignificant in a perfect mobility context, where resources are freely traded and accessed in the market without the need to join networks. Alliances are essential for gaining access to resources that are challenging to obtain particularly, when there are high barriers to access and trade unique resources.

The fifth assumption, concerning ongoing relationships with partners, posits that relational view relationships are continuous and not bound by time. In reality, however, firms typically enter into relationships for a specified duration and renegotiate the terms for extending the partnership once that period ends. Companies that have had negative experiences in past partnerships are often reluctant to commit to long-term relationships, which diminishes the potential benefits associated with the relational view.

The sixth assumption is voluntary governance structure, which suggests that the frameworks outlined in relational view theory are established voluntarily, characterized by shared authority and power, and are non-governmental. Partners in alliance are assumed to possess equal power to control and share resources without a central authority dominion.

The last assumption is that the firms involved in the relationship are private entities focused on generating profit. These firms recognize the prospective of generating relational rents and, as a result, actively participate in alliance networks. In contrast, nonprofit or non-governmental organizations prioritize relational values over relational rents, focusing on opportunities that enhance human well-being.

In this study, we explored the relational view as a framework for understanding how enhanced relational competencies can strengthen resilience of supply chain in the presence of unexpected events. Relations in the supply chain are founded on collaboration, organization, and integration throughout the chain. Sharing of information among the supply chain members helps to lessen costs, substitute information with lead time and inventory, enhances responsiveness, reduces demand variability, and improves service level (Lusiantoro et al., 2022).

Coordinated business processes, such as the flow of information, finances, and materials enhance the performance of the supply chain, resulting in growth of business (Choonho & Joungho, 2023). Supply chain visibility refers to information that is usable and can assist customers at various points throughout the supply chain (Sri, 2024).

This helps improve processes and eliminate redundancies, ultimately providing a competitive advantage to the firm (Sri, 2024). Supply chain visibility is enhanced through IT use as data solutions, customers and trading partners securely gain insights into the entire supply chain. Relational Theory is thus useful to management stakeholders in Kenyan floricultural sector for formulating relationship strategies that promote supply chain resilience.

The theory was utilized in the context of supply chain collaboration strategies, as supply chain managers can implement relationship strategies to enhance supply chain resilience in procurement firms in Kenya. In view of Relational Theory, the first null hypothesis that was evaluated in this study was as follows:

$H_0$1: Supply chain collaboration strategies have no significant effect on floricultural firms' performance in Kenya-Nakuru County.

2.2.2 Complex Adaptive System

The name 'complex adaptive systems' (CAS) was invented in the 1980s at the Santa Fe Institute in New Mexico (Chan, 2001). CAS, drawing on John Holland's work, is defined as a dynamic network of agents that operate simultaneously, continuously responding to one another's actions and thus shaping the overall behavior of the network (Holland, 1995). Control is often decentralized and dispersed, and the system's behavior emerges from the numerous decisions made by individual agents (Mitchell, 2022).

Essentially, it provides a framework of thinking and analyzing patterns, complexity, and interconnections, instead of concentrating exclusively on cause and effect. CAS assumptions have often been applied to the physical sciences, but its proponents argue that these ideas also hold value in understanding how communities interact and behave. Two key assumptions include: first, that each observed effect has a traceable cause-meaning that even complex phenomena can be comprehended by dissecting them into smaller components for analysis; and second, that analyzing past events thoroughly helps to foresee future outcomes (Holland, 1999).

A CAS is a system that evolves into coherence through self-organization and adaptation. Adaptation suggests that agents in the system are reactive and proactive, demonstrating flexibility and responsiveness to inputs from other agents (Holland, 1995). Thus, floricultural firms should embrace proactive and adaptable strategies by restructuring their operations and making strategic decisions to enhance resilience and performance in the face of challenges. A complexity adaptive system consists of interconnected agents responding to environmental and internal changes.

Floricultural firms in Kenya, for instance, operate in unpredictable environments frequently disrupted by external factors, and they must adapt to survive. Their environment contains both chaos and order, making adaptation essential. In a CAS, agents follow schemas or order-generating rules that shape their adaptive responses. To stay aligned with their dynamic and challenging environment, these agents must adapt swiftly (Hasgall, 2013).

Co-evolution introduces new alterations in both the CAS and its surrounding environment, requiring ongoing learning and adjustments to schemas to enhance their effectiveness. A CAS not only modifies its environment but also learns from it, evolving its behavior based on feedback (Mitchell, 2022). CAS events are inherently unpredictable, and disruptions can result in unequally positive or negative outcomes, highlighting the system's non-linear nature (Hasgall, 2013).

Non-linearity in CAS is affected by the quantity and nature of interactions among agents. For example, the level of connectivity within a system can limit or enhance an agent's independence, such that higher connectivity reduces autonomy and vice versa (Shirado & Christakis, 2017). Non-linearity within CAS also results in self-organization and emergence, which can lead to new properties, patterns, and structures.

Scalability, a key CAS feature, implies that entities across different system levels share similar concerns-such as improving delivery speed, enhancing adaptability, and reducing costs (Hasgall, 2013). Agents within a CAS aim to meet their goals, and in doing so, they create collective patterns that emerge at the system level. Supply chains function like a CAS, exhibiting key characteristics of the system.

For example, a resilient SC adapts to environmental threats without compromising its integrity. This adaptation often involves co-evolution, such as educating and influencing other actors in the economic system. Supply chains are also highly non-linear, indicating that minor changes in control mechanisms can lead to disproportionately significant consequences (Mitchell, 2022; Shirado & Christakis, 2017).

Covid-19 pandemic highlighted the non-linear and interconnected nature of global SCs, leading to major disruptions across industries, including floriculture. These firms, which depend on exports, experienced severe drops in sales and revenue. For these firms to build supply chain resilience, managers must recognize that resilience emerges through self-organization, not through centralized control.

Due to the vastness and intricacy of supply chains, no single firm can manage or oversee the entire system. As a result, managers must cultivate flexibility and collaboration with other floricultural firms and stakeholders-including the government, customers, and suppliers-to foster resilience. In light of the CAS Theory, the second evaluated hypothesis in this study was:

$H_0$2: Supply chain flexibility strategies have no significant effect on floricultural firms' performance in Kenya-Nakuru County.

2.2.3 Contingency Theory

Contingency theory formulates broad generalizations regarding the formal structures that are usually linked to or most suitable for various technologies. This perspective originated with Joan Woodward (1958) who contended that technology directly affects diverse organizational characteristics, for example: span of control, the formalization of rules and procedures, and centralization of authority. According to Contingency theory, factors like external environment, technology, and culture influence the design and function of organizations.

The theory posits that a series of optimal resolutions of a firm depends on factors that are external and internal to it, and that the alignment between processes and organizational structures enhances performance (Woodward, 1958). Leaders in a contingent framework are flexible, adapting strategies to changing situations as needed (Peters et al., 1985). The central idea of "fit" in this theory indicates that appropriate alignment among internal and external organizational elements positively influences performance in an organization (Woodward, 1958).

The theory rests on two presumptions: firstly, there is no one-size-fits-all approach to organizing as suitable forms depend on the environment or tasks being managed; and secondly, management must focus on achieving good fits and alignments between structure and environment (Otley, 2016). Firms attaining greater agility typically outperform their less agile competitors (Smith & Zhang, 2022).

Agility is broadly defined as the supply chain’s ability to rapidly react to changes by adapting its existing configuration. It involves two main factors: reacting to changes in a timely and appropriate manner, and seizing opportunities from those changes to survive and thrive in a competitive environment (Roberts & Wang, 2021). The key capabilities of a production system that’s agile include: the ability to instigate products without requiring additional expenditures and the system's flexibility in switching between products.

Contingency theory was relevant to this study as it helped to understand external and internal environments in which floricultural firms operate, as well as how these firms can utilize resources to gain a strategic advantage. Supply chain managers can apply this theory to comprehend and implement agility plans that improve supply chain resilience in floricultural firms in Nakuru-County, Kenya. Accordingly, the third hypothesis evaluated in this study was as follows:

$H_0$3: Supply chain agility strategies no significant effect on floricultural firms' performance in Kenya-Nakuru County.

2.2.4 Agency theory

Agency theory is an economic framework that considers the firm as a series of contracts between self-interested individuals. Originally developed by Jensen and Meckling (1976) it posits that a relationship in agency is formed when a principal grants an agent the authority to act on their behalf, including some decision-making power. A risk is introduced in this relationship that the agent may be opportunistic and not act in the principal's best interests.

To mitigate such risks, contracts or agreements ought to be designed to lessen the likelihood of opportunistic behavior by the agent (Jensen & Meckling, 1976). Agency theory is grounded in one of the oldest issues in economic thought-understanding the dynamic between a 'master,' who holds socially legitimate control, and a 'servant,' who controls information vital to decision-making (Cyert & March, 1992). Berle and Means (1932) introduced agency theory to modern firms, where ownership and management are separate.

In the decades that followed, the theory developed considerably, becoming primarily focused on the relationships between two contracting parties (Eisenhardt, 1989). The theory presupposes that both principals and agents are utility maximizers with differing interests. The agent may not always act in the principal's best interests due to the irregularity of information, however, the principal can curb this discrepancy by implementing suitable incentives for the agent and by bearing agency costs (Jensen & Meckling, 1976).

While some proponents argue that agency theory is a powerful organizational theory (Jensen, 1983), critics contend that it offers limited insights into the broader social, cultural, and political contexts in which organizational actors operate (Matinheikki et al., 2022). Critics also argue that agency theory portrays managers negatively, assuming that they are inherently opportunistic and self-serving, acting at the expense of their employers (Donaldson, 1990).

Perrow (1986) considered the theory as dehumanizing, arguing that it overlooks the complexity of human behavior. Furthermore, attempts to universally apply agency theory to every organization ignore the importance of context in understanding social phenomena. Despite these critiques, agency theory provides useful insights in certain settings, especially where conflicts of interest are prominent. In supply chain management, for instance, it can be challenging for the principal (purchaser) to assess quality and technical capabilities, particularly in complex procurement processes, since they often rely on information provided by the agent (contractor).

Risk-sharing is a key issue in these relationships, which occurs when principals and agents have varying perspectives toward risk. By applying agency theory, researchers can identify and understand the five landscapes where procurement risks occur, offering a foundation for developing risk management strategies. These landscapes include: the procurement process, market behaviors and conditions (e.g., supply availability, competition), management controls, external dependencies (e.g., supplier viability, supply chain robustness), and the ability to handle unforeseen events (Matinheikki et al., 2022).

Effective procurement risk management involves ex-ante risk identification (e.g., feasibility studies and market analysis), risk reduction (e.g., accurate information in cost forecasts), risk allocation (e.g., sharing risk based on ability and negotiation power), and ongoing risk monitoring, especially in the context of a swiftly evolving procurement environment.

Thus, in light of agency theory, the study explored the effects of risk management asa strategy of supply chain resilience in the floricultural firms in Nakuru-County, Kenya, as our fourth hypothesis of this study, that is:

$H_0$4: Supply chain risk management strategies have no significant effect on floricultural firms' performance in Kenya-Nakuru County.

2.2.5 Technology Organization Environment (TOE) Model

TOE Model was put forward by Tornatzky and Fleischer (1990). It centers on factors—internal and external—that affect the acceptance of an innovation and wraps up that an innovation's diffusion is influenced by an organization, environmental factors and technology. Organizational factors are: size, scope and amount of slack resources available internally.

Technological factors are: existing technologies in use and new technologies applicable to the firm. The environmental factors are: dealings with the government, competitors and industry. These elements facilitate technological innovation by offering constraints and at the same time opportunities (Tornatzky & Fleisher, 1990). Consequently, they affect how a firm perceives the need for new technology, seeks out, and implements it.

The TOE model is designed for analysis at the organizational level (Awa et al., 2017). The focus is on higher-level attributes, such as organizational, environmental, and technological contexts, rather than individual behaviors within a firm. At the individual level, technology adoption can be understood by examining behavioral models such as the reasoned action theory, planned behavior theory of, and the technology acceptance model (Taherdoost, 2018).

While the distinction between individual and organization level theories is accepted extensively, it still presents challenges in studying higher-level attributes effectively (Li, 2020). Although the TOE framework has been utilized widely, it has seen minimal development theoretically since its inception.

The reason being according to Baker (2012) that the TOE framework aligns very closely with other technology adoption theories, which limits its potential for offering unique or competitive insights. This strong alignment results in minimal impetus to modify the framework. Baker highlights that while this framework is useful for understanding broad factors influencing technology adoption, its generic and flexible nature may hinder theoretical development. The lack of specificity in the framework can create challenges when applying it to particular contexts.

Also, Oliveira and Martins (2011) review at the firm level, various IT adoption models including the TOE framework. They find that although the TOE model is extensivelyemployed to understand technology acceptance, it lacks depth in exploring interactions between different contexts. Its broad scope provides flexibility but also reduces precision, potentially limiting its practical application in specific organizational settings.

TOE has five characteristics namely; compatibility, relative advantage, complexity, observability and trialability. First, compatibility is an innovation's consistency and has existing values of likely end-users, needs and past experiences. Second, relative advantage depicts an innovation as superior to the idea it replaced. Third, complexity is the end-users supposed difficulty level in comprehending innovations and their ease of use. Fourth, observability is visibility of innovation results by others. Last, trialability is the extent innovations are tested on a constrained basis. These characteristics explicate the end-user as having a new creation and making decision for it (Li, 2020).

The Technology Organization Environment model enlightened the concept of technology in this study. In view of this model, the fifth hypothesis that was evaluated was:

$H_0$5 Supply chain technology does not significantly moderate the relationship between supply chain resilience strategies (i to iv) and the performance of floricultural firms in Kenya-Nakuru County.

2.3 Conceptual Framework

A conceptual framework is an illustration between an outcome and predictor variables. It is a hypothesized model recognizing studied variables and presenting their relationship (Moser, 2018). A variable is a quantifiable attribute assuming varied values among specific population. It takes varied quantitative values like height, weight, or income (Ali et al., 2018). In this study, key variables were grouped into independent and dependent variables. Independent or predictor variables predict total variations taking place in another variable while the dependent or criterion variable is altered or influenced by another variable.

The researcher sought to investigate resilience strategies for firm survival during supply chain disruptions, including: flexibility, collaboration, risk management, and agility as predictor variables of performance which is the dependent variable. The relationships were also examined under supply chain technology effect as a moderating variable between these resilience strategies and floricultural firms' performance in Kenya-Nakuru County. These variables were drawn from the discussed theories and reviewed scholarly literature in this study, shown in the figure 2.2.

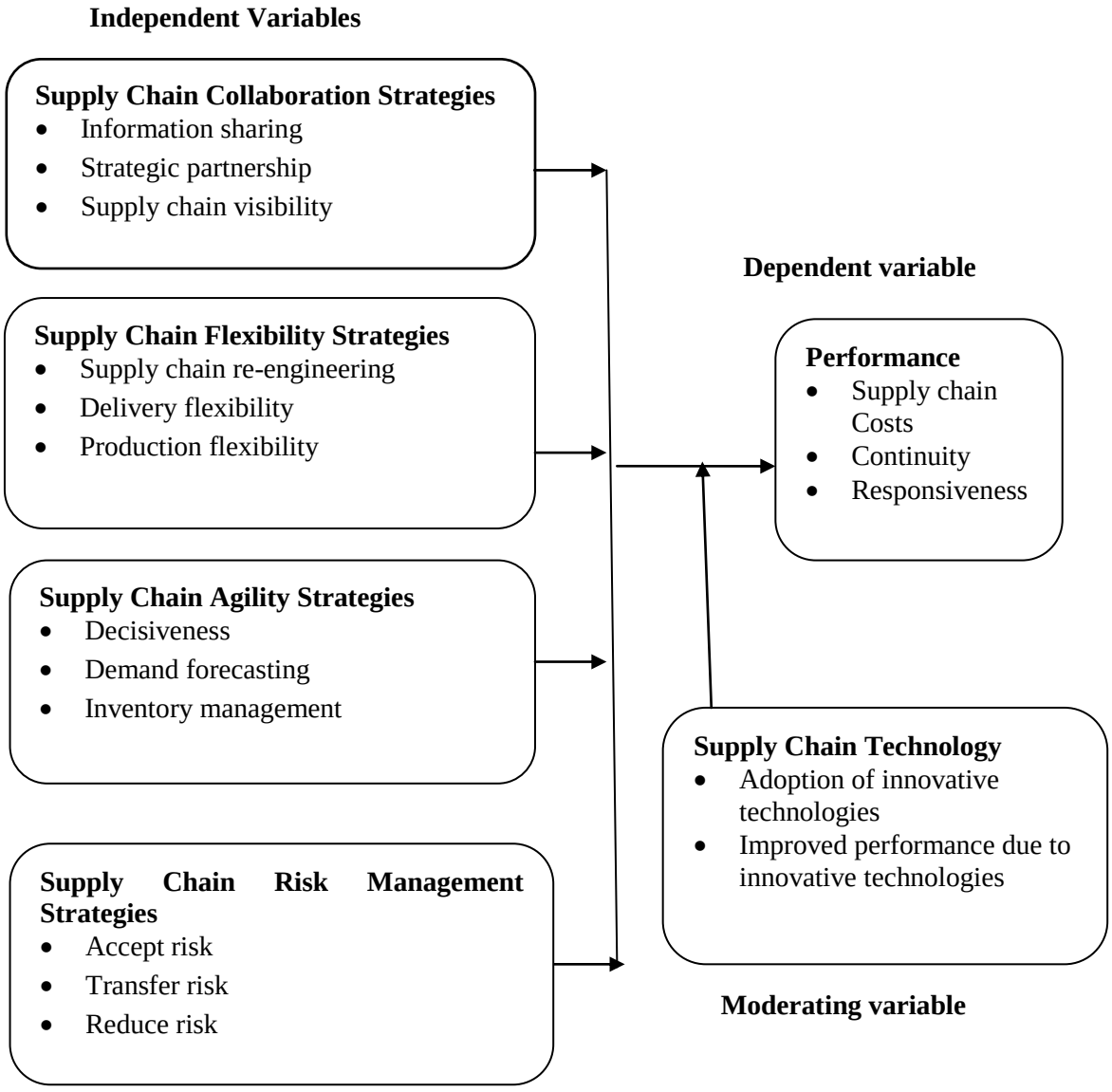

Figure 2.2: Conceptual Framework

Source: Researcher, 2023

2.3.1 Supply Chain Collaboration Strategies

Supply chain collaboration refers to the contemporary of referring B-2-B partnerships that vary in scale, context, and structure, where involved parties share mutual objectives and collaborate to achieve those (Huang et al., 2020). By planning and executing joint activities, collaboration allows participants to quickly react to dynamic shifts in the environment of business (Shafique et al., 2019).

Companies can adapt to a temporary crisis, learn from it and innovate in the long term which assists them in managing significantly colossal crises, such as the change in climate (Wieland & Durach, 2021). Key collaborative activities that enhance resilience in the supply chain include: relationship efforts, exchange of information, collective communication, and jointly created knowledge (Scholten & Schilder, 2015).

Umar and Wilson (2021) aver that effectual communication, joint reliance, sharing information, informal financial support, and trust are among the constituents of supply chain collaboration that enhance overall resilience during natural disasters. The most effectual supply chain collaboration dimensions to cope with the myriad of risks in the supply chain are corroborated by Mansoor and Mahour (2021) as: communication, collaborative relationships, information sharing, trust and continuous coordination and cooperation.

Supply chain collaboration offer numerous merits including: better knowledge distribution to greater access to expertise and products (Jraisat et al., 2021; Thi et al., 2020). Firms must quickly reconfigure their supply chains by fostering collaboration with suppliers and maintaining ongoing partnerships to enhance agility and responsiveness (Benzidia & Makaoui, 2020). Supply chain participants work together to manage organizational processes and resources, aiming for effective and efficient flows (Tang et al., 2021).

This study adopted three collaboration metrics: information sharing, visibility and strategic supplier partnership. Realizing advanced supply chain performance heavily relies on information sharing (Alzoubi & Yanamandra, 2020). Information sharing and alignment are essential elements for coordinating effectively throughout the supply chain (Dubey et al., 2021; Agrawal, 2023).

An all-inclusive approach to supply chain networks is necessary, particularly due to the demand for a circular economy and sustainability, making collaboration and information sharing in the supply chain essential (Chen et al, 2017). Visibility in the supply chain can be described as knowing at any instant the location of inventory from the producer to the end destination. It's the actionable information that can improve processes and remove redundancies giving a firm a competitive advantage (Sri, 2024).

Partnerships positively impact supply chain performance (Teboho & Chinomona, 2019). Through a sustained relationship, trust develops and evolves over time, potentially creating an advantage that rivals will find difficult to replicate (Salam, 2017).

2.3.2 Supply chain Flexibility Strategies

Novak et al. (2021) posit that a supply chain exhibits resilience where a system is able to preserve its primary utility by repeatedly transforming, advancing and adapting to the vibrant multidimensional interactions among the huge number of unified systems forming the larger supply chain. Therefore, businesses operating in a high-risk supply chain environment ought to possess the flexibility required to maintain effective operations and achieve a higher level of supply chain resilience (Piprani et al., 2022).

Flexibility is a crucial factor in managing and mitigating supply chain risk through its adaptation and reconfiguration mechanisms which is critical for enhancing resilience (Piprani et al., 2020). Flexibility in the supply chains is a crucial strategy that enables companies to manage disruptions and foster resilience on adapting rapidly to changing conditions. This study adopted three flexibility metrics: re-engineering, delivery flexibility and production flexibility.

Supply chain re-engineering involves the conceptual development of supply chains, designing, execution, and its operation (Naim et al., 2023). Firms may need to pursue logistics flexibility by seeking alternative routes or switching to different logistics modes, while customer demand can be rapidly adapted through product design flexibility and output capacity (Piprani et al., 2022). According to Rajesh (2021) supply chains can quickly react to disruptive events if designed based on a supply chain system that is flexible, enabling organizations to reorganize and realign their capabilities and resources.

2.3.3 Supply chain Agility Strategies

An adaptive supply chain architecture illustrates supply chain resilience (Um & Han, 2021). This capability stems from an agile supply chain, one that tolerates fluctuating demands by modifying its design in response to unforeseen events within the business environment (Al-Shboul, 2017). One of the various tactics that make a supply chain resilient is its agility. (Tukamuhabwa et al., 2015).

Agility, as defined by Al-Shboul (2017) is a crucial factor for firms to exist through supply chain threats and also enable JIT delivery of the required products. Agility consists of two primary factors: responding to changes in an appropriate and timely manner, and leveraging these changes as opportunities to thrive and remain competitive (Roberts & Wang, 2021).

Agility in the supply chain relies on visibility gained through information sharing, which in turn enhances effective response ability to supply chain disruptions (Um & Han, 2021). Enhanced holistic visibility throughout the operations of the supply chain enables the network to respond agilely to impending disruptions, thereby strengthening the resilience of the supply chain (Purvis et al., 2016).

SC agility enables firms to keep an eye on environments that are highly unpredictable or unmatched interferences to proactively counter them (Naughton et al., 2020). SC agility guarantees a resilient supply chain by promptly adjusting delivery times or implementing alternative delivery plans when needs change (Al-Shboul, 2017). This research examined demand forecasting, inventory management, and decisiveness as agility indicators.

Demand forecasting involves future customer demand predicting for products or services to make informed decisions regarding inventory levels, production, and supply chain logistics (Fildes & Makridakis, 2021). Advances in AI and machine learning have improved forecasting models, but challenges remain in dealing with demand variability and sudden market changes (Chopra & Meindl, 2019).

In the realm of supply chain agility, decisiveness is the ability to make timely and effective decisions in response to shifting conditions in the market and unanticipated disruptions. Decisiveness is fundamental in adapting to rapid changes and disruptions, such as supplier failures or shifts in consumer demand which involve cross-functional teams and real-time data analysis (Gartner, 2023; Harrison & van Hoek, 2021).

Inventory management entails overseeing the ordering, storage, and use of inventory to maintain optimal stock levels that meet demand while minimizing holding costs (Heizer & Render, 2021). Technology such as the software for inventory management and tracking real-time systems can significantly elevate inventory control and accuracy (Silver et al., 2016).

2.3.4 Supply Chain Risk Management Strategies

Risk is a phrase that broadly encompasses: susceptibility, interruption, uncertainty, hazard, disaster, and peril (Zio, 2016). Various literature highlight supply chain disruption in floricultural firms as a result of: political unrest, employee strike, increased global supply chains, supply base complexity, leanness, natural disasters, extreme weather, excessive outsourcing, system failure and economic recession (Musau, 2017).

Such disruptions are cases of low impact, high frequency supply chain risks; else-ways, pandemics are low frequency, high impact events framing substantial supply chains risks (Kinra et al., 2019). The COVID-19 pandemic affirmed the significance of adapting, reacting, and establishing mechanisms for crisis management to endure situations of uncertainty (Joanna & Subramanian, 2021). Supply chain risk management practices focus on assessing, identifying, monitoring, and controlling all potential risk instigators in an entity (Wieland & Durach, 2021).

This research study examined three risk management strategies including risk acceptance, reduction of risk, and transfer of risk. Supply chain resilience is grounded on the fundamental postulation that all risks cannot be completely eliminated. Risk mitigation strategies are designed to reduce the force of both human-made and catastrophic events (Gurtu & Johny, 2021).

Ongisa (2016) asserts that entities ought to identify and explore their exposures to risk so that they are able to implement risk abatement plans. Effective supply chain risk mitigation seeks to either eliminate the prospect of a risk occurring, minimize its force, or divert to a third party its outcomes (Sodhi & Tang, 2021). Technology has the prospect of significantly augmenting decision-making during severe disruptions and to enhance resilience (Ivanov et al., 2019).

2.3.5 Supply Chain Technology

Information technology (IT) has revolutionized supply chains positively by improving competitiveness, coordination, sharing information, efficiency, responsiveness and improved sensing and analysing information equipping firms to deal with unforeseen events swiftly (Minhao et al., 2021). Dubey et al. (2019), posit that the information sharing and processing capabilities, which are beneficial for recovering from disruptions are enhanced by IT. Firms leverage IT to share detailed information, enabling them to be aware of the change trends in the environment and develop restoration options for disruptions in the supply chain (Minhao et al., 2021).

According to Van (2020) supply chains are risk prone due to their nature that is robust and multifaceted hence big data analytics—a Blockchain technology—can greatly aid in managing supply chain risks. Applying Blockchain technology to supply chain problems guarantees enormous benefits (Van, 2019). The Internet of Things (IoT) technologies — sensors and devices that collect and transfer data—yield greater efficiency in decision-making and management (Jake et al., 2019). Enabling technologies for IoT systems are: data security, data hubs, and technologies for accountability—big data analytics and Blockchain (Jake et al., 2019).

The IT infrastructure and big data analytics equip firms to adapt to unpredictable interruptions (Minhao et al., 2021). The novelty and resilience of supply chain performance is augmented by big data analytics (Mohammad et. al, 2022). In disaster management, Big data analytics plays a crucial from its capacity to anticipate, envisage, and analyze disasters (Akter & Wamba, 2019).

Artificial intelligence, automation and robots are increasingly used to reduce human contact, by doing tasks requiring close proximity, which was a major test in Covid-19 crisis (Minhao et al., 2021).Internet, provided procurement best-practices counteracting the economic recession from COVID-19 (Staal, 2020). ISM website guided on short and long term actions; CIPS website guided on long-term change:-decentralised storage, invest in ERP systems, warehousing and distribution reassessment, access to flexible capacity, improved risk management, re-assess critical suppliers list and improve emergency operations (Green, 2020).

Digital procurement tools were crucial in reducing the need for face-to-face meetings (social distancing) with their ability to locate and pick innovative suppliers with a mobile app: for example e-auction or e-tender (RFx) systems are helpful when sourcing for new suppliers (Procurement & SMEs & Digitisation Dragons, 2017; Green, 2020). Although the crisis disrupted the global supply chain, other entities depended on their global solid IT connections with partners for continued production and sales (Minhao et al., 2021).

Wamba et al. (2020), aver that IT built supply chain resilience and retained operation stability during the COVID-19 pandemic. IT exploitation deals with efficiency while IT exploration highlights operations flexibility, which could encompass diverse effects on an entity's recovery (Koryak et al., 2018; Minhao et al., 2021). However, using ICT in business operation is no guarantee for performance as it depends on technology, adoption degree and correct usage ability (Hernandez, Galindo, & Colin, 2015).

Technology provides a platform for enhancing the resilience of supply chains. E-supply chain collaboration refers to a firm's capability to leverage e-business applications for coordinating activities, facilitating online collaboration processes, and supporting the knowledge and information exchange with its partners (Al-Omoush et al., 2023).Technology advancement and cloud-based business solutions have by far revolutionized agility in supply chains and generally the performance of entities (Baah et al., 2021; Al-Omoush et al., 2023).

2.3.6 Performance

Organizational performance is the assessment of how successfully an organization meets its objectives (Goyal & Mishra, 2016). Naresian (2019) agree that organizational performance entails measuring a firm's real results against planned outputs. Kapsali et al. (2019) concur that performance it that element of an entity's measurable processes. Firms with a clear objective of fostering supply chain resilience need to assess their performance (Singh et al., 2019).

Supply chain performance consists of established measurement criteria used to assess the competence and capability of the supply chain (Özkanlısoy & Bulutlar, 2023). The reason of measuring performance in entities is to illuminate the organization's processes, review if customer needs are met, validate existing knowledge or divulge unknown factors, and identify problems, bottlenecks, and waste (Neely, 2020). Performance therefore helps in measuring organizational progress and achieving goals.

Firms can evaluate performance through various measures and the choice of appropriate performance metrics is key in being successful. Ivy et al., (2019) posit that performance is contingent on growth of sales, yearly gross margin, customer approval, and return on investment. Conversely, Shradha et al. (2017) and Amit et al. (2016) aver that organisational performance is a measure of cycle time reduction, cost savings, reduced defects, revenue growth, better asset utilization, improved superior customer service, stronger competitive position, value delivery to customers, improved profits, and quality improvements.

We have financial or non-financial measures describing capacity, costs, levels of service, and lead times (Maqsood & Finegan, 2020). Other metrics are: timely delivery, reliability, quality, productivity, profit, customer satisfaction, inventory and forecast accuracy (Paranjape & Hande, 2018). The Industrial Organization Theory states that, firm performance is closely related to the industry performance and typically subjected to structural components like; price, input costs, collusions, product diversification among others (Jean, 1988).

A disaster response operation entail trade-offs of cost saving, accuracy and speed (Wakasala, 2020). This study adopted three metrics: cost, responsiveness, and continuity. Cost metrics measure the financial expenditures related to supply chain activities, including procurement, production, and logistics. They help assess the financial performance and operations efficiency (Christopher, 2016).

Responsiveness metrics gauge how quickly a supply chain adjusts to variations in supply or demand interruptions. These metrics are critical for assessing the agility and adaptability of supply chain operations (Aitken et al., 2020). Continuity metrics assess the proficiency of supply chain to maintain operations and overcome interruptions. They focus on ensuring that business processes continue smoothly even in the face of challenges (Brotby & Buehler, 2018).

2.4 Empirical Review

The section covers the empirical research from pertinent academic literature concerning various variables and gaps associated with this study.

2.4.1 Supply chain collaboration Strategies and Performance

Scholten and Schilder (2015) in their study "The Role of Collaboration in Supply Chain Resilience," explored the impact of collaborative activities on visibility, velocity, and flexibility within the food processing industry in the Netherlands. Their exploratory case study, which involved eight buyer-supplier relationships, identified several key collaboration activities such as: information exchange, collective communication, jointly relationship efforts, and created knowledge that significantly contribute to SC resilience.

However, while the study provides valuable insights into the mechanisms through which collaboration enhances resilience, it focused exclusively on Netherlands' food processing industry and did not address these mechanisms' resultant effect on performance. Our study examined how collaboration metrics- information sharing, visibility, and strategic partnerships-affected performance specifically within the Kenyan floricultural sector.

Naburuk (2018) did a research titled “Supplier Collaboration and Supply Chain Resilience among Relief Organizations in Kenya.” Utilizing a descriptive research design and a sample of 15 organizations, findings indicated an insignificant association between supplier collaboration and resilience among the organizations. Challenges identified included inadequate preparation and organization in crises, disaster anticipation inability, distrust among parties, and insufficient information about disaster. However, the study highlighted the necessity for more research on this topic and also exploring more variables that could influence supplier collaboration and resilience.

Our study built on those findings by adopting three collaboration indicators—supply chain visibility, information sharing, and supplier partnership—and examined their effects on performance within the Kenyan floricultural sector, aiming to give a subtle understanding of how collaboration influences performance in a different geographical and industry context, thereby offering new insights and practical implications for the floricultural industry.

Thi et al. (2020) researched on “Supply Chain Collaboration and Performance: An Empirical Study of Maturity Models,” focusing on the relation between supply chain collaboration mechanisms specifically, maturity levels and performance outcomes. Based on case studies from garment and textile industry in Switzerland, they found internal collaboration mechanisms—operations management and integration—moderated the relation between performance and external integration.

However, their study was limited to Switzerland and did not explore specific collaboration indicators like supply chain visibility, information sharing, and strategic partnerships in relation to performance. The current study addressed these gaps by focusing on Kenyan floricultural firms in Nakuru County. By broadening the scope to a different context, this study offered a more wide spread perceptive on supply chain collaboration effects on performance.

Umar and Wilson (2021) conducted a research titled "Supply Chain Resilience: Unleashing the Power of Collaboration in Disaster Management," employing a multiple case study to investigate collaboration in supply chains of food at two South Asian areas frequently affected by acts of nature. Their findings highlighted that mutual dependence, effective communication, trust, information sharing, and informal financial support are critical components of supply chain collaboration enhancing resilience in light of natural disasters.

However, their study was confined to the food supply chains and did not explore other crucial indicators of collaboration, such as visibility in supply chain and strategic supplier partnerships, nor did it examine their specific effects on performance. As such, this research addressed these gaps by investigating how these metrics impact performance in the Kenyan floricultural sector, particularly in Nakuru County. By broadening the scope beyond food supply chains and focusing on these additional collaboration indicators, the current study presented more comprehension on how these factors influence supply chain performance and resilience.

Mansoor and Mahour (2021) assessed the impact of various practices namely: collaboration, redundancy, agility, and flexibility on curtailing different types of supply chain disruptions—environmental, process, demand, control, and supply. They ascertained collaboration as the most critical strategy for managing control disruptions, while flexibility emerged as key for addressing process, demand, environmental, and supply disruptions. However, their study did not specifically address the specific indicators of collaboration like: information sharing, supply chain visibility, and strategic partnerships which the current study examined and their effects on performance in Kenya flower firms

Jraisat et al. (2021) investigated the "role of focal actors and their dyads in fostering sustainable collaboration within agri-triads", focusing on the sharing of information along SCs. They employed a multiple-case approach through 42 interviews, observations and documentaries and highlighted the benefits of collaborative systems within the triad structure.

Their findings emphasized the merits of SC collaboration, such as enhanced sharing of knowledge and improved use of expertise and products. However, these scholars did not delve into specific collaboration strategies like supply chain visibility and strategic partnerships, and their direct effects on performance, a gap the current study filled by examining these strategies' impression on performance in the Kenyan flower sector.

Al-Omoush et al. (2023) examined the interplay between value co-creation, collaborative innovation, agility; and e-supply chain collaboration. Their study utilized empirical data from 221 managerial participants across key industries and employed the approach of Smart-PLS-SEM for analysis. The results revealed that e-supply chain collaboration impacts value co-creation, agility, and collaborative innovation.

While their research provides important cognition on the e-supply chain collaboration role of in elevating various aspects of performance, it primarily focuses on the technological aspects of collaboration and its broader impacts on innovation and agility. Conversely, the current study delved into specific collaboration metrics—visibility, sharing information, and strategic partnerships—and explored their direct effects on flower firms' performance in Nakuru County, Kenya.

2.4.2 Supply chain Flexibility Strategies and Performance

Arani et al. (2015) investigated "Enhancers for Supply Chain Resilience in Kenyan Manufacturing Firms" using a cross-sectional survey design with a sample of 62 Nairobi firms. The study identified flexibilities in order fulfillment, production capacity, and sourcing, as significant predictors of supply chain resilience. The current study extends these researchers' work by exploring additional flexibility indicators-specifically, delivery flexibility and production flexibility-within the context of floricultural firms in Kenya, Nakuru-County.

Gupta et al. (2019) researched on "Leveraging Smart Supply Chain and Agility of Information System for Flexibility in Supply Chain." The research provided theoretically grounded guidance for achieving higher levels of flexibility in variable situations and utilized the method of Partial Least Squares (PLS) to investigate the theoretical framework empirically. The analysis was based on 150 respondents.

Findings revealed a positive relation between smart supply chain management and flexibility of information system, contributing to enhanced supply chain flexibility. However, their study focused on theoretical and empirical aspects of flexibility in general conditions. Our study extended these scholar's findings by examining specific flexibility metrics such as re-engineering, delivery flexibility, and production flexibility, and their effects on floricultural firms' performance of in Kenya, Nakuru-County. The current study offer practical insights into how these strategies can be effectively implemented to enhance resilience and performance in the floricultural sector.

Muricho and Muli (2021) conducted research on the "Influence of Supply Chain Resilience Practices on Kenyan Food and Beverages Manufacturing Firms Performance " Using a cross-sectional survey design with a sample of 101 firms in Nairobi, the study employed questionnaires for data collection and performed linear regression and correlation analysis. The findings identified collaboration, risk management, agility, and integration considerably influenced the performance of these firms.

However, their study focused solely on the food and beverages sector and did not include flexibility as a resilience strategy. The current study extended their research by examining specific flexibility metrics-supply chain re-engineering, delivery flexibility, and production flexibility in the context of floricultural firms in Nakuru-County, Kenya. Thus the current research provided up-to-the-minute perspectives on the role of flexibility in amplifying resilience and performance in a different industry and geographic context.

Rajesh (2021) did an empirical study on flexible business strategies to support resilience in manufacturing supply chains. These were investigated on the supply, process, and demand fronts of supply chains. They used correlation amongst the constructs derived from survey-based research, afterward by dimensionality reduction of constructs through factor analysis. The exclusive items that measured flexibility of process, supply, pricing, and product strategies were confirmed to be correlated strongly. The findings assist managers in making decisions about implementing flexibility to improve resilient supply chains. This study explored the effects of re-engineering supply chains, delivery, and production flexibility on performance in floricultural firms in Kenya.

David et al. (2021) investigated "COVID-19 and the Pursuit of Supply Chain Resilience". Their research aimed to provide contemporary insights into how logistics service providers have adapted to the pandemic caused disruptions. Employing interpretive research methodologies, the study identified five key areas where the firms put their efforts: creating new revenue streams, enhancing transport flexibility, enforcing data management and digitalization, optimizing logistics infrastructure, and improving personnel capacity.

These strategies were crucial in maintaining operational continuity and supply chain resilience during the pandemic. Based on their findings, flexibility is coming out as a key resilience strategy in disruptions of which this study investigated particularly re-engineering supply chain, flexibility in delivery and also production flexibility and their impact on performance in floricultural firms in Nakuru-County, Kenya.

Maxim et al. (2022) conducted a study titled "Adapting Supply Chain Operations in Anticipation of and during the Pandemic—COVID-19." Their research explored the outcome of vigilance and recovery decisions on supply chain operations and performance, focusing on two-stage and three-stage supply chains across various pandemic contexts. They found that two-stage supply chains are more vulnerable to disruptions but recover more positively due to lower system inertia.

The study emphasized that proactive adaptation before a pandemic is more beneficial compared to reactive measures during the pandemic, which can improve operational recovery. In relation to their findings, this study specifically investigated supply chain re-engineering, delivery, and production flexibility in floricultural firms in Kenya. The current study revealed unique insights into how the strategies can enhance performance and resilience.

Dilek et al. (2022) in their study "Supply Chain Resilience during the COVID-19 Pandemic", focused on understanding how effectively available options supported resilient supply chains in the perishable goods market—UK. A model of research was formulated and evaluated using covariance-based structural equation modeling. Data was drawn from 282 respondents.

Findings highlighted that reactive and proactive approaches contributed to building resilience. Among the various factors, innovation emerged as the optimal in enhancing resilience; others were: risk management, empowerment, and robustness. Building on this, the current study also explored how flexibility metrics—re-engineering, delivery, and production flexibility—impacted Kenyan floricultural farms' performance in Nakuru County. The emphasis on flexibility aligns with the idea that innovation is closely tied to the ability of a firm to adapt and react effectively to changes.

Minhyo and Aaron (2022) researched on "Supply Chain Resilience and Operational Performance amid COVID-19 Interruptions". They indicate that many Korean manufacturers navigated challenging supply chain dynamics and ensured uninterrupted operational performance during the pandemic. Their research focused on identifying the key elements that strengthen resilience and enhance operational effectiveness offering insights into ways manufacturers might sustain uninterrupted operations even amid dynamic disruptions. They examined six key variables: operational performance, intention of management, orientation of supply chain disruption, adoption of innovation, capability of digital infrastructure, and supply chain resilience.

These variables highlight the importance of flexibility in maintaining resilience and performance. To build on these findings, the current study explored flexibility resilience metrics—re-engineering of supply chain, flexibility in delivery, and flexibility in production—and their impact on performance within the Kenyan floricultural sector. This examination aligns with the idea that flexibility, supported by variables like innovation adoption and digital infrastructure, is key to fostering resilience and operational performance across different contexts.

Piprani et al. (2022) engaged in a study to identify and prioritize factors contributing to resilient capabilities during various phases of supply chain disruptions in Pakistan's textile sector. Their research underscored the importance of establishing an integrated supply chain ranking to enhance resilience and highlighted the readiness phase as the most critical for building resilience.

The study provided industry-specific guidelines on essential resilient capability factors for effective implementation. Based on their findings, flexibility was identified as a key resilience strategy during disruptions. Building on this, the current study examined how specific flexibility metrics namely—re-engineering of the supply chain, delivery flexibility, and production flexibility—affect performance in floriculture firms in Nakuru-County, Kenya.

2.4.3 Supply chain Agility Strategies and Performance

Tukamuhabwa et al. (2015) conducted a broad review titled "Supply Chain Resilience: Definition, Review, and Theoretical Foundations for Further Study." Their research involved a methodical analysis of 91 articles on supply chain resilience (SCRES), identifying various strategies to enhance resilience. Key strategies included fostering collaborative relationships, increasing flexibility, improving agility, and creating redundancy. They proposed the CAS theory as a suitable framework for reviewing SCRES, highlighting it shares characteristics with CAS, such as adaptation, co-evolution, non-linearity, self-organization, and emergence.

Building on their findings, the current study focuses on specific agility indicators—demand forecasting, decisiveness, and inventory management—and examines their impact on flower firms' performance in Kenya, Nakuru County. By applying the insights from CAS theory and addressing key agility metrics, we aim to contribute to a deeper appreciation on how these factors manipulate resilience and performance in a floricultural sector and a growing economy.

Al-Shboul (2017) researched on the manufacturing supply chain agility and the infrastructure framework aiming to examine how time to market and delivery reliability affect the relation of infrastructure framework and agility of supply chain. Further, the study examined the effect of agility on organizational performance. Data were gathered from 113 respondents across 12 countries through a large-scale survey, and the research framework was evaluated through hypothesis-testing and structural equation modeling with covariance-based analysis.

The findings revealed that agility positively affected firm performance. Drawing on these insights, the current study focuses on three specific agility indicators—demand forecasting, decisiveness, and inventory management—and examined their impact on floricultural firms' performance in Kenya, Nakuru-County.

Altay et al. (2018) investigated the impact of agility and resilience of the supply chain on performance while organizational culture was the moderator. Utilizing the view of dynamic capability, they developed theoretical paradigms for different segments within humanitarian supply chains. Their study, based on partial least squares analysis of 335 responses collected through questionnaires in India, established that both agility and resilience of supply chains are crucial transformative capabilities with major impact on pre-crisis performance. However, while resilience was found to significantly impact post-crisis performance, agility was insignificant.

This insignificance might be ascribed to the characteristics of humanitarian supply chains, where other factors may overshadow agility. We hypothesized that, due to the specific challenges faced by floricultural firms, agility may have a different impact on performance, warranting further investigation. Since the floricultural sector is highly sensitive to global disruptions, agility could therefore play a more pronounced role in performance. Our study aimed to explore this possibility by focusing on industry-specific agility measures like—decisiveness, forecasting demand, and management of inventory.

Naughton et al. (2020) investigated supply chain agility (SCA) as a process for acclimating to uncertainty in environment and organizational vulnerabilities, particularly within SMEs. The study explored how SMEs develop and apply SCA in reaction to these challenges. Findings emphasized that the attitude of an organizational play a significant role in shaping how SMEs interpret and address indeterminacy and deficiencies in the environment, and how they develop SCA.

Key factors identified include: supply chain relationships, resource constraints, access to information, and inter-organizational power dynamics. Building on these insights, the current study examines three specific agility indicators—decisiveness forecasting demand, and inventory management—and their effects on floriculture firms' performance in Nakuru-County, Kenya.

Schmid et al. (2021) conducted a study titled "COVID-19 and Business Continuity - Learning from the Private Sector and Humanitarian Actors in Kenya." This study utilized a qualitative case study approach to explore how COVID-19 affected business continuity in Kenya. The study used semi-structured online interviews and respondents were identified through a snowball sampling method.

The study highlighted the potential for an agile, simplified, and accessible business continuity strategies that could be useful in future disruptions but leaves room for further exploration of the specific agility indicators that ensure continuity during such disruptions. To address this gap, our research—decisiveness, forecasting demand, and inventory management—and their impact on floricultural firms' performance in Kenya.

Muricho and Muli (2021) researched on the “Influence of Supply Chain Resilience Practices on the Performance of Food and Beverages Manufacturing Firms in Kenya.” They used cross-sectional design to collect data from 101 firms in Nairobi City via questionnaires and analyzed it with descriptive statistics. Their findings indicated that agility positively impacted firm performance by enabling flexible and swift responses to emerging needs.

However, the study left out other economy sectors and did not consider specific agility indicators like demand forecasting, decisiveness and inventory management which the current study addressed and their effect on floricultural firms’ performance in Kenya-Nakuru County.

Scholz and Anna (2021) studied “Capabilities and Consequences of Supply Chain Resilience: The Moderating Role of Digital Technologies,” focusing on how agility and integration of the supply chain enhance resilience in Germany's manufacturing industry. They equally inspected the effect of these capabilities on operational performance, moderated by digital technologies.

Their findings underscored the significance of supply chain agility and integration but did not detail specific agility indicators. Building on their insights, the current study investigated specific agility metrics as: demand forecasting, decisiveness, and inventory management and their effects on performance of flower firms in Kenya.

Esra et al. (2022) conducted a study titled “Resilience and Complexity Measurement for Energy Efficient Global Supply Chains in Disruptive Events,” focusing on the COVID-19 impact on supply chains globally, particularly in energy management between Turkey, the EU, and China. Their research analyzed how various countries' reaction to the pandemic influenced supply chain complexity and resilience. They found that while Turkey's situation was unique, most countries showed improved handling of disruptions in the pandemic’s second wave compared to the earlier one.

This improvement was attributed to increased agility and responsiveness gained from initial experiences. The current study addressed the gap in specific agility metrics not indicated by investigating decisiveness, forecasting demand, and management of inventory in the floriculture sector in Kenya, Nakuru-County. By applying these principles to a different region and industry, we aimed to improve global supply chain management, particularly in sectors sensitive to global disruptions.

Minhyo and Aaron (2022) conducted a study on operational performance and supply chain resilience amid the interruptions of COVID-19, which explored how manufacturers in Korea navigated the challenges of dynamic supply chains throughout the pandemic while maintaining operational performance. Their research identified key critical factors that contributed to building and sustaining uninterrupted operations by examining six key variables: digital infrastructure capability, disruption orientation, supply chain resilience, management's intention, innovation adoption, and operational performance.

The current study focused on additional agility indicators, specifically demand forecasting, decisiveness, and inventory management and how these metrics influence floricultural firms' performance in Kenya, Nakuru-County a sector also impacted by global disruptions.

Ivanov (2022) explored the concept of a "Viable Supply Chain Model: Integrating Resilience, Agility, and Sustainability-Thinking Beyond the Pandemic-COVID-19." The study presented the supply chain cloud as a novel research domain, emphasizing its characteristics such as digital supply chains, multi-structural dynamics, visibility, and ecosystems. Key features included entwined supply networks, service composition flexibility, evolving buyer/supplier roles, viability, and resilience within a circular economy framework.

The research provides valuable insights into these advanced supply chain concepts, but does not focus specifically on traditional agility indicators. The current study addressed this gap by examining decisiveness, forecasting demand, and management of inventory as specific agility measures and evaluating their effects on floricultural firms' performance in Kenya, County of Nakuru.

2.4.4 Supply Chain Risk Management Strategies and Performance

Ongisa (2016) investigated how supply chain risk management strategies affect output in Kenyan foods and beverage processing firms. Using a census method, 187 firms were targeted and data collected from senior-level managers through questionnaires. Descriptive and inferential statistics were employed.

The findings revealed a direct connection between risk management and performance of organisations, indicating that risks in the supply chain have an effect on performance when they materialize. The study recommended that organizations identify and consider all risk exposures and implement plans on risk reduction to enhance production. Building on these findings, our study examines risk accepting, reduction of risk, and risk transferring strategies and their effect on floricultural firms' performance in Nakuru County, Kenya. By specifically focusing on these strategies, the current study aimed to offer an in-depth exploration of how they influence performance in a different sector.

Ray et al. (2020) researched on, "Supply Chain Risks"-An examination of the factors affecting identifying risk, detecting, and mitigating within the food supply chain. The study utilized expert interviews with 100 professionals and a comprehensive field survey of 512 respondents. The aim was to discover risks affecting the efficiency of the agri-food supply chain and through exploratory factor analysis to pinpoint critical factors influencing risk detection, identification, and mitigation strategies.

The research identified key enablers of supply chain risk management, including remuneration, cooperation, and postponement. However, the study did not explore specific risk alleviation metrics like risk accept, reduction, and transfer which the current study addressed and inspected their effects on floricultural firms' performance in Kenya, Nakuru-County.

Gurtu and Johny (2021) researched on risk management in supply chain by reviewing the open literature on risk factors in SCM within competitive and uncertain business environment. Their research posits that risk management in supply chains is a crucial constituent of the supply network and that effective risk alleviation measures can significantly reduce the force of both artificial and natural crises.

Building on this foundation, our study focuses on specific risk management strategies as—risk accepting, reduction, and transfer—and examined their effects on floricultural firms' performance in Nakuru-County, Kenya. By exploring these mitigation strategies, the current study aimed to enhance the comprehension of their role in supply chain resilience and performance in a precarious floricultural sector.

Debashree et al. (2021) researched on "Building supply chain resilience in the COVID-19 era". They aimed to determine key factors disrupting supply chains globally and assess risk reduction tactics for enhancing resilience. Their findings highlighted that cost optimization emerged as the most crucial element in decreasing supply chain vulnerabilities, while human resource management was the least. The current research built on these insights by focusing on specific risk mitigation strategies—accept risk, reduce, and transfer—and examined their effects on the floricultural firms' performance in Kenya, County of Nakuru.

Sodhi and Tang (2021) provided a thorough overview of supply chain risk and resilience, highlighting various types of risk mitigation strategies such as risk transfer and proactive management techniques, and proposed future research directions that include integrating advanced technologies and creating dynamic risk management frameworks. However, their study lacks specific insights into how these strategies can be tailored to different industries, such as floriculture. Additionally, other risk management strategies like risk acceptance and risk reduction remains underexplored. The current study addresses and inspect these strategies and their effects on the floricultural firms' performance in Kenya, Nakuru-County.

Joanna and Subramanian (2021) researched on "Covid-19 Impact on Health Supply Chain -Preliminary Evidence from Africa". Their study employed an online questionnaire and a desk review of accessible literature. The findings underscored the critical need for effective reaction, adaptation, and crisis management mechanisms to handle uncertainties brought about by the COVID-19 pandemic. Building on these insights, our study investigates—acceptance, reduction, and transfer—as risk management strategies and examines their effects on the floricultural firms' performance in Kenya, Nakuru-County.

Maxim et al. (2022) researched on "Supply Chain Operations Adaptation in Anticipation of and during the Pandemic-COVID-19". Their study investigated how recovery decisions and preparedness impact operations and performance in supply chains during a pandemic. The findings indicated that supply chain operations that are adapted in expectancy of a pandemic is more beneficial than relying on recovery policies deployed during the pandemic.

Building on this perspective, our study examines risk acceptance, reduction, and transfer strategies and their effects on the floricultural firms' performance in Kenya, Nakuru-County. By focusing on these risk management strategies, the current research provided insights into how proactive and reactive approaches to risk management influence floricultural supply chain resilience and performance.

Minhyo and Aaron (2022) investigated why many Korean manufacturers were able to withstand significant supply chain disruptions and maintain operational performance during the pandemic. Their study explored the predecessors of operational performance and supply chain resilience, aiming to provide recommendations for developing and sustaining continuous operations in the midst of ever-changing supply chains and worldwide disruptions.

They utilized Partial Least Squares Structural Equation Modeling to scrutinize six variables: intention of management, operational performance, capability of digital infrastructure, SCRES, adoption of innovation, and orientation of SC disruption. Building on their insights the current study focused on risk management strategies—acceptance, reduction, and transfer—and their effects on the floricultural firms' performance of in Kenya, Nakuru-County.

Mwangi and Osoro (2024) assessed the impact of supply chain complexities on the performance of flower exporting firms in Nakuru-County, Kenya. Their research examined the effects of operational and external complexities on performance, steered by Resource-Based and Prospect theories.

Using a descriptive design, 172 respondents were surveyed. They recommended that flower exporting firms in Nakuru County adopt a proactive approach to managing external risks and uncertainties. Building on these recommendations, the current research examined the strategies of risk management as—risk accept, reduce, and transfer—and their effects on the floricultural firms' performance in Nakuru-County, Kenya. By focusing on these strategies, our study aims to enhance the perceptive of how proactive risk management approaches contribute to supply chain resilience and performance in the floricultural sector.

2.4.5 Supply Chain Technology and Performance

Peterson et al. (2015) did a study in Kenya on "Does Supply Chain Technology Moderate the Relationship between Supply Chain Strategies and Firm Performance?" Using a sample of 138 firms, they employed descriptive statistics, correlation, and regression analyses to test their hypotheses. Their findings revealed SC technology was significant in moderating the relationship between SC strategies and firm performance.

By extending their research, this study sought to understand how technology impacts the efficacy of resilience strategies in the floricultural sector. Specifically, the current study examined the degree to which supply chain technology moderated the relationship between supply chain resilience strategies and the floricultural firms' performance in Nakuru-County, Kenya.

Lamba and Singh (2017) conducted a comprehensive review on "Big Data in Operations and Supply Chain Management: Current Trends and Future Perspectives." Their study focused on the incorporation of big data into supply chain management and operations by examining past literature. They identified three key areas where big data has been applied: manufacturing, procurement, and logistics. Additionally, their paper proposed various applications of big data within these domains.

Building on their insights, the current study delves into a related aspect by investigating how supply chain technology moderates the relationship between the strategies of supply chain resilience and performance within the context of floriculture firms in Nakuru-County Kenya. The aim was to extend the understanding of the role of technology in enhancing supply chain effectiveness.

Jake et al. (2019) undertook a research on transparency in food supply chains: enabling technology solutions. They focused on technologies that enhance transparency in food supply chains, with a particular emphasis on the Internet of Things (IoT). The IoT enables comprehensive data collection across various phases of the supply chain, fostering a more visible and data-driven food production system. They also examined blockchain and big data analytics, which improve transparency and efficiency.

Building on their insights, the current study examined how supply chain technology moderates the relationship between supply chain resilience strategies and performance within the context of floriculture firms in Kenya, Nakuru-County.

By integrating concepts from IoT and other enabling technologies, the current study aimed to understand how advancements in technology implicate resilience strategies and overall performance in the flower sector.

Dubey et al. (2020) conducted a research study on “Big data analytics and artificial intelligence: pathway to operational performance” under environmental dynamism (ED) and entrepreneurial orientation (EO) effects. They surveyed 256 manufacturing firms in India using a questionnaire. Their findings expanded the dynamic capability view and contingency theory, offering insights into how organizations can enhance their dynamic capabilities by aligning EO with technological capabilities. Building on these insights, the current study explored how these technologies influence the effectiveness of resilience strategies and overall performance in the floricultural sector by investigating their moderation effects.

Minhao et al. (2021) explored "The Impact of IT Usage on SC Resilience and Performance: An Ambidextrous View." Their research on 206 China manufacturers, examined how IT contributes to enhancing resilience in the supply chain and if this resilience builds firm performance and delivers value to clients. The study found that client and supplier resilience positively impacted supply chain performance. Additionally, the complementary use of exploitative and explorative IT strategies enhances customer resilience. The current study built on these findings by investigating how supply chain technology moderates the relationship between supply chain resilience strategies and floriculture firms’ performance in Kenya, Nakuru-County.

Wamba et al. (2020) studied the role of artificial intelligence (AI) on performance of firms. They aimed to analyze how AI impacts firm performance, particularly by leveraging AI-based transformation projects to enhance business value. The study reviewed 500 case studies and found that firms are increasingly taking on AI technologies to adjust to or disrupt their ecosystems while cultivating and enhancing their competitive and strategic advantages. Building on these insights, the current study examined how supply chain technology moderates the relationship between supply chain resilience strategies and floriculture firms' performance in Kenya, Nakuru-County.

Akwalu (2022) explored how inter-organizational systems moderated the relationship between SC relationship management and Kenyan pharmaceutical firms' performance. Using a descriptive design and sample of 171 firms, the study employed multiple regression analysis and found that IT system integration significantly improved performance in areas like service speed, quality, waste reduction, inventory management, responsiveness, and lead times.

Building on the findings, the current study investigated whether supply chain technology moderated the relationship between supply chain resilience strategies and performance in floriculture firms in Kenya, Nakuru-County. The current research examined how technological integration impacts resilience strategies and overall performance in the floriculture sector.

2.5 Summary of Reviewed Literature

From the above systematic literature review, the specific supply chain resilience strategies a firm uses ensure continuous and stable supply and are essential for a company's survival and success in case of major disruptions. The impact of Covid-19 pandemic and potential future challenges drives us to reconsider resilience in supply chain management and performance sphere. Supply chain resilience strategies were already a priority prior to the pandemic; however, they have taken on a different and more significant role today.

Resilience is the ability of a supply chain to prepare for uncertain developments, respond quickly, and rebound from the interruption. The current study investigated collaboration, agility, flexibility and risk management resilience strategies, and the performance of floriculture firms in Kenya, Nakuru-County. Visibility of supply chain, sharing information, and supplier strategic partnership were identified as key variables for collaboration. Re-engineering, production and delivery flexibility were key flexibility variables while agility variables were: demand forecasting; decisiveness and inventory management.

Risk mitigation eliminates the possibility of a risk occurring, shift to a third party and establishes contingency plans. Technology boosts resilience and performance in supply chains. By adopting new technology, supply chain managers can make decisions more quickly and forecast demand with greater accuracy and prepare for unexpected events. Technology was therefore examined as a moderator in this research.

Supply chain performance was viewed as the overall set of indicators that were used to estimate both the competence and capability of the supply chain. This study used cost, continuity and responsiveness as performance measures. This study was built on five theories which provided a look at the firm in relation to risks and how to remain resilient. Relational theory competencies like the developed supplier relationship positively relate to SC resilience.

Contingency theory shows the need for firms that operate in a volatile environment to adapt and survive by making strategic decisions, being pro-active, flexible, and re-designing structures. CAS theory posits that a sequence of finest decisions within a company depends on both external and internal issues, and that aligning organizational structure with processes will result in improved operations.

Agency theory shows that a risk-sharing problem occurs when the agent and the principal possess differing risk perceptions. Finally, TOE Model focused on internal and external factors affecting adoption, implementation and use of technological innovations to build supply chain resilience.

2.6 Summary of Research Gaps

Despite the extensive body of work on supply chain resilience, a distinct shortage exists of empirical inquiries specifically targeting floricultural firms, particularly in the context of Kenya. The Kenyan floriculture industry encounters a wide array of challenges that necessitate continuous and proactive strategies for mitigation.

Research by Musau (2017) and Khan (2020) has highlighted various disruptions and their causes within the sector. However, these studies mainly document the nature of these disruptions rather than offering concrete, actionable strategies for addressing them. They emphasize the necessity for additional research and investment to enhance resilience but fall short in providing specific implementation guidelines for firms.

Similarly, Mwangi and Osoro (2024) explored how supply chain complexities affect the performance of exporting flower firms in Nakuru County. They advocate for a proactive strategy for managing external risks and uncertainties but do not delve into detailed strategies or frameworks for such an approach. This gap underscores a critical need for additional research focused on developing practical solutions and frameworks that floricultural firms can employ to effectively manage and mitigate disruptions.

The existing research primarily addresses general challenges and offers broad recommendations, but falls short in providing detailed, actionable strategies customized to the specific needs of this sector. This is a gap the current study aimed to address by examining resilience strategies in supply chain specifically, risk management, flexibility, collaboration, agility, and also the moderating effect of supply chain technology between these strategies and performance of floriculture firms in Kenya, Nakuru-County.

While collaboration is extensively recognized as a crucial component of supply chain resilience, there is a noticeable lack of empirical works that center on how collaborative practices (information sharing, visibility and strategic partnership) can be effectively implemented within the floricultural industry.

The existing literature emphasizes the benefits of collaborative relationships and information sharing but does not delve deeply into how these practices might be operationalized to tackle the unique challenges faced by floricultural firms, such as demand fluctuations and perishable goods management. The research identifies flexibility as a fundamental strategy for enhancing resilience in the supply chain.

However, there is insufficient exploration of how different flexibility metrics, such as production capacity and delivery flexibility, can be practically applied in the floricultural sector. Existing studies often discuss flexibility in broad terms but do not provide specific, industry-relevant frameworks or solutions that floricultural firms can adopt to enhance their responsiveness to disruptions.

Agility is another critical factor for resilience in supply chains. While research highlights its salience in general, there are limited detailed studies focusing on how agility parameters (decisiveness, forecasting demand, and management of inventory) can be integrated into the operations of floricultural firms to enhance their capacity to adjust to sudden variations in demand and supply disruptions.

Research on risk management is extensive but, there is a deficiency of empirical works regarding their specific effect on floricultural firms. The existing literature tends to address risk management in broad terms, failing to provide detailed insights into how specific risk mitigation strategies like accept risk, reduce, and transfer can be adapted to the unique floricultural industry risks such as environmental factors and market volatility.

The contribution of technology in moderating the relationship between resilience strategies and performance is an emerging area of interest. However, there is limited research focusing on how supply chain technology impacts resilience in floricultural sector. While studies highlight the general benefits of technology and big data analytics, there is insufficient investigation into how specific technological advancements can elevate the efficacy of resilience strategies and elevate performance in these firms.

Addressing these gaps requires focused exploration that does not only explore the theoretical dimensions of resilience but additionally provides practical, industry-specific solutions. By investigating these areas, the current study offered informative insights and actionable recommendations for enhancing the resilience of floricultural firms in Kenya. Appendix (vi) summarises the gaps in research.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section comprises of the procedures and techniques employed for data gathering, processing, and analysis, specifically addressing the research design, philosophical approach, population of study, size of sample and selection technique, and data processing and analysis.

3.2 Research Design

Dawson (2019) describes research design as a systematic and organized inquiry designed to find solutions to a research issue. It is a logical plan that is structured to direct a research study. The research design used in this study was cross-sectional survey. Cross-sectional studies are in nature observational and analyze population data at a single point in time (Wang & Cheng, 2020). A cross-sectional study provides a glimpse of participants' attitudes, behaviors, or other target variables from a population study at a particular point in time (Christian et al., 2023).

Cross-sectional studies are valuable for providing groundwork evidence that can inform the planning of more advanced studies in the future (Wang & Cheng, 2020). Cross-sectional data can reveal associations between concepts; however, to effectively demonstrate causality and cause-and-effect relationships, research designs that determine the sequence of variables over time are needed (Christian et al., 2023).

This study employed a cross-sectional survey research design with a quantitative approach, as it focuses on measurement and analyzes data in numerical format to offer a concise description. Quantitative analysis is objective and relies on numerical data, producing generalizable findings (Bagshaw & Nissi, 2019). It applies the scientific method to analyze complex systems, seeking to understand problems and develop models to assess decision impacts.

By using natural science methods, it produces arithmetic data to determine cause-and-effect relations using statistical, mathematical, and computational techniques, involving data categorization, ranking, or measurement, and supports analysis with graphs and tables (Ahmad et al., 2019; Bagshaw, & Nissi, 2019). According to (Bagshaw, 2017), quantitative analyses are crucial for managerial decision-making as they help optimize resource use and support organizational growth and development.

Therefore, cross-sectional survey design was suitable for this study for the reason that it ensures an efficient and cost-effective execution (Christian et al., 2023). By employing questionnaires, the researcher collected extensive data once over a period of less than two months, analyzed it using standard statistical tools, and reported findings using figures and tables.

3.2.1 Research Philosophy

A research philosophy is the overarching framework where a researcher formulates choices concerning theories and methodologies. It pertains to the advancement and characteristics of knowledge.

Moser (2018) define it as the concepts, attitudes, and general belief of a person or a group. Three research philosophies prevail in the field of business and management research—interpretivism, positivism, and realism—of which interpretivism and positivism are the main philosophical frameworks guiding any scientific research (Willis, 2016).

Willis (2016) describes positivism as an epistemological stance that promotes the use of natural sciences in exploring social reality and other areas. Its primary emphasis is on what constitutes acceptable knowledge within a discipline. Positivism is exemplified by believing in a theory prior to conducting research, along with the statistical validation of conclusions drawn from experimentally verifiable hypotheses, the primary principle of social science (Dawson, 2019).

In this approach, Knowledge is considered valid if it is grounded in rationality and factual evidence, obtained through direct observations and experiences, and measured empirically using quantitative methods and statistical analysis (Moser, 2018).

Since the focus is to ascertain facts, the standards of quality are reliability and validity within this approach. The research philosophy that this study used is that of positivism since the variables of study are drawn from the reviewed empirical and theoretical literature; quantitative methods and statistical analysis was conducted to empirically measure results; and study respondents comprised of supply chain executives whose comprehension on the study variables is from experience and direct observations.

3.3 Target Population

Dawson (2019) defines population as the complete collection of individuals, items, or events possessing a shared observable trait. According to Moser (2018) target population is an entire segment of each object that possesses exclusive features that can be examined from a broader perspective. Target population therefore comprises a total set of objects, cases, or individuals with a number of common uniqueness. This study targeted a population of 101 floriculture firms in Nakuru County, drawn from the directory of Janifarm (2022) and Kenya Flower Council (2022).

Since the study focused on floricultural industry supply chain, the target respondents were those that were primarily engaged in supply chain and logistics and possessed the essential knowledge to provide dependable data. They included supply chain managers drawn from warehousing, purchasing, logistics, sales and production departments who filled the questionnaires. They were regarded as knowledgeable about issues related to the resilience of supply chains and the performance of their firms, which was this research's area of study.

3.4 Sampling Frame

A sampling frame is a tally of the entire elements from which to select a representative sample for a given study. It is a group of cases, respondents or records that are empirically chosen as a representative of the entire study population, and must be precise, accurate and representative of the total population (Moser, 2018). According to Dawson (2019) a sample frame represents a directory of sample items in the complete population from where the sample will be acquired.

The list could be of geographical areas, institutions, individuals, or other units. In the current study, our sampling frame consisted the directory of 101 floriculture firms in Nakuru County (Appendix V) compiled from various online resources majorly JanifarmDirectory (2022) and Kenya Flower Council (2022) directories.

3.5 Sample Size and Sampling Techniques

This section comprise of: determination on sample size and the sampling technique utilized in this study.

3.5.1 Sample Size Determination

A sample is a portion of the available population: Moser (2018) defines it as a collection of units representing the universe they are chosen from. The idea of sampling is to get a perceptive about some attributes or features of the entire population grounded in the sample characteristics (Noor et al., 2022). The researcher must make sure that the subdivisions entitled in the analysis are precisely addressed.

To establish the size of the sample, the researcher can calculate a sample size from published tables, use formulas or imitate the sample size of identical studies. In this study, the sample size was calculated by a formula derived from Yamane (1967) at a confidence level of 90% and a 10%preferred margin of error from a range of 5% to 10% because it was used by earlier researchers to achieved high respondents (Wanjala et al., 2017). Sample size was calculated as:

$$n = \frac{N}{1 + N(e^2)}$$

Where; n = sample size required

N = total population

e = margin error.

Therefore, $n = \frac{101}{1 + 101(0.1^2)}$

$n = 50.2$

$n \approx 51$ flower firms

51 flower firms were therefore chosen through a simple random sampling method. This technique ensures there is unbiased, equal probability and representativeness of the population (Noor et al., 2022).

3.5.2 Sampling Technique

This involves choosing a group of entities from a numerical population to approximate the complete population's characteristics (Brase & Brase, 2016).The key factor considered in sample size determination is the necessity to keep it manageable and representative enough of the entire study population. The study's respondents were managers from warehousing, purchasing, logistics, sales and production departments.

This study applied purposive sampling to pick one manager from each department where applicable as illustrated in table 3.1. These are key informants and can give more accurate and reliable information for this specific study. Purposive sampling entails a purposeful selection of specific units from the universe that will offer the most comprehensive information about the phenomenon under investigation (Moser, 2018).

Table 3.1: Sample Size

Department	Number of flower firms	Number of respondents	Total (Questionnaires)
Warehousing	51	1	51
Purchasing	51	1	51
Logistics	51	1	51
Production	51	1	51
Sales	51	1	51
			255 respondents

3.6 Research Instruments

Data gathering from respondents is achievable through the use of research instruments. Moser, (2018) avers that it is how information is sourced from designated study participants. The current study utilized survey questionnaires to gather primary data. They were structured with close ended questions that provided precise information thus reducing information bias and facilitated data analysis. A questionnaire is a research tool designed to collect extensive data samples by first converting research goals into targeted questions, where responses supply the data for testing hypotheses (Ali et al., 2018).

A Five-Point Likert scale was used to measure research variables and scale responses from the questionnaire. A Likert scale, which is a type of psychometric measurement is usually used in survey researches which employ questionnaires (Creswell, 2018). It permits a respondent to convey unfavorable or a favorable outlook to the subject in question (Piirainen & Gonzalez, 2015). Likert-type scale is suggested for researches relating to social sciences. To respond to an item in a Likert questionnaire, respondents specified their levels of disagreement or agreement with a series of remarks on a symmetric scale. This scale measures the intensity of their feelings regarding each item.

3.7 Pilot Test

A pilot test serves as a trial run and practice for the main survey (Creswell, 2018). Pilot testing is conducted to assess the validity and reliability of the instruments of research (Dawson, 2019). It is carried out to identify weaknesses in instrumentation and design while also providing substitute data for selecting a sample. Pilot testing provided a chance to identify and address a broad spectrum of possible issues with the research tool.

Pilot testing in this study allowed the researcher to verify whether the data collection tool functioned effectively by posing suitable questions and ensuring that the correct data was gathered. The widespread guideline is that the pilot test ought to constitute 10% of the sample size (Piirainen & Gonzalez, 2015). Dawson (2019) posits that 25-50 subjects from the population of study are usually picked for pre-testing the tools of measurement. The current study's sample size was 255 subjects.

In the present study, the researcher utilized 10% of the sample size—comprising 25 participants—who were involved in the pilot study to assess the accuracy of the questionnaires. Simple random sampling was applied to select 4 flower farms that were within the target population but not part of the sample and 1 flower firm in Ruiru, Nairobi, totaling 5 flower firms. Five managers, one from each department (warehousing, purchasing, logistics, sales and production departments) in each farm filled the questionnaire.

3.7.1 Reliability of the Research Instruments

The basis for pilot testing in this study was to evaluate the research instrument for likely weaknesses, achieved through reliability and validity assessments. For the reliability test, respondents must answer a research question consistently each time. Reliability refers to the stability or consistency of tools of measurement across diverse settings, ensuring that similar results are consistently achieved (Creswell, 2018).

Equivalence, stability, and internal consistency are the three facets of reliability: Equivalence is the level of agreement where more than one instruments are distributed almost simultaneously (Hajjar, 2018). The researcher did not use the equivalent form method because it demands a significant amount of time and lengthy overlapping questions which will make participants to answer untruthfully.

This research study used the method of internal consistency instead, because it enabled testing through the Cronbach's alpha statistic and is significantly more stable (Piirainen & Gonzalez, 2015). Hajjar, (2018) proposes that, for a test to exhibit internal consistency, the estimates of reliability must be established on the aggregate correlations among all individual items within the test. Cronbach's alpha was used to determine the dependability of the collected data.

Cronbach's alpha values vary from 0 to 1.0; where 1.0 is perfect reliability and0.70 is viewed as being below the acceptable threshold (Bryman & Bell, 2015). Hajjar, (2018) posit that when using Cronbach's Alpha coefficient for reliability testing, the value should exceed 0.7.In this research study, Cronbach’s alpha (α) was determined as:

$$\alpha = \frac{K}{(K-1)\,[1-(\Sigma\sigma k2 \,/\, \sigma total2)]} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$ Equation (1)

Where K = number of items

$\Sigma\sigma_k^2$ = sum of the k item score variances

σ_{total}^2 = variance of scores on the total measurement

From table 3.2, the Cronbach's Alpha value was 0.953 which is greater than the critical value0.7. Therefore, there was internal consistency between the questions on a 1 to 5scale.

Table 3.2: Reliability Statistics

Cronbach's Alpha	N of Items
0.953	6

It can further be observed in table 3.3, that the Cronbach's Alpha value for the response variable (performance) and all the independent variable were greater than 0.7 as required.

Table 3.3: Reliability Analysis for Constructs

Construct	Number of Items	Cronbach's Alpha	Conclusion
Supply Chain Collaboration Strategy	9	0.892	Reliable
Supply Chain Flexibility Strategy	9	0.871	Reliable
Supply Chain Agility Strategy	9	0.899	Reliable
Supply Chain Risk Management Strategy	9	0.867	Reliable
Supply Chain Technology	6	0.901	Reliable
Performance	9	0.905	Reliable

Overall Cronbach's alpha =0.953

From table 3.3, supply chain collaboration strategy had a Cronbach's alpha value of 0.892, supply chain flexibility strategy had a Cronbach's alpha value of 0.871, supply chain agility strategy had a Cronbach's alpha value of 0.899, supply chain risk management strategy had a Cronbach's alpha value of 0.867.

Supply chain technology had a Cronbach's alpha value of 0.901and performance had a Cronbach's alpha value of 0.905. The overall Cronbach's alpha value was 0.953, surpassing the threshold of 0.70. Therefore, the pilot study findings demonstrated that all six scales were reliable and were retained for further analysis.

3.7.2 Validity of the Research Instruments

Validity refers to the extent to which the results attained from the analysis of data accurately represent the aspect being investigated (Ali et al., 2018). It is the extent to which a test measures what it is supposed to measure (Dawson, 2019). Three forms of validity include: the first being face validity- indicating if a test appears to assess what it allegedly measures. As argued by Creswell (2018) a test may seem to be measuring something but not really measuring it at all.

The second is content validity- as (Creswell, 2018) posit, a good content validity presents adequate coverage of the study's inspective question and includes a representative sample of the universe; and finally, construct validity-the extent to which a tool measures accurately the theoretical construct it was designed to assess (Dawson, 2019). This study adopted content and construct validity.

In terms of content validity, the questionnaire was designed and actioned according to the study variables to ensure that the items for each variable were adequate and representative of the study's purpose and objectives. Hajjar (2018) gives two ways of content validity assessment: by asking several questions with reference to the study instrument or seek the opinions of field experts.

A researcher can ask survey development experts in their field of study to review and recommend any improvement on data collection tool so as to grant content valid data. Content validity was confirmed by consulting supervisors and two practitioners from the supply chain industry. They reviewed the questionnaire and provided recommendations for enhancing its validity. Their feedback was used to adjust the questionnaire for better clarity.

Conversely, construct validity depicts the extent to which the tools of measurement represent precisely what they are intended to measure (Hajjar, 2018). Common methods for assessing construct validity include: factor analysis, correlation tests, and item response theory models. In social sciences construct validity manifests because latent measures are repeatedly employed for factors that cannot be directly observed or measured (Dawson, 2019). Typical methods to assess this type of validity are correlation tests, item response theory models and factor analysis.

In this study, validity test for scale measurements was conducted using correlation. This is done by comparing the result of correlation coefficient for the data totals against the critical value in the correlation coefficient table where degrees of freedom equals N-2. If the calculated value exceeds the critical value at any level of significance, then the item/questions are concluded to be valid. From the correlation coefficient table 3.4, the critical value at 5% significance level is 0.138, with degrees of freedom N-2 (25-2 = 23 degree of freedom).

Table 3.4: Correlation between the Variables and the Total

Variable	Correlation
Performance	0.879
Supply Chain Collaboration Strategies	0.714
Supply Chain Flexibility Strategies	0.706
Supply Chain Agility Strategies	0.581
Supply Chain Risk Management Strategies	0.623
Supply Chain Technology Strategies	0.752

From table 3.4, it can be clearly evidenced that all the correlation coefficients are greater than (0.138) the critical value. That is, 0.879, 0.714, 0.706, 0.581, 0.623, and 0.752 are all greater than 0.138. This is a significant indication that all questions from all sections are valid at 95% level of confidence.

3.8 Data Collection Procedure

First, an introduction letter of the researcher was obtained from Maasai Mara University to look for NACOSTI permit to authorize for data collection. Next, questionnaires were administered accompanied by one research assistant to respective respondents during working hours and collected on agreed dates. Confidentiality and anonymity of the collected data was assured.

The researcher provided contact mobile number and email address for any concern that required clarity. Follow-up phone calls were conducted in the time frame agreed with respondents to inquire on the progress of filling up the questionnaires. The target respondents: managers, from warehousing, purchasing, logistics, sales and production departments filled the questionnaires.

It was presumed they have adequate knowledge on resilience strategies in supply chain which their flower firms have put in place to enhance performance, considering their crucial role as management.

3.9 Data Processing and Analysis

Data analysis involves applying reasoning to interpret the gathered data, determine consistency in patterns, and summarizing the key study details (Moser, 2018). It involves analysis of collected data to establish support for the hypotheses. According to Creswell (2018) statistical analysis entails collecting and examining all sample data drawn from a collection of items.

Data processing entails: sorting, coding, tabulation and editing of attained data prior to analysis (Dawson, 2019). Data entry converts collected information into a format for manipulation and viewing. In this study, data that was obtained from questionnaires administered by the researcher was quantitative. Responses were encoded and analyzed by Statistical Packages for Social Sciences (SPSS) version 26 to conduct descriptive analysis and inferential statistics of each variable.

Descriptive statistics involved mean, standard deviation and frequency distributions. A low standard deviation indicated that most observations bunched around the mean, while a high one signified that the responses varied considerably. The gathered data for each of the regressor variables being studied and the effect on the performance of floriculture firms was processed using inferential statistics (correlation and multiple ordinal regression).

Inferential statistics were applied to allow the researcher use the sample size in making a generalization about the population (Creswell, 2018). Correlation analysis determined the direction and strength of the association between the predicted and predictor variables using Pearson's product moment correlation analysis.

Multiple ordinal regression analysis explained the relationship between the outcome variable (performance) and influencing variables (supply chain collaboration, flexibility, agility and risk management strategies), while supply chain technology was the moderating variable. R^2 measured the regression model fit while Analysis of Variance tested the model significance. The ordinal multiple regression model used to estimate the coefficient was as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon \quad \text{..... (3.1)}$$

Where: Y = Performance of floricultural firms in Nakuru County-Kenya.

β_1, β_2, $\beta_3$and β_4= Regression Coefficient to be estimated for independent variables

β0= Constant or coefficient of intercept

X1 = Supply Chain Collaboration Strategies

X2 = Supply Chain Flexibility Strategies

X3= Supply Chain Agility Strategies

X4 = Supply Chain Risk Management Strategies

ε = Error term

The moderated multiple regression model was given as:

$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_1X_1Z + \beta_2X_2Z + \beta_3X_3Z + \beta_4X_4Z + \varepsilon$ ……(3.2)

Where: Y = Performance of floricultural firms in Nakuru County-Kenya

β1, β2, β3and β4= Regression Coefficient to be estimated for independent variables

β0, Constant or coefficient of intercept

X1 = Supply Chain Collaboration Strategies

X2 = Supply Chain Flexibility Strategies

X3= Supply Chain Agility Strategies

X4 = Supply Chain Risk Management Strategies

Z= Corresponding coefficients for the moderating variable

ε = Error term

3.10 Assumptions of Regression Model

An outcome variable is predicted from multiple independent variables using multiple regression analysis tool. A multiple regression model calls for some key assumptions to be met so as to ensure its proper application and validity. If these assumptions are invalid, then the results will not be reliable, not predictable and out of control for the researchers (Creswell, 2018). This misleads the researcher into making scientifically unsupported or invalid conclusions. Multiple regression postulations of are discussed as follows:

3.10.1 Outliers

These are notably divergent data points from the rest of the observations. As Osborne (2019) puts it, an outlier is an observation that lies far from the overall pattern of the variables' distribution. Outliers might increase proportionately with the sample size. The outlying values result from measurement or coding error like: typographical mistake or including a case that falls outside the intended population, which obviously damagingly affect regression analysis results.

3.10.2 Independence of errors

Creswell (2018) describes independence of errors as the supposition that errors do not influence each other, meaning subjects respond independently. Violation of this assumption will threaten the analysis interpretation (Osborne, 2019); for instance, significance tests and standard scores may lack precision, increasing the likelihood of committing a Type I error. Creswell (2018) adds that if standard errors are underestimated or wrongly labeling variables as statistically significant results in a higher risk of erroneously rejecting the null hypothesis beyond the assumed error rate of the test.

3.10.3Linearity

Linearity specifies the outcome variable as a linear equation of the explanatory variable (Greenland et al., 2016). When the relationship is linear in nature, multiple regression precisely approximates the dependent and independent variables' relationship. A desecration of this postulation might yield in biasness of the analyzed estimates- like regression coefficients, standard errors and statistical significance, hence portraying inaccurate or false population values (Osborne, 2019).

If the true relationship between these variables is not linear, it can lead to underestimation in the analysis, resulting in two risks: Type I (overestimation) error for other regressor variables having similar variances and Type II error for that regressor variable.

3.10.4 Multicollinearity/Collinearity

Osborne (2019) describes multicollinearity as a state where regressor variables are strongly correlated with one another, which is not desirable. When collinearity is low, researchers can more accurately deduce regression coefficients as reflecting the impact of regressor variables on the outcome variable.

However, if regressor variables are strongly correlated mutually rather than with the outcome variable, it indicates the presence of autocorrelation (Osborne, 2019). High intercorrelation among predictor variables can lead to underestimating their significance, complicate hypothesis testing of relationship effects, and reduce the ability to identify moderating effects

3.10.5 Normality

Multiple regression presumes a normal distribution of the variables implying that errors are normally distributed (Osborne, 2019). Normality is essential for estimating the outcome variable results and understanding the shape of the distribution (Greenland et al., 2016). Positively or negatively skewed non-normal distributions have excessive outliers which can skew the significance levels of the analysis leading to biased standard errors and impact the overall results accuracy (Osborne, 2019).

When the size of the sample is small, outliers can have a more pronounced impact on normal distributions; contrary to larger sample sizes that tend to reduce the standard errors for both skewness and kurtosis (Greenland et al., 2016).

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

The chapter outlines the analysis of data, findings, and interpretation of results. It contains pilot results, background information, descriptive and inferential statistics. Data is structured in themes matching the research objectives; specifically—supply chain collaboration, agility, flexibility, risk management strategies the effect of supply chain technology as a moderator.

4.2 Background Information

This information is essential for ensuring the dependability of the results. This information was categorized based on response rate, duration of firm existence, job position, and work department.

4.2.1 Response Rate

In total, 255 questionnaires were issued and 197 duly filled valid questionnaires were received from 41 flower firms. This represents a 77.25% response rate which according to Dawson (2019) is appropriate for analysis. The rate of response that is exceeding 50% is considered acceptable, while a rate above 70% is regarded as excellent (Willis, 2016). The high response rate was achieved due to the researcher’s consistent reminders and the research assistant's follow-ups. Additionally, the engaging nature of the research topic contributed to this success. Table 4.1 presents the response rate.

Table 4.1: Response Rate

Questionnaires	Frequency	Percentage (%)
Responsive	197	77.25
Non-Responsive	58	22.75
Total	255	100

4.2.2 Response by Number of Years of Operation

The participants were requested to specify the total years that their respective firms had been in operation. From the 51 flower firms whose, 25 of them have been in operation for over 15 years, 11 firms have operated between 11years to 15 years, 11 firms have operated between a record time of 6 years to 10 years and 4 flower firms operating for a time frame less than 5 years as presented in table 4.2.

Table 4.2: Years of Operation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 5 years	4	21.6	21.6	21.6
	6-10 years	11	7.8	7.8	29.4
	11-15 years	11	21.6	21.6	51
	over 15 years	25	49	49	100
	Total	51	100	100	

Phokwane and Makhitha (2020) emphasize the significance of taking the number of years in operation into account when evaluating business performance and formulating strategies for growth and success. With the fact that around 80% of the flower firms had been operating for over 10 years, it made the study successful since the firms provided a good foundation for collection of the data.

4.2.3 Respondents Job Position

The study aimed to determine the positions held by the respondents. Where the top level manager was unavailable, the middle manager or lower level manager acted in response to the research questions. From table 4.3, it can be evidenced that out of 197 respondents, 47.2% (93 respondents) are in top management position, followed by middle managers 43.7% (86 respondents) and lastly the support staff 9.1% (18 respondents). This showed that most respondents were in the top and middle levels of management, thus relevant information was gathered for use in the research study.

Table 4.3: Job Position

			Percent	Valid Percent	Cumulative Percent
Valid	top management	93	47.2	47.2	47.2
	middle management	86	43.7	43.7	90.9
	Lower management	18	9.1	9.1	100.0
	Total	197	100.0	100.0	

4.2.4 Response by Department of Work

In table 4.4, it can be seen that most respondents work in purchasing department, that is, 38.1% of the respondents (75 respondents). From the analysis, it was also found that 15.2% of the respondents (30 respondents) work in warehousing department, 10.7% of the respondents work in logistics department (21 respondents). Also 18.3 % work in production department (36 respondents) and lastly, 17.8% of the respondents work in sales department (35 respondents).

This information is crucial as these departments are vital because are active in the supply chain and production of the flowers and thus the response shows there are representations from each department in most firms with all these departments as stated.

Table 4.4: Department of Work

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Warehousing	30	15.2	15.2	15.2
	Purchasing	75	38.1	38.1	53.3
	Logistics	21	10.7	10.7	63.9
	Production	36	18.3	18.3	82.2
	Sales	35	17.8	17.8	100.0
	Total	197	100.0	100.0	

4.3 Diagnostic Tests

Diagnostic tests are performed to assess the suitability of data before carrying out inferential analysis. The relationship between the outcome and regressor variables must meet the assumptions of normality and multicollinearity.

4.3.1 Normality Test

Before reaching a conclusion on which model to use, it is necessary to conduct a test of normality. This is performed to establish the likelihood that the sample was extracted from a normal distribution. Normality tests have higher accuracy because they calculate actual probabilities (Osborne, 2019). If the transformed data for the scale variables are found to be normally distributed, then a Pearson's correlation and linear regression can be harnessed to study the data.

Otherwise, if the data is found not normally distributed at any significance level, then ordinal logistic model and Spearman rank correlation is used instead. Normality testing uses several methods, including: the histogram for visual examination, Chi-square test, kurtosis and skewness values, as well as the Kolmogorov-Smirnov and the Shapiro-Wilk tests.

The Shapiro-Wilk tests are used with small sample sizes (n<50 samples sometimes can be more) while Kolmogorov-Smirnovtest is used for n>=50. Null hypothesis will posit that data was taken from a normally distributed population. The rule is, when p>0.05, null hypothesis accepted and data are thus normally distributed. In this study, Kolmogorov Smirnov test was used for normality test because N > 100.

Table 4.5: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	**Df**	**Sig.**	**Statistic**	**df**	**Sig.**
Performance	0.130	197	0.052	0.952	197	0.051
Supply Chain Collaboration Strategy	0.225	197	0.058	0.913	197	0.056
Supply Chain Flexibility Strategy	0.191	197	0.067	0.914	197	0.063
Supply Chain Agility Strategy	0.277	197	0.055	0.863	197	0.056
Supply Chain Risk Management Strategy	0.247	197	0.051	0.882	197	0.051
Supply Chain Technology	0.225	197	0.062	0.882	197	0.058

a. Lilliefors Significance Correction

From table 4.58, it can be concluded with 95% level of confidence that the data representing all variables was distributed normally. This is due to the fact that all the p-values in the table are >0.05, which leads to failing to reject the null hypothesis that stated that the data is normally distributed. Consequently, we proceeded to investigate the study objectives using Pearson's correlation and an ordinal multiple regression model.

4.3.2 Multicollinearity Test

According to Shrestha (2020) multicollinearity describes the existence of correlations among the regressor variables. In extremes of perfect correlation between regressor variables, multicollinearity will indicate that a unique least squares solution cannot be determined for the regression analysis (Osborne, 2019).

Multicollinearity increases the confidence intervals and standard errors resulting in estimates that are unsteady for individual predictors' coefficients (Greenland et al., 2016). Multicollinearity was assessed in this study using the variance inflation factor (VIF) and tolerance levels. A common guideline is that VIF's equal (=) to or great than (>) 10 may raise concerns (Shrestha, 2020).

From table 4.6, first it can be concluded that the regressor variables were not correlated highly. This was supported by the VIF values which were all less than 10 showing no multicollinearity between the independent variables and they were therefore accepted for subsequent analysis.

Table 4.6: Multi-Collinearity Results

	Collinearity Statistics	
Variables	**Tolerance**	**VIF**
Supply Chain Collaboration Strategy	0.560	1.787
Supply Chain Flexibility Strategy	0.377	2.655
Supply Chain Agility Strategy	0.790	1.265
Supply Chain Risk Management Strategy	0.395	2.530
Supply Chain Technology	0.590	1.696

4.4 Descriptive statistics

The main purpose of descriptive analysis is to illustrate the main data features. It allows us to illustrate raw data in the most demonstrative approach using graphs and statistics. The widely used descriptives are central tendency measures—median, mode and mean and the dispersion measures—quartiles, variances, standard deviations, and ranges. Based on this study's objectives, results of descriptive statistics and subsequent discussions were presented in form of Standard Deviations and Mean.

The responses were in a 5 Point Likert-Scale ranging as:-1=Strongly Disagree, 2=Disagree, 3=Not sure, 4=Agree and 5=Strongly Agree. The interpretation for the descriptive statistics for the scale responses is always done based on intervals as will follow: If the means is between 1 - 1.8 then indicates that most study respondents strongly disagree.

A mean value of between 1.81 - 2.60 implies that majority disagreed; mean value between 2.61 - 3.40 implies that most study respondents were neutral; a mean value between 3.41 - 4.20 indicates that most study respondents agreed with the questions and lastly, a mean value between 4.21 - 5 implies that major study respondents agreed strongly with the research questions.

4.4.1 Descriptive statistics for supply chain collaboration strategies.

Supply chain collaboration strategies were gauged by: sharing information, questions 1-3; visibility of supply chain, questions 4-6 and strategic supplier partnership questions 7-9. The study respondents reacted to the statements relating to strategies of supply chain collaboration and results were presented on table 4.7.

Table 4.7: Descriptive Statistics of Supply Chain Collaboration Strategies

	N	SD %	D %	NS %	A %	SA %	Mean	Std. Deviation
Efficient collaborative measures on information sharing with partners	197	0.0	35.5	0.0	60.9	3.6	3.32	1.003
Sharing information prior to expecting disruption in supplies	197	0.0	12.2	0.0	68.0	19.8	3.95	0.829
Joint problem solving with partners	197	0.0	12.2	0.0	64.0	23.9	3.99	0.854
Visibility of data to all stakeholders	197	0.0	16.2	0.0	59.4	24.4	3.92	0.944
Visibility effectively improves logistics and operations	197	0.0	12.7	0.0	67.0	20.3	3.95	0.844
Visibility quickens response to supply chain disruption	197	0.0	16.8	0.0	63.5	19.8	3.86	0.924
Handling changing needs and market information in partnership.	197	0.0	27.4	0.0	61.4	11.2	3.56	1.011
Maintenance of a good relationship with partners	197	0.0	23.4	0.0	64.5	12.2	3.65	0.970
Strategic partnership has given my company a competitive edge	197	0.0	27.4	0.0	57.4	15.2	3.60	1.048
Average score							3.76	0.936
Valid N (listwise)	197							

The findings indicates that most study respondents were of the view (Mean = 3.32; Std Dev =1.003) that their firm had instituted collaborative measures on sharing information with other firms and buyers though it's still not sufficient, this could be due to limitations like adopting latest technologies which enable swift information sharing and visibility. Respondents also agreed (Mean = 3.95; Std Dev =0.829) that their partners consistently provided them with advance information when disruptions in supplies were anticipated.

The findings further indicates that the firms have joint problem solving with their partners (Mean = 3.99; Std Dev =0.854). The respondents assented (Mean = 3.92; Std Dev =0.944) that visibility in the supply chain enhances their performance by providing readily available data to all stakeholders.

The results also shows that the respondents agreed (Mean = 3.95; Std Dev =0.844) that visibility in supply chain enhances their performance by enabling them to manage their logistics and operations more effectively. Respondents further acknowledged that (Mean = 3.86; Std Dev =0.910) that visibility in supply chain enhances their performance by the capability to respond swiftly to supply chain disruptions reducing risk. The respondents had a cooperation agreement with other firms to notify each other ahead concerning evolving needs and market information (Mean = 3. 56; Std Dev =1.011).

It can be seen that maintaining a strong partnership encouraged the feedback flow between the flower firms and their partners (Mean =3. 65; Std Dev =0.970. Lastly findings show that strategic partnership has given the firms a competitive edge (Mean = 3. 60; Std Dev =1.048). In conclusion, these study questions had a mean value ranging in 3.41 - 4.20 and averagely 3.76; with a standard deviation of 1.057. This implied that most study respondents assented to the questions asked in relation to collaboration.

This study examined supply chain collaboration through information sharing, strategic partnerships, and visibility, revealing that respondents largely agree these components are essential for supporting floricultural firms amid various disruptions. However, while many believe their organizations have established collaborative measures for information sharing, these efforts are still insufficient. There is limited adoption of advanced technologies that enable effective and rapid information sharing. The findings are in line with Jraisat et al. (2021) that collaboration in the supply chain offers merits ranging from more sharing of knowledge to greater access to and expertise products.

Further, Wieland and Durach (2021) contend that companies can adapt to a temporary crisis, learn from it and innovate in the long term which enables them to cope with far more colossal crises, such as the climate crisis. Similary, Umar and Wilson (2021) aver that in natural disasters the supply chain collaboration elements that improve general supply chains resilience are: trust, casual funding, interrelationships, information sharing and effective communication.

Equally, Scholten and Schilder (2015) concur the important partnership activities that enhance supply chain resilience are: exchange of information, team communication, relationship initiatives, and knowledge created jointly. Mansoor and Mahour (2021) are also of the view that the most effective supply chain collaboration dimensions to cope with the myriad of risks in supply chain are: communication, collaborative relationships, information sharing, trust and continuous coordination and cooperation.

4.4.2. Descriptive statistics for supply chain flexibility strategies

Supply chain flexibility strategies were determined by: re-engineering of the supply chain, question 1-3; flexibility in production, question 4-6 and flexibility in delivery, questions 7-9. The study findings were displayed in table 4.8.

Table 4.8: Descriptive Statistics for Supply Chain Flexibility Strategies

	N	SD %	D %	NS %	A %	SA %	Mean	Std. Deviation
An adaptive supply chain structure to cope with disruption changes	197	0.0	29.4	8.1	47.7	14.7	3.48	1.067
Supply chain reengineering has a competitive edge	197	0.0	25.9	8.1	43.7	22.3	3.62	1.098
Well-developed system that can integrate information	197	0.0	25.9	8.1	47.2	18.8	3.59	1.068
We can delay flower production	197	0.0	26.4	4.1	43.1	26.4	3.70	1.129
Effective response to adjust production capacity	197	0.0	30.5	8.1	38.6	22.8	3.54	1.149
Quick response to create new products	197	0.0	34.5	4.1	39.1	22.3	3.49	1.181
Quick response to changing delivery times	197	0.0	15.7	0.0	60.4	23.9	3.92	0.931
Quickly increase the capacity of distribution services	197	0.0	19.8	0.0	65.0	15.2	3.76	0.943
Quickly change the routing and mode of transportation	197	0.0	19.8	0.0	65.0	15.2	3.76	0.943
Average score							3.65	1.057
Valid N (listwise)	197							

The results disclose that the respondents assented (Mean =3.48; Std Dev =1.067) that their flower firm possesses a flexible supply chain structure to manage effectively the changes caused by supply chain disruptions. Respondents also acknowledged (Mean =3.62; Std Dev =1.098) that supply chain reengineering has helped their organization to gain a competitive edge. The findings further indicated (Mean =3.59; Std Dev =1.068) that they manage a robust system capable of effectively integrating information. The respondents concurred (Mean =3.70; StdDev =1.129) that they can delay flower production until shortly before customers place their orders.

Findings also revealed that respondents consented (Mean=3.54; StdDev=1.149) that their flower firm responds effectively to adjust production capacity. Findings further indicated

the study respondents agreed (Mean=3.49; StdDev=1.181) that their flower firm responded swiflty to create latest products for the market. Further, findings proved (Mean =3.92Std Dev =0.931) that the supply chain swiftly adapted to their evolving delivery time requirements.

Additionally, respondents granted (Mean =3.76Std Dev =0.943) that they can quickly increase the capacity of distribution services. Finally, findings revealed that (Mean =3.76StdDev =0.943) they can swiftly modify the routing and transportation method for outbound shipment. In conclusion, the questions yielded a mean value of 4.21to 5 with a mean average of 3.65 and a 1.057 standard deviation. This implied that most study participants agreed strongly with the study questions regarding flexibility.

This study investigated flexibility of the supply chain determined by re-engineering the supply chain, flexibility in production and also flexibility of delivery. Evidently, most of the study respondents concurred with the questions regarding supply chain flexibility that flexibility in production, supply chain re-engineering, and delivery flexibility are key flexibility strategies used by floricultural firms.

These firms operate in a risky supply chain environment characterized by seasonality and ever new challenges. As such, the firms should institute flexibility strategies that are essential for maintaining operational efficiency and achieving a higher level of supply chain resilience by adapting rapidly to changing conditions.

The findings are in line with Piprani et al., (2022) that flexibility in the supply chain is a crucial strategy that enables companies to manage disruptions and build resilience by

quickly adapting to evolving conditions. Further, Mansoor & Mahour (2021) also augur that flexibility is crucial in managing environmental, process, supply, and demand disruptions. Equally, Rajesh (2021) argues that supply chains that are designed based on a supply chain system that is flexible can swiftly react to upsetting events, enabling firms to realign and restructure their resources and capabilities.

4.4.3. Descriptive statistics for supply chain agility strategies.

Supply chain agility strategies were studied using three variables: demand forecasting, questions 1-3; decisiveness, questions 4-6 and inventory management questions 7-9. The participants responded to the statements on supply chain agility and findings were depicted on table 4.9.

Table 4.9: Descriptive Statistics for Supply Chain Agility Strategies

	N	SD %	D %	NS %	A %	SA %	Mean	Std. Deviation
Quick response to order changes in market demand	197	0.5	13.7	0.0	61.4	24.4	3.94	0.932
Swiftly maximize on new customer trends and priorities	197	0.0	23.4	0.0	67.0	9.6	3.63	0.947
Quickly responds to changing pricing requirements	197	0.0	30.5	0.0	57.9	11.7	3.51	1.048
Decisive plans and adjustments to improve performance	197	0.0	7.1	0.0	78.7	14.2	4.00	0.655
Ability to deploy adaptive capability	197	0.0	8.1	4.1	80.7	7.1	3.87	0.649
Ability to respond quickly in introducing alternative plans	197	0.0	8.1	4.1	78.2	9.6	3.89	0.673
Extra capacity to quickly boost output if needed	197	0.0	19.3	4.1	65.0	11.7	3.69	0.915
Effectively manage inventory levels	197	0.0	19.3	4.1	67.0	9.6	3.67	0.897
Quickly increase storage capacity	197	0.0	19.3	4.1	67.0	9.6	3.67	0.897
Average score							3.76	0.846
Valid N (listwise)	197							

The findings point out that the respondents assented (Mean=3.94; StdDev=0.932) that their flower firm can respond quickly to demand order changes in market. Further the flower firms can swiftly maximize on new customer trends and priorities as a result of mutual effort (Mean =3.63; Std Dev =0.947). In addition, flower firms responded quickly to changing requirements of pricing (Mean=3.51; StdDev=1.048). Further, findings indicated that respondents agreed (Mean =4.00; Std Dev =0.655) that they could implement decisive plans and adjustments to enhance performance.

The respondents also concurred (Mean =3.87; Std Dev =0.649) that their flower firm has the ability to deploy adaptive capability to external environment. Additionally, respondents were in conformity (Mean =3.89; Std Dev =0.673) that their flower firms had the ability to respond quickly to introduce alternative plans. Findings further indicated that respondents agreed (Mean=3.69; StdDev =0.915) that having an ample stock of materials and personnel can rapidly increase output when necessary. Respondents also acknowledged (Mean =3.67; Std Dev =0.897) that their organizations can effectively manage inventory levels thus managing pricing.

Lastly, the respondent's consented (Mean =3.67; Std Dev =0.897) that they can quickly increase storage capacity. In conclusion, the questions resulted in a mean value between.3.41 - 4.20, with a mean average of 3.76 and a 0.846 standard deviation. This suggested most study participants agreed with the questions asked regarding agility. This study investigated agility strategies in the supply chain determined by forecasting demand, decisiveness and management of inventory.

It's seen that most study participants concurred with the questions regarding supply chain agility that decisiveness, management of inventory, and forecasting demand are key strategies allowing floricultural firms to be resilience to the myriad of disruptions ever present in this sector. Agility enables flower firms to adapt to unexpected fluctuations in supply and demand.

The findings align with Naughton et al. (2020) that supply chain agility allows companies to keep an eye on the highly unpredictable environment of unmatched disruptions and proactively respond to them. This is consistent with Tukamuhabwa et al. (2015) that agility is among the main vital capabilities for strengthening supply chain resilience. Ivanov (2022) and Altay (2018) also hold that supply chain agility is among the many approaches building a resilient supply chain.

4.4.4. Descriptive statistics for supply chain risk management strategies

Risk mitigation strategies in flower supply chain were studied using three variables: risk acceptance, questions 1-3; risk reduction, questions 4-6 and transfer risk questions 7-9. The respondents were invited to act in response to the statements concerning supply chain risk management strategies and results were presented on the table 4.10.

Table 4.10: Descriptive Statistics for Supply Chain Risk Management Strategies

	N	SD %	D %	NS %	A %	SA %	Mean	Std. Deviation
Frequently monitor supply risks	197	0.0	24.9	4.1	58.9	12.2	3.58	0.995
Employee training on risk management strategies.	197	0.0	28.9	4.1	58.9	8.1	3.46	0.997
Continuity plans addressing major supply chain risks	197	0.0	24.9	0.0	67.0	8.1	3.58	0.953
Measures instituted to identify and manage risks	197	0.0	40.6	0.0	51.3	8.1	3.27	1.085
Capacity to learn from past disruptions	197	0.0	33.0	0.0	58.9	8.1	3.42	1.035
Continuous improvement initiatives based on risk management culture	197	0.0	36.5	0.0	55.3	8.1	3.35	1.061
Appropriate policies for risk assessment, delegation and avoidance	197	0.0	39.1	0.0	53.8	7.1	3.40	1.035
Dedicated supply chain risk management team	197	0.0	31.5	0.0	61.4	7.1	3.44	1.012
Collaboration with partners to share risks and minimize uncertainty	197	0.0	43.1	0.0	47.7	9.1	3.23	1.108
Average score							3.42	1.031
Valid N (listwise)	197							

The study further indicated that the respondents were not sure (Mean =3.27; Std Dev =1.085) that their flower firm had instituted measures to identify and manage risks', this could be due to insufficient or unclear contingency measures for business continuity plan and risk management clearly communicating and allocating responsibility for response team. Findings revealed (Mean =342; Std Dev =1.035) that the flower firms had the ability to learn from previous disruptions to be better prepared.

Further, study respondents were not sure (Mean =3.35; Std Dev =1.061) if ongoing improvement efforts were grounded in a risk management culture; also they were not

sure (Mean =3.40; Std Dev =1.035) if their flower firm had appropriate policies for risk assessment, delegation and avoidance.

All these could be due to poor internal controls as related to proactive contingency measures and risk management strategy. The respondents concurred (Mean=3.44; StdDev=1.012) that their firm had team dedicated to supply chain risk management. Finally, the respondents were not sure (Mean =3.23; Std Dev =1.108) that their flower firm copes with disruption changes through collaboration with partners to share risks and minimise uncertainty.

This issue may stem from other flower companies' reluctance to collaborate or share information. It could also be because of lack of suitable and compatible platforms, such as technology-enabled communication tools, that facilitate timely and visible information sharing. In conclusion, the questions yielded a mean value of 3.41 - 4.20 with a mean average of 3.42 varied by a 1.031standard deviation. This suggested that study participants assented to the questions.

This study explored supply chain risk mitigation strategies in the flower firms, focusing on risk acceptance, risk reduction, and transfer of risk. The findings point out that these strategies are crucial for enhancing resilience in floriculture firms amidist the constantly evolving disruptions within this sector. However, it was revealed that the firms lacked adequate risk management plans and policies, as well as collaborative initiatives with partners to effectively share risks and reduce uncertainty.

These findings align with Ongisa (2016) who emphasized the need for organizations to identify and assess their exposure to risk, then implement risk mitigation plans that enhance productivity.

Similarly, Joanna and Subramanian (2021) aver that effectual risk lessening strategies can lessen the impacts of both natural and human-made disasters. They emphasize the significance of proactive measures, adaptation, and crisis management mechanisms to navigate uncertain situations, like the COVID-19 pandemic. Wieland and Durach (2021) similarly supported the necessity of comprehensive supply chain risk mitigation practices that focus to spot, evaluate, manage, and monitor various risks within an organization.

In like manner, Sodhi and Tang (2021) assert that risk mitigation is essential for organizations to minimize the likelihood of risk incidents, transfer potential risk outcomes to third parties, and institute contingency plans to lessen the effect of unforeseen events. Collectively, these perspectives underscore the critical need for improved risk management frameworks in floricultural firms to enhance resilience against disruptions.

4.4.5 Descriptive statistics for supply chain technology

Supply chain technology was measured using two variables namely, adoption of innovative technology (questions1-3) and improved performance due to innovative technology (questions 4-6).The descriptive statistics are given in table 4.11

Table 4.11: Descriptive Statistics for Supply Chain Technology

	N	Mean	Std. Deviation
Technology is employed in the procurement and supply function	197	3.56	1.112
Technology is employed duringthe cultivation of flowers	197	3.89	0.928
Technology is employed in forecasts	197	3.53	0.998
Technology facilitates continuous operations amidst disruptions	197	3.72	1.009
Technology reduces production wastages	197	3.81	0.871
Technology allow quick response to demand changes	197	3.32	1.085
Average score		3.64	1.001
Valid N (listwise)	197		

The findings revealed that the respondents agreed (Mean =3.56; Std Dev=1.112) that they use supply chain technology for procurement and supply functions. Respondents were also in agreement that they use supply chain technology in flower farming operations like planting, irrigation, fertigation and systems e.g teff planting machine (Mean =3.89; Std Dev =0.928). The respondents also consented with the statement that they used supply chain technology in demand forecasting and response (Mean =3.53; Std Dev =0.998).

Further, findings revealed that respondents acknowledged that supply chain technology (Mean=3.72; Std Dev =1.009) improved continuous business operation regardless of disruptions. It was also evident that supply chain technology (Mean =3.81; Std Dev =0.871) enabled the firms to reduce the number of production wastages. Finally, the respondents were not sure (Mean =3.32; Std Dev =1.085) that by using supply chain technologies, their flower firm rapidly responded to market demand variations caused by disruptions in the supply chain.

Overall, on a five-point scale, the participants assented to the statements pertaining to supply chain technology with an average mean of 3.64; varied by a 1.001standard deviation. The results are consistent with those of Akwalu (2022) that connecting information technology (IT) with business operations is crucial for enhancing supply chain flexibility, agility, and higher business performance. Equally, the results align with those of Wamba et al. (2020) that technology builds supply chain resilience by ensuring operation stability.

Similarly Dubey et al. (2020) hold that IT improves sharing information and processing capabilities which are beneficial for recovery from disruptions. Scholars, Lamba & Singh (2017) and Minhao et al. (2021) contend that connecting operations of a business with information technology is essential throughout and post disruption, ensuring a swift reaction, organizational survival, adaptability, and improved performance. Further, Minhao et al. (2021) hold that big data analytics and block chain technology allow companies to react to unexpected disruptions and changes.

4.4.6 Descriptive statistics for performance

Performance in flower supply chain was studied using three variables: continuity, questions 1-3; cost savings, questions 4-6 and responsiveness, questions 7-9. The study aimed to assess how much respondents agreed with regard to the statements as indicated in table 4.12.

Table 4.12: Descriptive Statistics for Performance

	N	SD %	D %	NS %	A %	SA %	Mean	Std. Deviation
Continuous operation regardless of the disruption	197	0.0	26.9	0.0	59.4	13.7	3.60	1.028
Increased market share, penetration and growth	197	0.0	43.7	0.0	50.8	5.6	3.18	1.068
Improved, efficient and effective operations	197	0.0	31.0	0.0	50.8	18.3	3.56	1.112
Reduce operational costs	197	0.0	5.1	0.0	88.8	6.1	3.96	0.513
Reduced production wastages	197	0.0	16.8	0.0	77.7	5.6	3.72	0.807
Reduced stock-outs	197	0.0	19.3	0.0	74.6	6.1	3.68	0.855
Quick response to demand changes from disruptions	197	0.0	12.2	0.0	78.2	9.6	3.85	0.752
Quick modification of delivery schedules and time	197	0.0	8.1	0.0	73.6	18.3	4.02	0.714
Improved time of changeovers	197	0.0	8.1	0.0	73.6	18.3	4.02	0.714
Valid N (listwise)	197							
Average score							3.73	0.840
Valid N (listwise)	197							

The findings revealed that study respondents consented (Mean =3.60; Std Dev=1.028) that their operations run continuous regardless of the disruption. The study respondents were not sure (Mean =3.18; Std Dev =1.068) if they experienced increased market share, penetration and growth. This could be due to lack of information on market trends and opportunities or low sales and profits to allow for expansion and market growth.

Further the respondents acknowledged (Mean =3.96; Std Dev =0.513) to experience reduced operational costs and reduced production wastages (Mean =3.72; Std Dev =0.807).Findings revealed (Mean =3.68; Std Dev =0.855) that the flower firms had reduced stock-outs. Further, firms were capable of quick response to demand changes from disruptions (Mean =3.85; Std Dev =0.752) and quickly modified delivery schedules and time (Mean =4.02; Std Dev =0.714).

Finally there was improved change overtime (Mean=4.02;StdDev=0.714). In conclusion, the questions yielded a mean value ranging from 3.41 - 4.20 with a mean average of 3.73 and a 0.840 standard deviation. This suggested that most study respondents were in agreement with the statements regarding the dependent variable performance. It is evident that supply chain resilience enhances the floricultural firms' performance linked to continuity of operations, responsiveness and cost savings.

These findings are in line with Ivy et al. (2019) who posit that performance is gauged by growth in sales, yearly gross margin, satisfaction of clients, and return on investment. Similarly, scholars Shradha et al. (2017) and Amit et al. (2016) postulate that performance in organisations is determined by improved asset utilization, enhanced profits, growth in revenue, reduction of cycle time, improvements of quality, saving cost, solid competitive position, value delivery to clients, superior customer service, and reduced defects.

4.5 Inferential Statistics

This study employed Pearson Correlation analysis and ordinal multiple regression analysis to investigate the effects of supply chain resilience strategies and performance of floricultural firms in Kenya, Nakuru-County. Results are as follows:

4.5.1 Correlation between Supply Chain Resilience Strategies and Floricultural Firms' Performance.

Correlation is an instrument used to measure a probable bidirectional linear relation between two variables that are continuous, which helps in understanding their strength and direction (Smith & Lee, 2023). A correlation is used to estimate the linear relationship strength indicating the degree of co-variation between two variables (Alem, 2020). The most widely used correlation measure in statistics is the Pearson correlation (or Pearson Product Moment Correlation or PPMC).

The study used Pearson Correlation Coefficients as it is the standard calculation method and is considered the most effective (Alem, 2020). The correlation coefficients vary from -1 to +1. A value approaching -1 or +1 indicates a strong relationship between the variables, while a value approaching 0 indicates a weak relationship. Also, a positive correlation signifies variables progressing in the same direction, and that they are directly related whereas a negative correlation indicates a movement in opposing directions and that the variables are inversely related (Smith & Lee, 2023; Alem, 2020).

Correlation coefficients of 0.10 are small, 0.30 are medium and of 0.50 are large in terms of magnitude of their effect sizes (Smith & Lee, 2023). The aim of this study was to establish the supply chain resilience strategies effect on the performance of Kenyan floricultural firms. Pearson Bivariate correlation coefficient was used to compute the correlation between the independent variables namely: supply chain collaboration strategies (SCCS), supply chain flexibility strategies (SCFS), supply chain agility strategies (SCAS) and supply chain risk management strategies (SCRMS).

The dependent variable was performance of floricultural firms. Also, supply chain technology (SCT) was the moderating variable. The correlation coefficient was calculated to determine the strength and nature of the relationship between the moderating, independent and the dependent variables. Results are as shown in Table 4.13.

Table 4.13: Correlation between Supply Chain Resilience Strategies and Performance

		SCP	SCCS	SCFS	SCAS	SCRMS	SCT
PERFORMANCE	Pearson Correlation	1					
	Sig. (2-tailed)						
	N	197					
SCCS	Pearson Correlation	**0.815****	1				
	Sig. (2-tailed)	0.000					
	N	197	197				
SCFS	Pearson Correlation	**0.429****	**0.348****	1			
	Sig. (2-tailed)	0.000	0.000				
	N	197	197	197			
SCAS	Pearson Correlation	**0.425****	**0.297****	**0.189****	1		
	Sig. (2-tailed)	0.000	0.000	0.008			
	N	197	197	197	197		
SCRMS	Pearson Correlation	**0.354****	**0.144***	**0.714****	**0.133**	1	
	Sig. (2-tailed)	0.000	0.043	0.000	0.063		
	N	197	197	197	197	197	
SCT	Pearson Correlation	**0.892****	**0.661****	**0.407****	**0.349****	**0.332****	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	
	N	197	197	197	197	197	197

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The results revealed that supply chain collaboration strategies (SCCS) and performance of floriculture firms are positively and significantly related (r=0.815, p=0.00) at significance level of 0.01 (two-tailed). The results are similar to (Scholten & Schilder, 2015; Umar & Wilson, 2021: Jraisat et al., 2021) that embracing collaboration will significantly improve supply chain performance and resilience during a crisis and in disaster management.

Results further indicate a significant and positive correlation between supply chain flexibility strategies (SCFS) and performance of floriculture firms(r=0.429, p=0.00) at significance level of 0.01 (two-tailed). This was in line with (Arani et al., 2015; David et al., 2021, Muricho, 2021) that linked flexibility as a significant indicator in relation to supply chain resilience. In addition, (Maxim et al., 2022; Minhyo & Aaron, 2022) argue that increasing flexibility is a key measure businesses can implement to enhance resilience by boosting their ability to minimize risk exposure in the event of supply chain disruptions.

Further, research results revealed a positive and significant relationship (r=0.425, p=0.00) at significance level of 0.01 (two-tailed) between supply chain agility strategies (SCAS) and performance of floricultural firms which is in line with Naughton et al., (2020) that supply chain agility permits firms to keep an eye on the highly unpredictable environment of unmatched disruptions and proactively respond to them. Adopting agility in supply chain is among the many strategies guaranteeing a resilient supply chain (Tukamuhabwa et al., 2015; Ivanov, 2022; Altay, 2018).

Equally, there was a positive significant correlation (r=0.354, p=0.00) at significance level of 0.01 (two-tailed) between supply chain risk management strategies (SCRMS) and performance of floricultural firms. This corresponds to the study by Joanna & Subramanian (2021) that risk alleviation plans will lessen the impact of both environmental catastrophes and human-induced catastrophes.

Similarly, Sodhi and Tang (2021), asserts that risk mitigation in supply chain is vital in any organisation to lessening the probability of occurrence of an event and setting up contingency plans lessening the impact after an event occurs.

Finally, results indicate supply chain technology (SCT) and floricultural firms' performance were positively and significantly related (r=0.892, p=0.00) at significance level of 0.01 (two-tailed). The findings match with Peterson et al. (2015) that Supply chain technology serves as an important moderator in the relationship between supply chain strategies and firm performance. Similarly, scholars Lamba &Singh (2017) and Minhao et al. (2021) contend that adopting information technology guarantees increased performance, survival of firms, rapid response, and adaptation.

4.5.2 The Effect of Supply Chain Resilience Strategies and Performance

Correlation only tells us about the direction and magnitude of the association between a pair of variables. To investigate the effect, therefore, we need to fit data to the relevant regression model which according to the assessment of the data is multiple ordinal regression, which was executed to empirically assess whether a significant relationship existed between the outcome variable—performance; and the regressor variables.

The moderating variable was supply chain technology. The primary metrics employed are: the P-value, the R^2 (R squared), and Beta coefficients.

The tested hypotheses for the studied objectives were are as follows:

$H_0$1: Supply chain collaboration strategies have no significant effect on floricultural firms' performance in Kenya-Nakuru County.

$H_0$2: Supply chain flexibility strategies have no significant effect on floricultural firms' performance in Kenya-Nakuru County.

$H_0$3: Supply chain agility strategies no significant effect on floricultural firms' performance in Kenya-Nakuru County.

$H_0$4: Supply chain risk management strategies have no significant effect on floricultural firms' performance in Kenya-Nakuru County.

To analyse the null hypotheses, the researcher employed the multiple ordinal regression model at 95% confidence interval.

Table 4.14 presents the findings of regression coefficients of supply chain resilience strategies (collaboration, agility, flexibility, and risk management) and performance of floriculture firms.

Table 4.14: Regression Coefficients of Supply Chain resilience Strategies and Performance

Variables	β	CI:95%	Collinearity Statistics Tolerance	VIF
Supply chain collaboration strategies	0.740***	0. 665, 0.825	0.802	1.247
Supply chain flexibility strategies	-0.045	-0.123, 0.052	0.429	2.334
Supply chain agility strategies	0.179***	0. 091, 0.222	0.902	1.109
Supply chain risk management strategies	0.256***	0. 111, 0.261	0.477	2.095
Model Fit Statistics				
F-Value	144.240***			
R^2	0.750			
ΔR^2	0.750			

Note: *** p<0.05

The analysis results in table 4.14, showed a good model fit $F(4,192)=144.240$, $P<0.05$, $R^2=0.750$ and $\Delta R^2 =0.750$. The analysis shows that collaboration strategies had positive effect on the floricultural firms' performance (β=0.740, CI=0.665, 0.825, $P<0.05$), thus null hypothesis **$H_0$1** was rejected**.** However, the results prove that we do not have evidence of effect of flexibility strategies (β=-0.045, CI=-0.123, 0.052, P=0.419) on floricultural firms' performance.

The analysis shows that, agility strategies had positive effect on the floricultural firms' performance (β=0.179, CI=0.091, 0.222, $P<0.05$), indicating null hypothesis **$H_0$3** was rejected. Also, the results found a positive influence of risk management strategies on the floricultural firms' performance (β=0.256, CI=0.111, 0.261, $P<0.05$), hence, null hypothesis **$H_0$4** was rejected. The results of the Value Inflation Factor (VIF) showed no multicollinearity presence in the dataset being that the VIF values were all less than 10.

For that reason, we can infer that from the examined resilience supply chain strategies, agility, collaboration, and risk management significantly affect the performance of the floricultural firms. Evidently, that the first hypothesis supply chain collaboration contributes positively to floricultural firms' performance in Kenya-Nakuru County. Supply chain collaboration was determined by visibility, sharing information, and strategic supplier partnership.

It's evident from the results of analysis that these strategies represent essential markers of performance of floricultural firms tied to continuity, cost saving and responsiveness. The findings concur with scholars (Scholten & Schilder, 2015;Umar & Wilson, 2021) that mutual dependence, visibility, joint relationship, collective communication and trust are essential facets of collaboration that enhance supply chain resilience during catastrophes.

Based on Relational Theory, it could be stated that that superior relational competencies can enhance supply chain resilience amid unforeseen risks. Supply chain relations are founded on coordination, collaboration and integration across the supply chain. The studied floricultural firms embraced collaboration through supply chain visibility and strategic partnership which improved supply chain performance leading to resilience.

The theory anchors decision making in floricultural firms by proposing relationship strategies that enhance performance and resilience of supply chains in event of unforeseen disruptions. The second hypothesis found no evidence of effect of flexibility strategies on floricultural firms' performance. Supply chain flexibility metrics were: re-engineering of supply chain, production and delivery flexibility.

The findings imply that flexibility of supply chain is not a strategy that the respondent firms fully utilize. However, floricultural firms need to incorporate supply chain flexibility to accelerate the reaction to transport and production disruptions observed in this industry. Extant literature indicate that flexibility in sourcing, production, transport order fulfillment are vital markers of resilience in supply chains (Arani et al., 2015; David et al., 2021, Muricho, 2021).

Further, scholars Maxim et al. (2022) and Minhyo & Aaron (2022) assert that enhancing flexibility is a crucial strategy for businesses to improve resilience by bolstering their ability to mitigate risk exposure in the event of supply chain disruptions. The complex adaptive systems (CAS) theory anchors Kenyan floricultural firms that function in an unreliable environment which changes regularly due to disruptions and yet they must adjust and endure within the same environment.

They progressively emerge into a coherent form through adaptation and self-organization. The managers or decision makers in floricultural firms ought to be make strategic decisions, be flexible, proactive, and re-design their structures so as to collaborate with stakeholders to create resilience in floricultural firms.

From the third tested hypothesis, it was established that SC agility strategies contributes positively to performance of floricultural firms in Kenya-Nakuru County. SC agility was determined by decisiveness, forecasting demand, and management of inventory. It was established that these enhance the firms' resilience in withstanding interruptions, recovery, and continuity amidst crises which saves costs and improves performance.

This aligns with Benjamin et al., (2021) and Esra et al., (2022) that extensive interruptions like Covid-19 confirmed the importance of learning from a catastrophe to develop clear, easily obtainable, and responsive plan of continuity before imminent disruptions. In like manner, (Muricho & Muli, 2021; Al-Shboul, 2017; Scholz & Anna, 2021) postulate that agility is a crucial component of the supply chain that effectively addresses environmental uncertainties and enables firms to deliver the right products precisely when needed.

This aligns with contingency theory which avers that the efficacy of decisions within floricultural firms depend on various external and internal factors. Despite disruptions, floriculture firms' managers and decision makers can gain strategic advantage in resilience and maintaining operational efficiency, by first understanding the environment in which they operate. Then afterwards, augment their agility in supply chain though flexible systems that effectively manage inventory and adjust delivery schedules to alternative plans as per the changing needs.

From the results of our fourth hypothesis it was evident that risk management strategies in the supply chain, determined by accepting risk, reduce risk and transfer risk positively and significantly affected the floricultural firms' performance affiliated with operational continuity, responsiveness, and cost savings. The floricultural supply chain is characterized by ongoing and evolving disruptions. However, it can achieve greater resilience by transferring most risks to third parties, as this risk reduction minimizes impacts and improves performance.

This is in sync with Gurtu and Johny (2021) that risk prevention measures reduce the consequences of both man-made and natural calamities. Additionally, the findings align with the views of (Minhyo & Aaron, 2022; Maxim et al., 2022; Ray et al., 2020; Debashree et al., 2021) that to avoid supply chain risks, resilience must be built through effective strategies that prevent or reduce the impact of disruptive events.

To build a more robust supply chain, flower firms should transfer a significant portion of the risks to third parties (insurer). This echoes the Agency Theory which contends that transferring risks to a third party will reduce the impact of disruptions which enhances resilience, and ultimately improves performance.

4.5.3 The Moderating Effect of Supply Chain Technology on Supply Chain Resilience strategies and the floricultural firms' performance

The study sought to ascertain if supply chain technology had a moderation effect between supply chain resilience strategies and the performance of floriculture firms in KenyaNakuru-County. The research hypothesis formulated was:

$H_0$5: Supply chain technology does not significantly moderate the relationship between supply chain resilience strategies—namely: collaboration, flexibility, agility, and risk management—and the performance of floricultural firms in Kenya-Nakuru County

These can be broken down as:

$H_0$5a: Supply chain technology does not significantly moderate the relationship between supply chain collaboration strategies and the performance of floriculture firms in Kenya-Nakuru County

$H_0$5b: Supply chain technology does not significantly moderate the relationship between supply chain flexibility strategies and the performance of floriculture firms in Kenya-Nakuru County

$H_0$5c: Supply chain technology does not significantly moderate the relationship between supply chain agility and the performance of floriculture firms in Kenya-Nakuru County

$H_0$5d: Supply chain technology does not significantly moderate the relationship between supply chain risk management and the performance of floriculture firms in Kenya-Nakuru County.

Table 4.15 shows results of moderated regression coefficients of the outcome and predictor variables at 95% confidence interval.

Table 4.15: Moderated Regression Coefficients of Supply Chain resilience Strategies and Performance

Variables	**B**	**CI:95%**
SCCS	0.704***	0.638, 0.779
SCFS	-0.043	-0.11, 0.041
SCAS	0.099***	0.029, 0.145
SCRMS	0.277***	0.136, 0.267
SCCSxSCT	-0.306***	-0.437, -0.263
SCFSxSCT	0.327***	0.172, 0.322
SCASxSCT	-0.081***	-0.131, -0.007
SCRMSxSCT	0.052	-0.035, 0.110
Model Fit Statistics		
F-Value	24.332***	
R^2	0.835	
ΔR^2	0.750	

Note: *** p<0.05, supply chain collaboration strategies (SCCS), supply chain flexibility strategies (SCFS), supply chain agility strategies(SCAS), supply chain risk management strategies (SCRMS) and supply chain technology(SCT).

From Table 4.15, the moderated findings suggested that supply chain collaboration strategies (SCCS) and supply chain flexibility strategies (SCFS) interacted with supply chain technology (SCT) and the inclusion accounted for additional 8.5% variance in predicting the performance of studied floriculture firms (R^2=0.835, ΔR^2 =0.085, *F(*4,188)=24.332, *P*<0.05).

The interaction between supply chain collaboration strategies (SCCS) and supply chain technology(SCT) significantly reduced the effect on performance of floriculture firms (*β*=-0.306, CI=-0.437, -0.263, *P*<0.05), thus rejecting null hypothesis **$H_0$5a.**Further**,** the interaction between supply chain flexibility strategies (SCFS) and supply chain technology (SCT) significantly increased the effect on performance of floriculture firms (*β*=0.327, CI=0.172, 0.322, *P*=0.05), rejecting null hypothesis **$H_0$5b**.

Finally, the interaction between supply chain agility strategies (SCAS) and technology significantly reduced the effect on performance of floriculture firms (*β*=-0.081, CI=-0.131, -0.007, *P*<0.05), thus rejecting null hypothesis **$H_0$5c**. However, there was no evidence that supply chain risk management strategies (*β*=0.052, CI=-0.035, 0.110, *P*=0.307) had any effect on performance upon the introduction of the interaction term.

4.5.4 The Interaction Graphs (slope)

Further, slope analysis was presented to better understand the nature of the moderation effects (figure 4.1, 4.2 and 4.3). The interaction slope, figure 4.1 shows that higher supply chain technology dampens the positive effect of supply chain collaboration strategies and performance of floricultural firms.

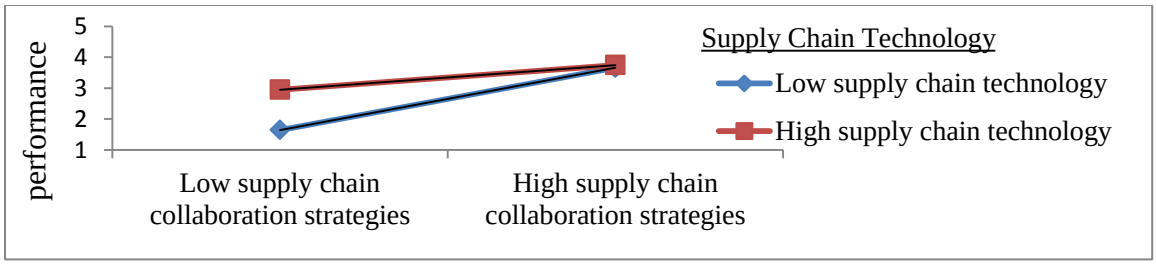

Figure 4.1: Interaction Graph (slope) for Supply Chain Technology and Supply Chain Collaboration Strategies

As shown in figure 4.1, the line is much steeper for low supply chain technology; this shows that at low level of supply chain technology, the supply chain collaboration strategies' impact on performance is much stronger in comparison to high supply chain technology. However, at higher supply chain technology, the line tends to straighten, this shows that at higher supply chain technology, the increase in supply chain collaboration strategies does not necessarily result in a corresponding improvement in performance.

In conclusion, higher supply chain technology weakens the supply chain collaboration strategies' impact on performance. Further, the interaction slope figure 4.2 shows that supply chain technology dampens the negative effect of supply chain flexibility strategies and performance of floricultural firms.

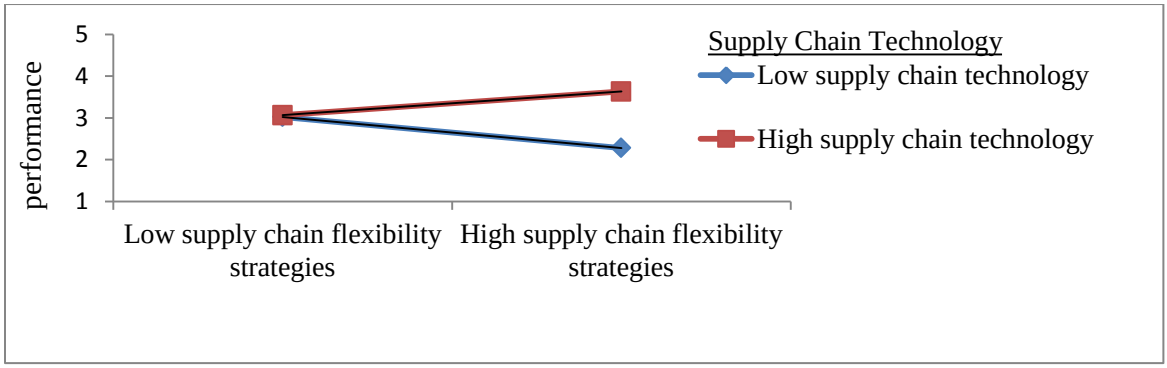

Figure 3.2: Interaction Graph (slope) for Supply Chain Technology and Supply Chain Flexibility Strategies

As illustrated in figure 4.2, the line slopes down more for low supply chain technology; this shows that at low levels of supply chain technology, the negative supply chain collaboration strategies' impact on performance is much stronger in comparison to high supply chain technology.

However, at higher supply chain technology, the line tends to straighten, this shows that at higher supply chain technology, the decrease in supply chain collaboration strategies fails to produce similar change in the performance. In conclusion, higher supply chain technology weakens the negative supply chain collaboration strategies' impact on performance.

Finally, the interaction slope figure 4.3 shows that supply chain technology dampens the positive relationship amid supply chain agility strategies and performance.

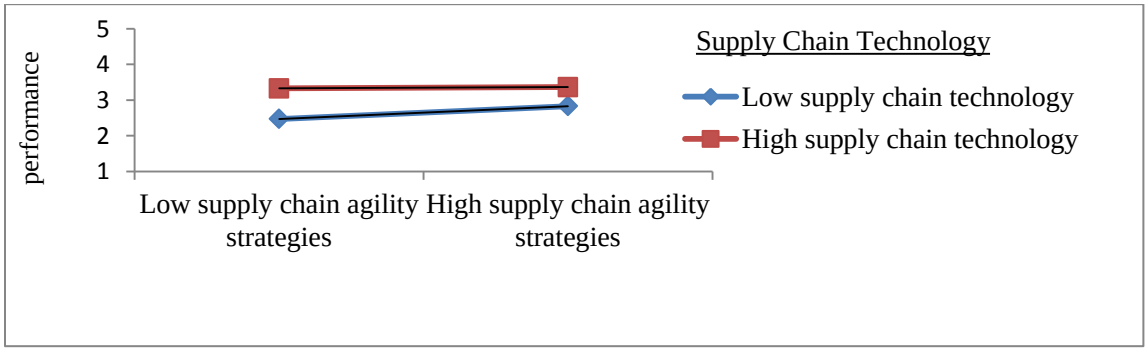

Figure 4.3: Interaction Graph (slope) for Supply Chain Technology and Supply Chain Agility Strategies

As depicted in figure 4.3, the line is a little steeper for low supply chain technology; this shows that at low levels of supply chain technology, the supply chain agility strategies' impact on performance is stronger in comparison to high supply chain technology.

However, at higher supply chain technology, the line tends to straighten, this shows that at higher supply chain technology, the increase in supply chain agility fails to produce to similar change in the performance. In conclusion, higher supply chain technology weakens the supply chain agility strategies' impact on performance.

It is evident that supply chain technology moderates the relationship between supply chain collaboration strategies (sharing information, visibility, and strategic supplier partnerships) and the performance of floriculture firms in Kenya, Nakuru County. These firms continually seek information on market dynamics and uncertainties to make informed decisions about demand and supply forecasting.

Investing in big data analytics, IoT, and Blockchain technologies can significantly enhance collaboration across the supply chain. The timely and accessible information provided by these technologies will improve market visibility for floricultural firms, thereby boosting performance and resilience against various disruptions in the sector. The findings are consistent with Al-Omoush et al. (2023) that information technology boosts collaboration by enabling companies to coordinate and share resources and other capabilities effectively.

Likewise, Dubey et al. (2020), hold that information technology augments processing capabilities and sharing information which is auspicious in disruption recoveries. Jake et al. (2019) contend that the Internet of Things (IoT) technologies with big data analytics facilitate data collection and transfer for efficient management and decision making.

It was established that supply chain technology moderates the relationship between supply chain flexibility strategies (re-engineering supply chains, delivery flexibility and production flexibility) and the performance of floriculture firms in Kenya, Nakuru County. Technology enables these firms to redesign their supply chains, improving preparedness and allowing for faster, effective responses to fluctuations in flower production caused by variations in order or unpredictable transportation.

The findings are consistent with the arguments of Gupta et al. (2019) that flexibility in supply chain can be realized by utilizing information technology. Further, Minhao et al. (2021) argue that implementing information technology can expand the effectiveness of a firm in discovering new information and introducing reconfigurations towards supply chain disruptions.

It's evident that supply chain technology moderates the relationship between agility strategies (decisiveness, forecasting demand, and management of inventory) and the floriculture firms' performance. Expedient and accessible information from technologies such as Big data or Blockchain will enhance agile supply chains, allowing for quick decisions and counteractions to changes in flower demand before, through, or post disruptions.

The results concur with Baah et al. (2021) and Al-Omoush et al. (2023) that web-based enterprise solutions and technological advancements have significantly evolved supply chain agility and the general firm performance.

In addition, Ivanov et al. (2019) contend that technology has the latent ability to drive excellence in decision-making during the management of severe disruptions, while also strengthening resilience. Equally, Minhao et al. (2021) postulate that firms should leverage technology to analyze trends in the environment and develop revival strategies from interruptions in the supply chain.

In conclusion, it is clear that supply chain technology significantly moderates the relationship between supply chain resilience strategies (collaboration, flexibility and agility) and the performance of floricultural firms. Scholars (Akwalu, 2022; Scholz & Anna, 2021) aver that instigating technology to strengthen supply chain resilience is advantageous for the firms. Peterson et al. (2015) also found that supply chain technology serves a crucial moderating role in the relationship between supply chain strategies and a firm's performance.

From the foregoing, it could be said that supply chain technologies and their applications are espoused by the TOE model Both existing and emerging technologies pertinent to the firm determine how a firm considers their need for adopting new technology hence searching for it. In view of that, floricultural firms will improve performance and enhance resilience by adopting latest technologies to antedate and brace for the varied and continually evolving risks within the floricultural industry.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The chapter summarises the findings of the study and also draw conclusions and make recommendations and suggestions for additional research anchored this study's results.

5.2 Summary of Findings of the Study

This study investigated the supply chain resilience strategies and floriculture firms' performance in Kenya, Nakuru County. The motivation for this study stemmed from the fact that the floriculture industry faces a range of frequent and evolving challenges that, if not effectually managed, may trigger closures of business, recovery impediments, and significant loss.

These challenges were aggravated by the global Covid-19 pandemic, a crisis that tested the supply chain industry like never before. However, supply chain resilience can help floricultural firms to work seamlessly, resurge, and withstand disruptions to meet customer gratification, added profits, and quality elevation thus improving overall performance.

The study utilized a cross-sectional survey design, focusing on101 floriculture firms in the County of Nakuru listed in the directory of Janifarm (2022) and Kenya Flower Council (2022). The sample consisted of 255 respondents at the management level from purchasing, logistics, production, and sales departments. A pilot study was carried out with 25 participants.

Primary data were collected using questionnaires, yielding 197 valid responses. The data were analyzed using version 26 of the Statistical Package for the Social Sciences (SPSS) to perform descriptive, correlation, and multiple ordinal regression analyses. Hypotheses were tested at a 5% significance level to determine whether they should be accepted or rejected.

The study was guided by five objectives: to investigate the effects of supply chain collaboration strategies, supply chain flexibility strategies, supply chain agility strategies, and risk management strategies on the floriculture firms' performance. Additionally, the study investigated the moderating effect of supply chain technology on the relationship between supply chain resilience strategies and the performance of floriculture firms in Kenya, Nakuru County.

The null hypotheses tested were as follows:

$H_0$1: Supply chain collaboration strategies have no significant effect on floricultural firms' performance in Kenya-Nakuru County.

$H_0$2: Supply chain flexibility strategies have no significant effect on floricultural firms' performance in Kenya-Nakuru County.

$H_0$3: Supply chain agility strategies no significant effect on floricultural firms' performance in Kenya-Nakuru County.

$H_0$4: Supply chain risk management strategies have no significant effect on floricultural firms' performance in Kenya-Nakuru County.

The first study objective investigated how supply chain collaboration strategies affected the studied floricultural firms' performance. From the findings most respondents believed these strategies positively influenced firm performance. There was a clear linear relationship between the collaboration strategies and performance. Additionally, the Beta values demonstrated a positive effect of these strategies on performance.

This study examined supply chain collaboration through information sharing, strategic partnerships, and visibility, revealing that respondents largely agree these components are essential for supporting floricultural firms amid various disruptions. However, while many believe their organizations have established collaborative measures for information sharing, these efforts are still insufficient. There is limited adoption of advanced technologies that enable effective and rapid information sharing.

The second study objective determined how supply chain flexibility strategies (measured by production flexibility, supply chain re-engineering, and delivery flexibility) influenced the performance of floriculture firms in Kenya, Nakuru County. The data showed that most respondents believed these strategies positively affected firm performance. Furthermore, there was a significant positive linear relationship between these flexibility strategies and performance. However, the Beta values did not reveal any significant impact of these strategies on performance.

The third study objective assessed how supply chain agility strategies (measured by decisiveness, forecasting demand, and management of inventory) influenced the floriculture firms' performance of in Kenya, Nakuru County.

Results indicated that most respondents believed these strategies positively affected firm performance. There was a significant positive linear relationship between these agility strategies and performance. Furthermore, the Beta values confirmed a positive impact of supply chain agility strategies on performance.

The fourth study objective determined how supply chain risk mitigation strategies affected the floricultural firms' performance in Kenya, Nakuru County. Results revealed that most respondents felt these strategies had a positive impact on firm performance. There was a significant positive linear relationship between these strategies and performance. Additionally, the Beta values indicated a positive influence of these risk management strategies on performance.

This study explored the supply chain risk management strategies, focusing on accepting risk, reduction of risk, and transferring risk. The findings indicate that the strategies are crucial for enhancing resilience in floricultural firms amidst the constantly evolving disruptions in the industry. However, it was revealed that the firms lacked adequate risk management plans and policies, as well as collaborative initiatives with partners to effectively share risks and reduce uncertainty.

The fifth study objective evaluated how supply chain technology moderated the relationship between the strategies of supply chain resilience and the performance of floriculture firms in Kenya, Nakuru County. Findings revealed that most respondents strongly believed that technological engagement plays a significant moderating role in this relationship.

Additionally, there was a significant positive linear relationship between supply chain technology and performance of firms. The tested hypothesis was:

$H_0$5 Supply chain technology does not significantly moderate the relationship between supply chain resilience strategies—namely: collaboration, flexibility, agility, and risk management—and the performance of floriculture firms in Kenya-Nakuru County.

The hypothesis can further be broken down as:

$H_0$5a: Supply chain technology does not significantly moderate the relationship between supply chain collaboration strategies and the performance of floriculture firms in Kenya-Nakuru County

$H_0$5b: Supply chain technology does not significantly moderate the relationship between supply chain flexibility strategies and the performance of floriculture firms in Kenya-Nakuru County

$H_0$5c: Supply chain technology does not significantly moderate the relationship between supply chain agility and the performance of floriculture firms in Kenya-Nakuru County

$H_0$5d: Supply chain technology does not significantly moderate the relationship between supply chain risk management and the performance of floriculture firms in Kenya-Nakuru County.

The moderation results indicated that the investigated supply chain resilience strategies (collaboration, agility, and flexibility strategies) interacted with supply chain technology, causing an additional variance in predicting the floricultural firms' performance. Particularly, the interaction between collaboration strategies and supply chain technology notably reduced the impact on floricultural firms' performance.

Similarly, the interaction between agility strategies and technology decreased the effect on performance. Conversely, the combination of flexibility strategies and supply chain technology significantly enhanced the effect on firm performance. However, there was no evidence that the interaction between supply chain technology and supply chain risk management influenced the performance of floriculture firms.

5.3 Study Conclusions

It was evident that supply chain resilience strategies-specifically, supply chain collaboration, agility, and risk management-positively and significantly impacted the performance of floriculture firms in Kenya, Nakuru County. These strategies help firms withstand disruptions, recover effectively, operate continuously, and reduce operational costs, thereby enhancing overall performance and resilience against the diverse and persistent risks in the floricultural sector. Based on the study objectives, we can therefore conclude the following:

The first objective supply chain collaboration strategies contributed positively to the floriculture firms' performance. Supply chain collaboration was measured by visibility, sharing information, and strategic partnerships. Floricultural firms clearly benefit from leveraging visibility and strategic partnerships to enhance collaboration and build resilience in a challenging environment. By improving visibility, these firms make data accessible to all stakeholders, which enhances their ability to manage logistics and operations more effectively. This results in faster responses to disruptions, changing needs, and market conditions.

While many organizations believed they have collaborative measures for information sharing, those efforts were insufficient due to limited adoption of advanced technologies that facilitate information sharing. Firms should prioritize adopting technologies like cloud-based platforms and real-time data analytics, along with employee training for effective use. Benchmarking best practices from successful case studies and establishing formal guidelines for information sharing will strengthen collaboration. Proactively addressing issues and sharing information with supply chain partners will help floricultural firms sustain better performance during disruptions and demand fluctuations.

The second objective, which focused on supply chain flexibility strategies, found that these strategies did not significantly affect the floricultural firms' performance. This lack of impact may be due to supply chain flexibility not being fully utilized by the respondent firms. If embraced, supply chain flexibility could enhance performance and resilience. Floricultural firms should integrate flexibility to enhance their ability to respond to transport and production disruptions that are prevalent in the industry.

This can be realized by adopting a supply chain structure that is adaptive and developing systems to integrate information, enabling quick adjustments in routing and transportation modes. Additionally, supply chain reengineering can confer a market advantage by allowing firms to respond swiftly to changes in delivery requirements, distribution capacity, and product development.

The third objective supply chain agility strategies—determined by decisiveness, forecasting demand, and management of inventory—contribute positively to performance of floriculture firms. These strategies increased supply chain agility by strengthening the resilience of floriculture firms in the face of various disruptions within the sector. Floricultural firms effectively applied agility in inventory management and adjusted delivery times to accommodate changing needs and seasons, thereby ensuring a resilient supply chain.

Supply chain managers are empowered to make decisive plans to adapt to external environment and varied disruptions within the industry. Floricultural firms can maintain an agile supply chain by implementing precise forecasting of demand, enhancing the capacity of storage, and maintaining surplus labor and materials on hand to rapidly increase output when necessary. It will serve as a bumper against varied orders, prioritization shifts of clients, and dynamic pricing.

The fourth objective, supply chain risk management strategies—determined by acceptance of risk, reduction of risk and transfer of risk—positively and significantly affected the floricultural firms' performance in Nakuru County affiliated to cost savings, responsiveness, and firm continuity. The floricultural supply chain is marked by constant and evolving disruptions resulting from the perishable nature of its products.

By establishing dedicated risk management teams, floricultural firms can draw insights from past disruptions to better strategize for impending challenges. As such, Floricultural firms can sustain risk management practices by shifting the majority of risks to third parties, such as insurance providers, since risk alleviation lessens its force and fosters resilience.

The fifth objective of the study assessed the moderating effect of supply chain technology on the relationship between supply chain resilience strategies and the performance of floriculture firms in Kenya, Nakuru County. It was evident that supply chain technology moderated the relationship between supply chain resilience strategies-specifically, supply chain collaboration, agility, and flexibility strategies-and the performance of the firms.

Integration of supply chain technologies is good and imperative for any floricultural firm to boost performance due to the improved performance obtained when firms use relevant and latest technologies thus guaranteed resilience against the myriad disruptions in this industry. Floricultural firms will likely be sustainable if they adopt the right and state-of-the-art technology to anticipate and brace for these varied and constantly evolving risks.

These firms require constant access to information on market dynamics and uncertainties to make informed decisions when forecasting supply and demand requirements. Allocating resources in technologies such as Blockchain, IoT, and big data analytics can augment collaboration across the supply chain. These technologies deliver prompt and actionable insights, enhancing the visibility of market data for floricultural firms

This improved visibility boosts performance and resilience against the sector's various disruptions. Additionally, technology enables floricultural firms to re-engineer their supply chains for amplified preparedness and a quicker, more effective response to changes in production of flowers because of order variations or transportation issues caused by unforeseen disruptions.

5.4 Policy Recommendations

Concerning the first objective, policies should be developed that focus on enhancing supply chain resilience by fostering collaboration between flower firms and their customers. Endorsing transparent strategic partnerships and visibility across all tiers will significantly improve performance. This approach will contribute to cost savings, ensure continuity despite ongoing disruptions in the sector, and enable quick responsiveness.

With reference to the second objective, policies should be developed to foster a flexible supply chain that integrates re-engineering for enhanced proactiveness and responsiveness. These policies should focus on improving production and transportation flexibility to better handle changes in production of flowers because of order variations, unforeseen events, and cyclic variations in the sector.

Pertaining to the third objective, policymakers in the sector of floriculture should develop adaptable policies that support expedited decision-making by fostering an agile supply chain. Such a supply chain should be designed to mitigate and perceive interruptions by effectually managing inventory, adjusting to fluctuating demands, and adapting delivery times when needed.

This approach will ensure a resilient and robust supply chain, that can effectively withstand the diverse upheavals in the industry. Regarding the fourth objective, it is important to acknowledge that it is impossible to eliminate all risks. Floriculture firms should accept the reality of diverse, persistent, and emerging risks in the industry. As such, policies should be developed to manage these risks, primarily by transferring the majority of them to third parties (insurers) as it is apparent alleviating risks lessens their outcome and enhances resilience, thereby improving performance.

As to the fifth objective, integrating supply chain technologies is essential for enhancing performance of floricultural firms. Management should implement policies that promote the adoption of latest technologies which align with their resilience strategies. This will improve overall resilience and performance, leading to saving costs, rapid responses and continuity of business amid disruptions.

5.5 Areas for Further Research

This research study offers further factual evidence that supply chain resilience strategies enhance firm performance and resilience against disruptions, particularly in the floriculture sector. However, the study prioritized four key aspects of supply chain resilience strategies namely: collaboration (measured by—visibility, information sharing, and strategic partnership), flexibility (measured by—production flexibility, supply chain re-engineering, and delivery flexibility), agility (measured by—decisiveness, forecasting demand, and management of inventory) and risk management (gauged by—accept risk, reduce risk and transfer of risk).

However, future research should explore additional facets of supply chain resilience strategies. A comprehensive examination of strategies such as diversification, vertical integration, technology adoption, multi-sourcing, and inventory and capacity buffers can provide valuable insights into their effectiveness. Additionally, focusing on cross-sector comparisons and methodological diversity will enhance understanding of their impact on the performance of floricultural firms.

For example, comparing these strategies across sectors, like manufacturing and retail, will help identify sector-specific challenges and opportunities, allowing for more tailored approaches. Employing varied research designs, such as case studies, longitudinal studies, and experimental designs, will enrich the understanding of resilience strategies over time and across various contexts. Also, utilizing diverse sampling techniques, like stratified or systematic, will ensure that findings are representative and generalizable.

By integrating these approaches, future studies can offer practical suggestions for policymakers and managers, supporting the development of more robust strategies to augment supply chain resilience and improve firm performance particularly in floricultural firms and across other sectors.

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APPENDICES

Appendix 1: NACOSTI Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 680520

Date of Issue: 20/February/2023

RESEARCH LICENSE

This is to Certify that Miss., LEONAH KEMUNTO NYAMETE of Maasai Mara University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nakuru on the topic: SUPPLY CHAIN RESILIENCE STRATEGIES AND PERFORMANCE OF FLORICULTURAL FIRMS IN NAKURU COUNTY, KENYA. for the period ending : 20/February/2024.

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See overleaf for conditions

Appendix II: Introduction Letter by the Researcher

Date: …….

To …….

Dear Sir/Madam,

RE: **Research Data Collection**

I am currently a Ph.D. student at Maasai Mara University, specializing in Business Administration with a focus on Supply Chain management. I am currently collecting data for my academic research titled "Supply Chain Resilience Strategies and Performance of Floricultural Firms in Nakuru County, Kenya." I would be delighted to have you participate in my study as a vital contributor and participant.

Your invaluable input and willingness to complete the attached questionnaire, despite your busy schedule, would greatly contribute to the success of this research. The information gathered for this study will be treated with the utmost confidentiality, ensuring your complete anonymity throughout the process. Should you wish to receive the study results once all analyses are finalized, a final report will be provided to you. I would greatly appreciate it if you could complete the questionnaire in the upcoming two weeks, as this would facilitate an early completion of the study. Thank you in advance for your thoughtful consideration, responses, and time.

Yours sincerely,

Leonah Nyamete

Appendix III: Authorization Letter

Date:…….

To the Managing Director,

……..

……..

Nakuru

Dear Sir/Madam,

RE: **Request to Collect Academic Research Data on "Supply Chain Resilience Strategies and Performance of Floricultural Firms in Nakuru County, Kenya"**

I am a Ph.D. student at Maasai Mara University, specializing in Business Administration with a focus on Supply Chain Management. As part of my doctoral program, I am obligated to complete a research thesis, as referenced above. Consequently, I kindly request for consent to obtain pertinent data from your Supply Chain Managers to facilitate my research. I assure you that all data collected will be treated with the highest level of confidentiality and will be used solely for academic purposes.

Thank you for considering my request. I hope your esteemed organization continues to excel in all its endeavors

Yours sincerely,

Leonah Nyamete

Appendix IV: Questionnaire

This questionnaire aims to explore the supply chain resilience strategies and performance of floricultural firms in Nakuru County, Kenya. In particular, it will involve aspects of supply chain collaboration strategies, flexibility strategies, agility strategies, risk management strategies and the moderating effect of supply chain technology on the strategies and the performance relations.

Take Note:

1. All responses will be kept strictly confidential.
2. Should you wish to obtain a copy of the findings kindly provide your name and address for receiving, preferably, e-mail (optional).
3. Kindly provide the requested information by filling in the blanks or marking (√) the answer that best applies.

Name: …….

Address: ……..

SECTIONA: General information

1. Please provide the name of your flower firm.....
2. How many years has the flower firm been in business?

Less than 5 [] 6-10years []

11-25years [] Over 15 years []

3. Please state your job title.

Top management [ ]

Middle management [ ]

Operation management [ ]

4. Please select your place/department of work

Warehousing [ ]

Purchasing [ ]

Logistics [ ]

Production [ ]

Sales [ ]

SECTION B: SUPPLY CHAIN COLLABORATION STRATEGIES

Rate each statement that describes the extent to which supply chain collaboration affects the performance of your firm by using a tick(√) where appropriate:

1: Strongly agree 2: Agree 3: Not sure 4:Disagree 5: Strongly disagree

STATEMENT	RATING				
	1	2	3	4	5
Information sharing					
1. Our organization has instituted efficient measures for collaborative information sharing with other firms and buyers.					
2. Our partners promptly notify us when they anticipate disruptions in supplies.					
3. We have joint problem solving with our partners					
Supply chain visibility					
4. Supply chain visibility improves our performance by providing all stakeholders, including customers, with easy access to data					
5. Supply chain visibility improves our performance by enabling us to manage our logistics and operations more effectively					
6. Supply chain visibility improves our performance through the capacity to respond swiftly to supply chain disruption thus reducing risk					
Strategic partnership					
7. We have a cooperation agreement with other firms to notify one another ahead of time about our evolving need and market information.					
8. Nurturing a good relationship has encouraged the exchange of feedback between the organization and our partners.					
9. Strategic partnership has given my company a competitive edge above					

SECTION C: SUPPLY CHAIN FLEXIBILITY STRATEGIES

Rate each statement that describes the extent to which supply chain flexibility affects the performance of your firm by using a tick(√) where appropriate:

STATEMENT	RATING				
	1	2	3	4	5
Supply chain re-engineering					
1. Our flower firm features a flexible supply chain framework designed to handle changes resulting from supply chain disruptions					
2. Supply chain reengineering has helped my organization to gain a competitive edge					
3. We utilize a robust system that allows for effective information integration.					

Production flexibility					
4. We can delay flower production right up until customers are ready to place their orders.					
5. Our flower firm responds effectively to adjust production capacity					
6. Our flower firm swiftly responds to develop new products for the market					
Delivery flexibility					
7. Our supply chain swiftly adapts to our changing delivery time requirements					
8. We can swiftly expand our distribution service capacity					
9. We can swiftly adjust the routing and mode of transportation for outbound shipments					

SECTION D: SUPPLY CHAIN AGILITY STRATEGIES

Rate each statement that describes the extent to which supply chain agility affects the performance of your firm by using a tick(√) where appropriate:

STATEMENT	**RATING**				
	1	**2**	**3**	**4**	**5**
Demand forecasting					
1. Our flower firm can swiftly react to order changes due to market demand					
2. Our flower firm can swiftly maximize on new customer trends and priorities					
3. Our flower firm responds quickly to our changing requirement of pricing					
Decisiveness					
4. Our organization is capable of making strategic plans and adjustments to enhance performance					
5. Our flower firm has the ability to deploy adaptive capability to external environment					
6. Our flower firm has the ability to respond quickly to introduce alternative plans					
Inventory management					
7. We maintain excess capacity in materials and labor to swiftly increase output when necessary.					
8. Our organization can effectively manage inventory levels thus managing pricing					
9. We can quickly increase storage capacity					

SECTION E: SUPPLY CHAIN RISK MANAGEMENT STRATEGIES

Rate each statement that describes the extent to which supply chain risk management affects the performance of your firm by using a tick(√) where appropriate:

STATEMENT	RATING				
	1	2	3	4	5
Accept risk					
1. We frequently monitor supply risks by collaborating with our strategic partners					
2. We provide training to employees about risk management strategies.					
3. We have formulated continuity plans aimed at managing significant supply chain risks.					
Reduce risk					
4. Our flower firm has instituted measures to identify and manage risks					
5. Our flower firm has the ability to leverage past disruptions to strengthen future readiness					
6. The foundation of our continuous improvement initiatives lies in our risk management culture.					
Transfer risk					
7. Our flower firm has appropriate policies for risk assessment, delegation and avoidance					
8. Our flower firm has devoted to overseeing supply risk management					
9. Our floriculture firm copes with disruption changes through collaboration with partners to share risks and minimise uncertainty					

SECTION F: SUPPLY CHAIN TECHNOLOGY

Rate each statement that describes the extent to which supply chain technology affects the performance of your firm by using a tick(√) where appropriate:

STATEMENT	RATING				
	1	2	3	4	5
Adoption of innovative technologies					
1. We use supply chain technology for procurement and supply functions					
2. We use supply chain technology in flower farming operations like planting, irrigation, fertigation and systems e.g teff planting machine					
3. We use supply chain technology in demand forecasting and response					
Improved performance due to innovative technologies					
4. Supply chain technology has improved continuous business operation regardless of disruptions					
5. Supply chain technology enables the firm to reduce the number of production wastages					
6. By using supply chain technologies, our flower firm can respond quickly to market demand variations caused by supply chain disruptions					

SECTION F: PERFORMANCE

The following are a number of outcomes in performance that organizations experience after implementation of supply chain resilience strategies across their operations. Please show the extent the outcomes your organization has experienced by ranking on a scale of 1-5 where: 1: strongly agree 2- agree, 3- not sure, 4- disagree, 5- Strongly disagree

STATEMENT	**1**	**2**	**3**	**4**	**5**
Continuity					
1. We are able to operate continuously regardless of the disruption					
2. We experience increased market share, penetration and growth					
3. We experience improvement, efficiency and effectiveness in operations					
Cost					
4. We are able to reduce costs of operations					
5. We experience a reduction in the number of production wastages					
6. We experience a reduction on stock-outs					
Responsiveness					
7. Our flower firm quickly responds to changes in market demand as a result of supply chain disruption					
8. We have the capability to quickly modify our delivery schedules and time to meet our major customer's requirements.					
9. Our flower firm has improved the time to make changeovers					

THANKYOU!

Appendix V: List of Flower Firms in Nakuru County

1.Africablooms
2.Agriflora(K)Ltd
3.Akina
4.AlaniGardens
5. Aquila development company
6.Beauty Line Kenya Limited
7.BenevFloraLtd
8. Bigot Flowers(K) Ltd
9.BilaShakaFlowersLtd
10.Bloomvalley
11.Blooming AfricaLtd
12.BlueSky
13.Buds&Blooms(K)Ltd
14.Carzan Limited
15.Color Vison RosesLtd
16.ColourCrops
17.DeRuiters
18.Dummenorange
19.Duro Farm
20.Elbur FloraLtd
21.Equator Flowers(k)Ltd
22.Esmeralda breeding
23.EZplants
24.Finlay's Flamingo
25.Finlay's Kingfisher
26.Finlays horticulture Kenya Ltd
27.Florafresh KenyaLtd
28.Florema(k)ltd
29.Florensis Hamer
30.Florensis Kenyaltd.
31.Fontana Ltd
32.Fourteen Flowers
33.Galaxy
34.Groove Ltd
35.Hamer Kenyaltd
36. Hamwe Ltd.–Molo Farm
37. Harvest flowers
38. Highland flower firm
39. Homegrown- Flamingo farm
40. Homegrown- Kingfisher flowerfarm
41. Imani Flowers Limited
42. Indufarm
43. Interplant Roses
44. Jatfloraltd.
45. Kariki Naivasha farm.
46. Karuturi flowers
47. Kentalya
48. Kongoni River Farm Ltd - Longonot Division
49. Kongoni River Farm Ltd. -StarDivision
50. Kongoni River Farm Ltd. –Gorge Division
51. Kongoni farm
52. Kreative Roses
53. Lake Flowersltd
54. Lamorna flowers
55. Leekem holding ltd.
56. Lex
57. Linssen Roses
58. Live WireLtd
59. Loldia
60. Longonot Horticulture
61. Maaskant FlowersLimited
62. Maridadi flowersltd
63. Mayflowers(k)Ltd
64. Mbegu farm
65. Molo River Roses Limited
66. Multigrow Investments
67. Mzurie farm flowers
68. Nini Ltd.
69. NIRP East AfricaLtd
70. Olijflower breeders, nakuru
71. OlijRozen Kenya ltd naivasha
72. Ol-Njorowa Ltd
73. Oserian Development Co.
74. Oserian FlowerFarm
75. Panda FlowersLtd
76. Plantation PlantK.Ltd
77. Racemes KenyaLtd
78. Rainforest
79. Rift Valley Roses K.Ltd
80. Rimi FloraLtd
81. Roseto Ltd
82. Savanna flowersltd
83. Savanna flowersplc
84. Schreurs East Africa Ltd
85. Shalimar flowers(k)ltd
86. Sojanmi spring fields
87. Sote FlowersLtd
88. Star flowers
89. Stockman Rozen Kenya Ltd
90. Subati FlowersLtd
91. SunBuds
92. TerraNigra
93. The Plant Factory KenyaLtd
94. Top Harvest.
95. Tulaga flowers
96. Twiga roses
97. VanDenBerg roses
98. WACinternational
99. Wildfire FlowersLtd
100. Xpressions flora
101. Zena RosesLtd

Appendix VI: Table 2.1 Summary of the gaps in Reviewed Studies

Authors / year	Focus of Study	Research Findings	The Gaps	Focus of Current Study
Thi et al. (2020).	Supply Chain Collaboration and Performance: An Empirical Examination of the Maturity Model in Switzerland.	The connection between SC collaboration mechanisms and performance is validated, with internal collaboration serving as a mediator. Internal collaboration— encompassing operations management and information integration— moderates the relationship between external integration and performance.	The study was however limited to Switzerland and did not link the collaboration indicators	This study addressed collaboration indicators like sharing information, visibility and strategic partnership and their effects on performance on the Kenyan floricultural firms, in Nakuru County.
Umar & Wilson (2021).	SC Resilience: Harnessing the Power of Collaboration in Disaster Management. The role of collaboration within food supply chains across two distinct South Asian regions that are frequently affected by catastrophes.	The findings indicate that mutual dependence, communicating effectively, sharing information, trust, and informal financial support, are key components of supply chain collaboration that enhance the overall resilience of supply chains during natural disasters.	The study was based on South Asia region limited to food supply chains and did not link other sectors nor study other indicators of collaboration like supply chain visibility and strategic supplier partnership and their effects on performance	This study addressed collaboration indicators like sharing information, visibility and strategic partnership and their effects on performance on the Kenyan floricultural firms, in Nakuru County
Muricho and Muli (2021)	Impact of Supply Chain Resilience Practices on the Performance of Food and Beverage Manufacturing Companies in Kenya.	Findings indicate that, supply chain risk management, collaboration, integration and agility significantly influenced the firms.	The study focused on food and beverages manufacturing firms. The study did not consider flexibility as a resilience strategy	This study examined flexibility indicators like re-engineering, delivery and production flexibility and their effects on the Kenyan floricultural firms

Maxim et al. (2022).	Adjusting Supply Chain Operations in Preparation for and During the COVID-19 Pandemic.	They concluded that, adapting the supply chain prior to a pandemic is more beneficial than making adjustments during the pandemic, especially when specific operational recovery policies are implemented.	The research did not aim to provide solutions to the challenges.	This study examined re-engineering, delivery and production flexibility and their effects on performance in Kenyan floricultural firms, Nakuru-county
David et al. (2021)	COVID-19 and the Quest for Supply Chain Resilience: Responses and "Lessons Learned" from Logistics Service Providers	The firms structured their actions and responses to the COVID-19 outbreak around five primary themes: creating new revenue streams, strengthen data management and digitalization, optimizing logistics infrastructure, personnel capacity enhancing and increasing transport flexibility.	Based on their findings, flexibility is coming out as a key resilience strategy in disruptions but not much is studied on that.	This study examined re-engineering, delivery and production flexibility and their effects on performance in Kenyan floricultural firms, Nakuru-county
Dilek et al.(2022).	Resilience of Supply Chains during the Pandemic-COVID-19	The findings reveal that disruptions related to the pandemic impacted resilience-building activities. Proactive and reactive approaches fostered resilience during the pandemic; however, they were insufficient to mitigate all negative effects. Innovation stood out as the most effective factor	The study aimed to assess how effectively existing solutions supported supply chain resilience in perishable goods market in the UK	This study examined flexibility resilience metrics like re-engineering, delivery and production flexibility and their effects on performance in Kenyan floricultural firms, Nakuru County.
Minhyo and Aaron (2022)	Supply Chain Resilience and Operational Performance During COVID-19 Disruptions: case of South Korean Manufacturers	The study investigated the factors influencing supply chain resilience and operational performance to provide recommendations for other manufacturers on how to establish and sustain continuous, uninterrupted operations, even in the face of dynamic supply chains and global disruptions.	Methodology and context is within south Korean manufacturers	This study examined flexibility resilience metrics: re-engineering, delivery and production flexibility and their effects on performance in Kenyan floricultural firms, Nakuru County.

Scholz and Anna (2021)	Capabilities and Consequences of Supply Chain Resilience: The Moderating Role of Digital Technologies in Germany's Manufacturing Sector	Findings revealed agility and integration in the supply chain are enablers of supply chain resilience	The study did not present the specific agility indicators and was limited to manufacturing firms in Germany.	This study analyzed agility metrics as—forecasting demand, decisiveness, and management of inventory—and their effects on performance in Kenyan floricultural firms, Nakuru County.
Esra, et al. (2022).	Measuring Resilience and Complexity for Energy-Efficient Global Supply Chains During Disruptive Events. The goal was to assess COVID-19 impacts and model the resilience of energy management global supply chain in view of the trade between Turkey & EU and Turkey & China.	The findings demonstrate that except in Turkey, the reporting differences of the second wave was lesser than in the first wave. The major conclusion of the apparent decrease in the second wave is due to agility by learning from the first wave and building swift responsiveness in overcoming the second wave	The specific agility metrics are overlooked.	This study analyzed agility metrics as—forecasting demand, decisiveness, and management of inventory—and their effects on performance in Kenyan floricultural firms, Nakuru County.
Schmid et al. (2021)	COVID-19 and Business Continuity: Insights from the Private Sector and Humanitarian Organizations in Kenya	The findings emphasize the potential for agile, streamlined, and attainable business continuity strategies, which could be applicable in future disruptions.	The study however, did not present agility indicators ensuring continuity in such disruptions.	This study analyzed agility metrics as—forecasting demand, decisiveness, and management of inventory—and their effects on performance in Kenyan floricultural firms, Nakuru County.

Joanna & Subramanian (2021)	Impact of COVID-19 on Health Supply Chains: Preliminary Evidence from Africa.	The report indicates that the COVID-19 pandemic underscored the necessity of responding, adapting, and establishing mechanisms for crisis management to endure uncertain situations.	However, the study did not address how to establish mechanisms for crisis management to withstand uncertainty	This study investigated three disruption mitigation metrics: accept risk, reduce risk and transfer risk as supply chain risk mitigation strategies and their effects on performance in Kenyan floricultural firms, Nakuru County.
Debashree et al. (2021)	Enhancing Supply Chain Resilience in the COVID-19 Era. The purpose was to discover vital factors disrupting supply chains globally and assess risk reduction tactics creating resilience.	Findings identified cost–optimization s the most significant factor, while human resource management was determined to be the least significant in decreasing supply chain network vulnerabilities.	This research however, did not point out specific risk management strategies that create resilience.	This study investigated three disruption mitigation metrics: accept risk, reduce risk and transfer risk as supply chain risk mitigation strategies and their effects on performance in Kenyan floricultural firms, Nakuru County.