



Faculty of Economics and Business

**Management Control, Collaboration Behaviour and Fresh Produce
Supply Chain Performance in Weifang Area, China**

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Management Control, Collaboration Behaviour and Fresh Produce
Supply Chain Performance in Weifang Area, China

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DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Malaysia Sarawak. Except where due acknowledgements have been made, the work is that of the author alone. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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ABSTRACT

Fresh produce supply chains (FPSCs) face significant challenges in management and control, particularly in emerging markets like China. These challenges include complex stakeholder relationships and the lack of empirical evidence on how management practices and collaboration behaviour interact to influence supply chain performance. Although existing research has examined individual aspects of supply chain management, there remains a limited understanding of the integrated effects of management control practices and collaboration behaviour on FPSC performance.

This study investigates the relationships between management control practices (i.e., top management, supplier integration, internal management, customer integration, and risk management), collaboration behaviour, and FPSC performance. To address this research gap, a cross-sectional survey was conducted among 173 enterprises in the Weifang area of China. Data were analysed using partial least squares structural equation modelling (PLS-SEM) for statistical testing.

The results reveal that management practices significantly affect FPSC performance, with internal management showing the strongest impact ($\beta = 0.269$, $t=4.817$). Furthermore, collaboration behaviour significantly moderates the relationships between four management practices (i.e., top management, supplier integration, customer integration, and risk management) and the performance of the FPSC, and its moderating effect on internal management was not supported.

This research makes several significant contributions. From a theoretical perspective, it deepens understanding of the interplay between management control practices and

collaborative behaviour in FPSCs, extending existing management control theory and stakeholder theory. From a practical perspective, it provides valuable insights for supply chain managers, helping them understand how to effectively integrate management practices and collaborative approaches to enhance performance. For policymakers, the findings indicate the need to develop frameworks that support structured management control and collaborative relationships in the sector of fresh agricultural products.

Keywords: Management control, fresh produce, collaboration behaviour, supply chain performance, PLS-SEM

Kawalan Pengurusan, Gaya Kerjasama dan Prestasi Rangkaian Bekalan Hasil Segar di Kawasan Weifang, China

ABSTRAK

Rangkaian bekalan hasil segar (FPSCs) menghadapi cabaran besar dalam pengurusan dan kawalan, terutamanya di pasaran membangun seperti China. Cabaran ini termasuk hubungan pemegang taruh yang kompleks dan kekurangan bukti empirikal tentang bagaimana amalan pengurusan dan tingkah laku kerjasama berinteraksi untuk mempengaruhi prestasi rangkaian bekalan. Walaupun penyelidikan sedia ada telah mengkaji aspek individu pengurusan rangkaian bekalan, pemahaman tentang kesan bersepadu amalan kawalan pengurusan dan tingkah laku kerjasama terhadap prestasi FPSC masih terhad.

Kajian ini menyelidik hubungan antara amalan kawalan pengurusan (iaitu pengurusan atasan, integrasi pembekal, pengurusan dalaman, integrasi pelanggan, dan pengurusan risiko), tingkah laku kolaborasi, dan prestasi FPSC. Untuk menangani jurang penyelidikan ini, satu kajian keratan rentas telah dijalankan ke atas 173 perusahaan di kawasan Weifang, China. Data dianalisis menggunakan model persamaan struktur kuasa dua terkecil separa (PLS-SEM) untuk ujian statistik.

Hasil kajian menunjukkan bahawa amalan pengurusan memberi kesan yang signifikan terhadap prestasi FPSC, dengan pengurusan dalaman menunjukkan impak paling kuat ($\beta = 0.269$, $t=4.817$). Tambahan pula, tingkah laku kerjasama secara signifikan menyederhanakan hubungan antara empat amalan pengurusan (pengurusan atasan, integrasi pembekal, integrasi pelanggan, dan pengurusan risiko) dan prestasi FPSC, dan kesan penyederhanaan terhadap pengurusan dalaman tidak disokong.

Penyelidikan ini membuat beberapa sumbangan penting. Dari perspektif teori, ia memperdalam pemahaman tentang interaksi antara amalan kawalan pengurusan dan tingkah laku kerjasama dalam FPSCs, memperluaskan teori kawalan pengurusan dan teori pemegang taruh sedia ada. Dari perspektif praktikal, ia memberikan pandangan berharga kepada pengurus rangkaian bekalan, membantu mereka memahami cara mengintegrasikan amalan pengurusan dan pendekatan kerjasama secara berkesan untuk meningkatkan prestasi. Bagi pembuat dasar, penemuan ini menunjukkan keperluan untuk membangunkan rangka kerja yang menyokong kawalan pengurusan berstruktur dan hubungan kerjasama dalam sektor produk pertanian segar.

Kata kunci: *Kawalan pengurusan, produk Segar, kolaborasi pengurusan, prestasi rangkaian bekalan, PLS-SEM*

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LIST OF ABBREVIATIONS

AFSCQ	Agri-fresh Food Supply Chain Quality
AVE	Average Variance Extracted
CI	Customer Integration
CB	Collaboration Behaviour
CMV	Common Method Variance
CR	Composite Reliability
CRM	Collaborative Risk Management
FPSC	Fresh Produce Supply Chain
IM	Internal Management
IoT	Internet of Things
MC	Management Control
MCT	Management Control Theory
OLS	Ordinary Least Squares
PMS	Performance Management Systems
SCI	Supply Chain Integration
SCM	Supply Chain Management
SCC	Supply Chain Collaboration
SCP	Supply Chain Performance
SEM	Structural Equation Modelling
SME	Small and Medium Enterprise
SI	Supplier Integration
SPSS	Statistical Package for the Social Sciences
TM	Top Management

UNIMAS	Universiti Malaysia Sarawak
VEA	Virtual Enterprise Alliance
VIF	Variance Inflation Factor
PLS	Partial Least Squares

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter presents the context of the study and a brief description of key variables in the research, namely, management control, collaboration behaviour (CB), and fresh produce supply chain (FPSC) performance. Management control includes five variables: top management (TM), supplier integration (SI), internal management (IM), customer integration (CI), and risk management (RM). CB focuses on the collaboration between companies and stakeholders upstream and downstream of the supply chain (Pollard & Rowley, 2010). FPSC performance refers to the evaluation of the efficiency and effectiveness of the supply chain involved in the delivery of fresh fruits and vegetables from production to consumption (Waqas et al., 2023).

This chapter is organized into nine sections to enhance clarity. Section 1.2 introduces the study's background and establishes the research context. Section 1.3 presents the problem statement, identifying key challenges. The research objectives are detailed in Section 1.4, with subsection 1.4.1 outlining the general objective and subsection 1.4.2 specifying the specific goals. Section 1.5 lists the research questions that guide the study's focus. The significance of the study is explored in Section 1.6, with theoretical implications discussed in Section 1.6.1 and practical applications examined in Section 1.6.2, highlighting the study's dual contributions. Section 1.7 defines the study's scope and parameters. Key terms are clarified in Section 1.8, including "supply chain," "FPSC," and others, ensuring conceptual clarity. Finally, Section 1.9 organizes the study, providing a roadmap of the thesis structure for easy navigation and comprehension of its sequential order.

1.2 Study Background

The FPSC represents a complex network of interconnected business processes and relationships that requires careful management and coordination. This study focuses on three fundamental concepts (i.e., management control, management collaboration, performance) that are critical to understanding FPSC operations.

The management control elements in FPSC operations comprise five key components (i.e., TM, SI, IM, CI, RM) (Thi Mac et al., 2024). While these management practices provide valuable benefits, modern FSC complexities require enhance. TM provides strategic direction and resource allocation for supply chain operations, while SI focuses on coordinating relationships and processes with upstream partners (Munir et al., 2020). IM optimizes organizational processes and resource utilisation within the organization, serving as a foundation for external integration (Ostaev et al., 2020). CI ensures alignment of operations with downstream requirements and market demands, contributing to overall supply chain effectiveness (Wiengarten et al., 2016). Furthermore, RM plays a crucial role in identifying, assessing, and mitigating potential supply chain disruptions and challenges, while improving supply chain agility (Dao & Phan, 2023).

CB in FPSC contexts manifests through multiple dimensions. Supply chain partners engage in comprehensive information sharing and participate in joint decision-making processes (Yi et al., 2016). These collaborative activities are fundamentally built upon trust-based relationships among all stakeholders, fostering long-term partnerships and mutual benefits.

Supply chain performance (SCP) in the fresh produce sector comprises multiple interconnected dimensions (Aramyan et al., 2007). Operational efficiency encompasses the

optimization of logistics processes and minimization of waste throughout the supply chain network. Quality assurance mechanisms maintain consistent product freshness and adherence to safety standards (Chepleting, 2024). The system's responsiveness is evaluated through its capacity to efficiently address market demands. Additionally, performance assessment integrates environmental and economic sustainability metrics, alongside financial indicators including cost management and profitability measures.

China is globally recognized as a prominent agricultural nation characterized by its substantial agricultural resources and wide range of crop varieties. Shandong Province, in particular, holds significant agricultural importance and is characterized by extensive agricultural land and abundant agricultural resources. The Weifang region, within Shandong Province, is notably important as an agricultural production hub, not only locally but also nationally (Han & Li, 2011).

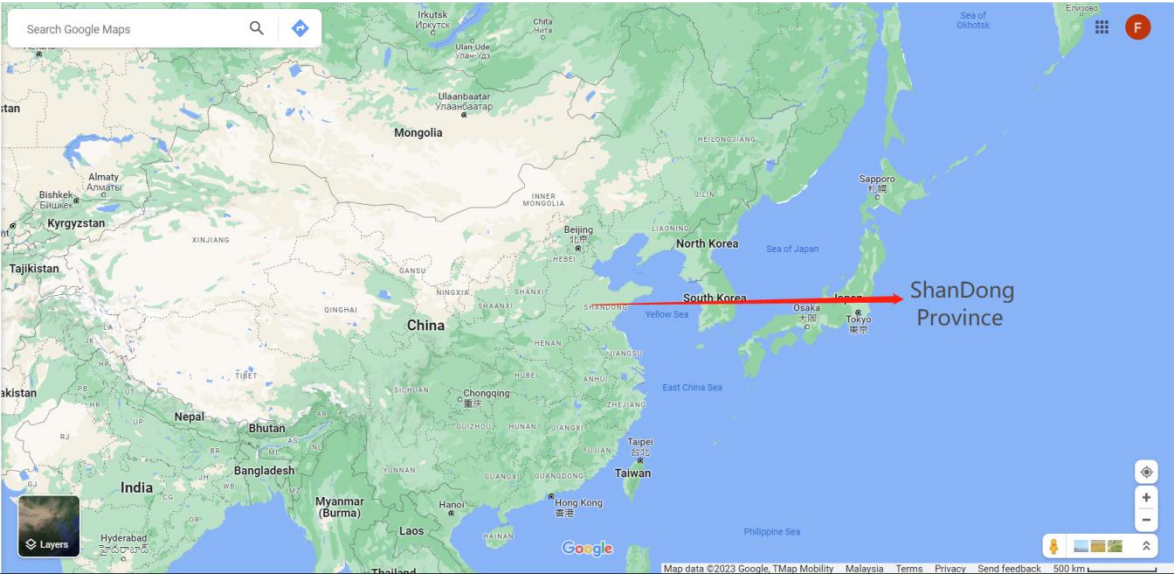


Figure 1.1: Shandong in China

Source: Google Maps

As a prominent province in the eastern coastal region of China, Shandong Province has a rich history and culture. Its provincial capital, Jinan, is known as the 'City of Springs' for its natural beauty. Furthermore, Shandong Province is one of the most populous regions in China, with an estimated population of 101.6279 million people by the end of 2022 (Shandong State Statistical Yearbook, 2023). This represents approximately 7.19% of the total population of the nation, making Shandong the second most populous province after Guangdong. Additionally, Shandong Province spans an area of approximately 158,000 square kilometres, which constitutes approximately 1.63% of China's total land area. However, despite its relatively small size, Shandong ranks 19th among the 34 provincial administrative regions in terms of area (China's National Bureau of Statistics, 2023).

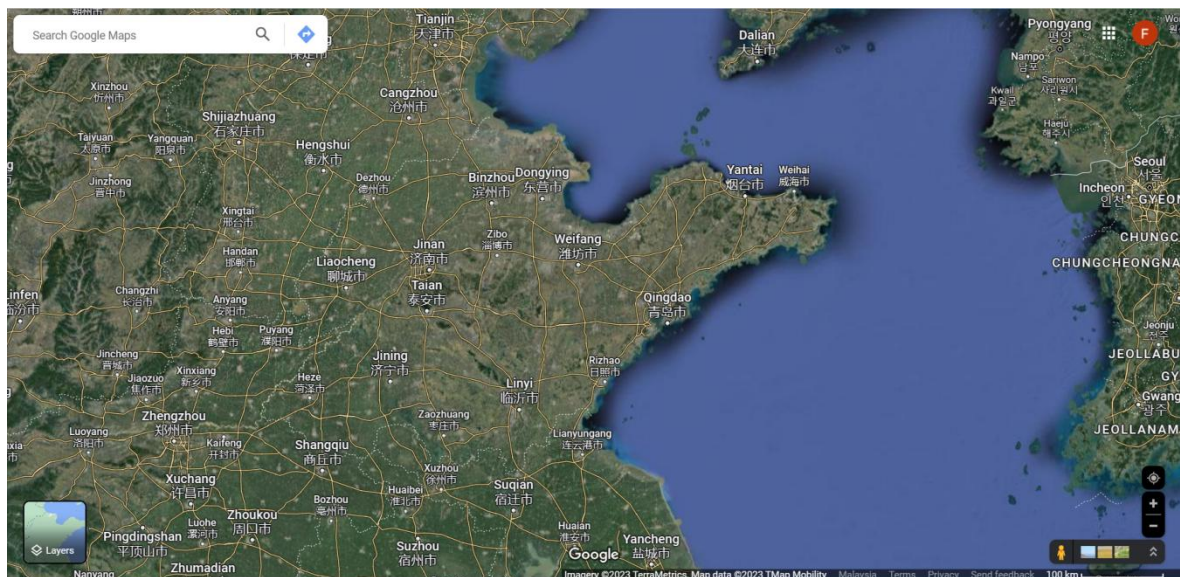


Figure 1.2: Shandong Province

Source: Google Maps

Shandong is not only a prominent province in the eastern coastal region of China but also a prosperous economic center. It is particularly known for its robust agricultural sector, which contributes a significant portion of the nation's grain supply. In 2021, Shandong's

agricultural production value reached a staggering 1.5 trillion yuan, with a grain production of 120 million metric tons. These impressive figures underscore Shandong's critical role as both an economic powerhouse and a vital food production hub within China's agricultural landscape (Shandong Statistical Yearbook, 2022).

According to data from the third national land survey, the current cultivated land area in Shandong Province is 96.928 million mu (approximately 6.462 million hectares). The total area of cultivated land in China is 1,917.90 million mu (approximately 127.86 million hectares). Thus, the cultivated land area in Shandong Province represents approximately 5.05% of the national total area (Ministry of Natural Resources of the People's Republic of China, 2021).

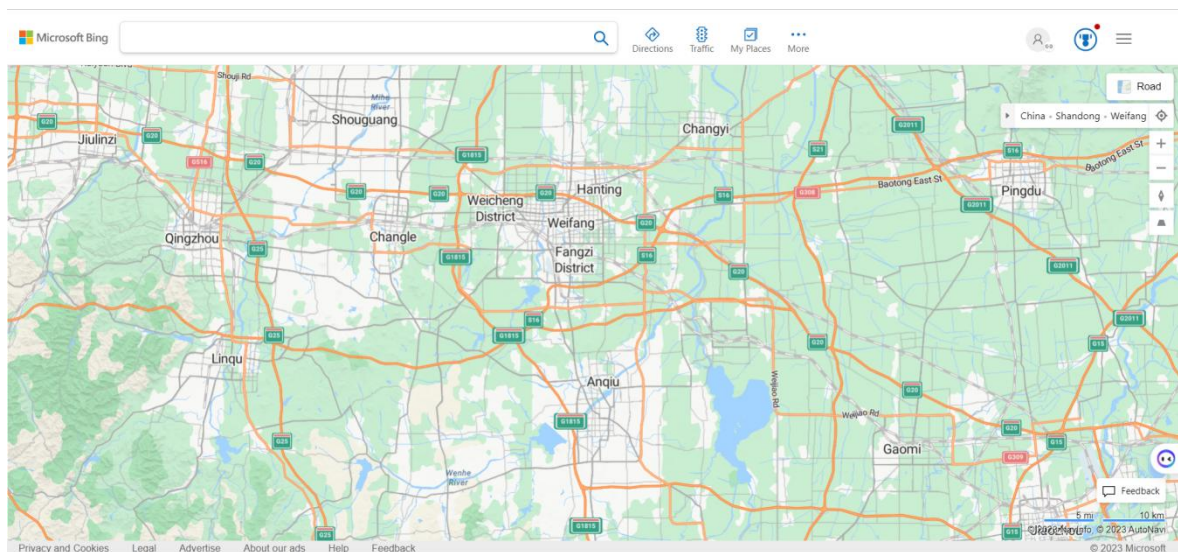


Figure 1.3: Weifang Area

Source: Google Maps

Weifang is a city in the central part of Shandong Province, China, with an area of 16,143.14 square kilometers. It governs 12 administrative regions at the county level. The city is bordered by Dong-Ying in the west, Linyi in the southwest, Ri-Zhao in the south, and

Qing-Dao in the east. Weifang comprises four districts: Kuiwen, Weicheng, Hanting, and Fangzi; six county-level cities: Qingzhou, Zhucheng, Shouguang, Anqiu, Gaomi, and Changyi; and two counties: Linqu and Changle.

As shown in Figure 1.4, Weifang leads these cities in vegetable production in 2021, with a yield of 13.066 million tons. This shows that Weifang has a well-developed vegetable cultivation industry with high competitiveness and production capacity. Furthermore, coastal cities, such as Qingdao, Yantai, and Weihai, have relatively lower vegetable yields than other cities (Source: Statistical Yearbooks of Various Cities/Regions 2023).

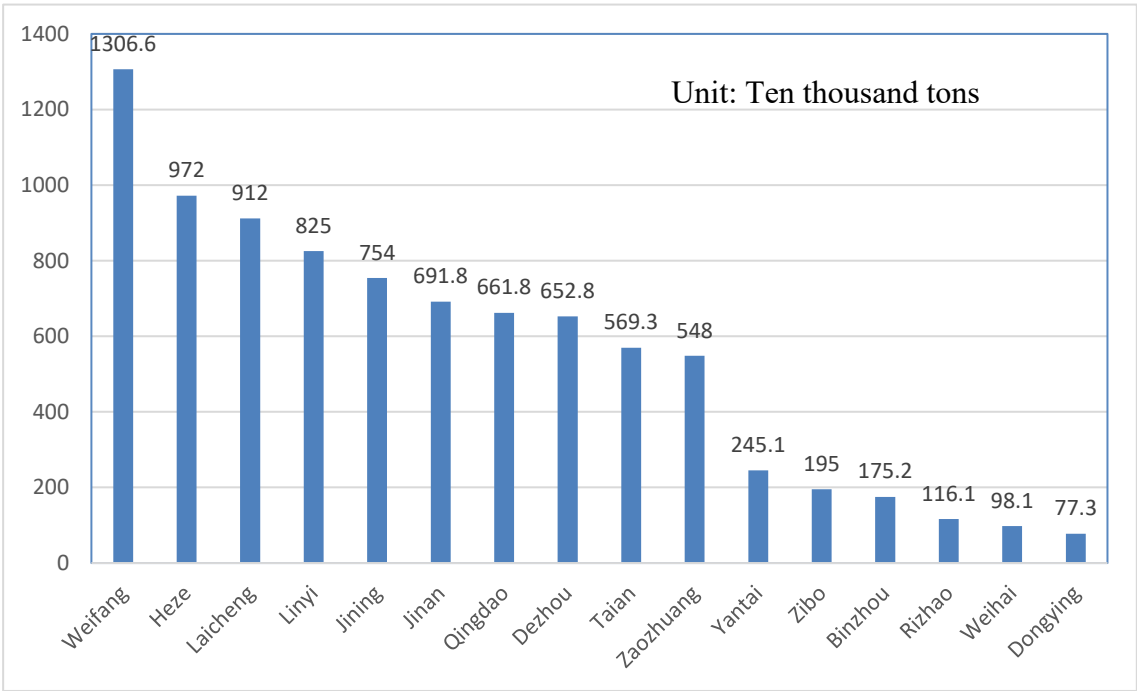


Figure 1.4: Vegetable Production in Various Regions of Shandong

Source: Shandong Provincial Bureau of Statistics (2022)

Shandong Province is a major producer of vegetables and fruits in China. In 2021, it produced 88.011 million tons of vegetables, accounting for approximately 11.34% of the national vegetable production, totaling 775.49 million tons. Figure 1.4 illustrates the

situation of vegetable production in different cities in Shandong Province (Shandong Statistical Yearbook, 2022). In the same year, the province also produced 32.3259 million tons of fruits, representing approximately 10.92% of the national fruit production of 296.11 million tons (China Statistical Yearbook, 2022). Vegetables and fruits, examples of fresh produce, are perishable agricultural products that should remain unprocessed or minimally preserved. Fresh produce requires strict control over time and temperature throughout the supply chain and on the market to ensure optimal freshness and quality.

As an important "vegetable basket" in northern China, the Weifang area holds a significant position in the field of fresh agricultural products. The region is not only known for its vegetable cultivation but also has a variety of fruits and seafood, such as the "Wei County radish" and "Changyi swimming crab", which are protected as national geographical indication products. Weifang has established itself as one of China's premier vegetable production bases, demonstrating remarkable productivity and economic significance in the agricultural sector. The region's annual vegetable output reached 13.066 million tons in 2022 (Shandong Statistical Yearbook, 2023), representing approximately 14.8% of Shandong Province's total vegetable production (Weifang Agricultural Bureau, 2023).

The Weifang area is renowned for its unique agricultural practices, crop diversity, and innovative supply chain management (SCM) approaches. These characteristics not only make it an ideal case for study but also provide insights into broader supply chain management issues.

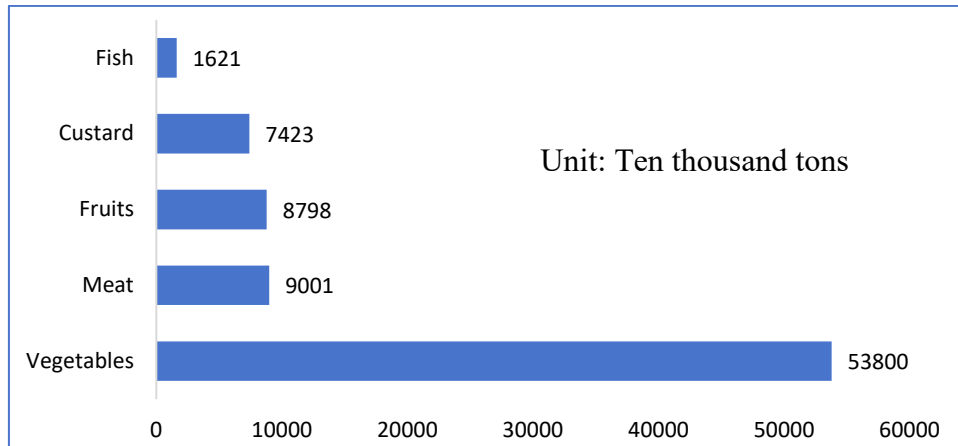


Figure 1.5: Consumption of Fresh

Source: China's National Bureau of Statistics (2023)

Figure 1.5 shows that vegetables are an important part of the Chinese diet, as they provide essential nutrients and health benefits. Therefore, this study focuses mainly on fresh agricultural products, using vegetables as the representative category to analyze the characteristics and challenges of this sector.

The study covers the production, distribution, and sales of fresh agricultural products, including the information, capital, and economic activities of different actors in the supply chain, such as farmers, wholesalers, retailers, and consumers.

Managing agricultural supply chains involves addressing critical factors such as quality, safety, efficiency, and sustainability, amid resource constraints (e.g., human, material, financial) at each chain node. Stakeholders must identify and manage key operational issues to improve the performance and quality of the fresh supply chain (Chen & Yin, 2023). Disruptions in any segment require collaborative efforts, information sharing, resource pooling, coordination, and strategic planning to restore operations and enhance

supply chain resilience, making it better equipped to handle and recover from disruptions (Duong & Chong, 2020).

1.3 Problem Statement

FPSC performance is fundamentally characterized by a complex interplay of time-sensitive metrics and quality-based indicators. At its core, the performance measurement system must address three primary dimensions: operational efficiency, product quality maintenance, and sustainability metrics. These aspects are particularly crucial given the perishable nature of agricultural products and the need for rapid, efficient distribution systems (Kumar et al., 2022).

Performance variables in fresh produce supply chains can be classified into three distinct categories. The first category encompasses quality-related metrics, which evaluate product freshness, visual appeal, and shelf life preservation throughout the distribution network. The second category comprises operational efficiency indicators, including order fulfillment accuracy, transport optimization, and warehouse productivity. The third category consists of collaboration-based measurements that assess the efficacy of information exchange, stakeholder coordination, and collective decision-making processes (Susanto & Othman, 2021). This integrated performance framework enables comprehensive evaluation and enhancement of fresh produce supply chain operations, particularly in environments characterized by intricate distribution networks and complex stakeholder relationships.

The supply chain management control practices in Weifang's fresh produce sector demonstrate a comprehensive approach to quality and safety management. The region has preliminarily implemented cooperative-based control systems that focus on food safety risk management and standardized distribution processes. These practices include systematic

monitoring of produce quality from farm to market and integrated logistics control mechanisms that ensure product freshness throughout the supply chain journey.

The collaborative aspects of Weifang's FPSC are characterized by strong partnerships between agricultural cooperatives and distribution networks. The region has developed an integrated network marketing system that facilitates cooperation between farmers, distributors, and retailers. This collaborative framework enables efficient information sharing and coordinated response to market demands, particularly in managing fresh produce quality and distribution timing. The integration of multiple stakeholders has created a more resilient and responsive supply chain system (Hao et al., 2017).

From a management perspective, the organizational structure of a supply chain can be likened to that of a corporate group, with a complex network of relationships and interactions between various stakeholders. Effective supply chain management can be divided into two primary components: management control and management collaboration. Management control encompasses senior management oversight, internal management processes, risk management protocols, and supplier and customer relationship management (Krajewski & Malhotra, 2022). On the other hand, management collaboration focuses on inter-organizational cooperation, and communication among supply chain partners to achieve common goals and objectives (Ledner, 2001).

According to a study by Kim (2019), the organizational structure of a supply chain plays a crucial role in determining its performance, with a dedicated department responsible for operational decisions and coordination between internal and external channels. Another study by Pakurár et al. (2019) highlights the importance of internal control mechanisms, such

as process integration and risk management, in achieving supply chain efficiency and effectiveness.

Supply chain integration (SCI) presents significant operational challenges, particularly in coordination between farmers, processors, and distributors. Research shows that poor information sharing and lack of standardized quality measures between supply chain partners lead to inefficiencies. The absence of proper coordination mechanisms affects both product quality and overall supply chain performance (Singh et al., 2009).

Internal management and food safety control represent another critical area of concern. Studies (Aworh, 2021) emphasize the importance of maintaining proper temperature control during transportation and storage, as well as implementing robust quality maintenance systems throughout the supply chain. These challenges particularly impact small-scale farmers and developing regions, where infrastructure limitations often compound these issues.

Customer-facing operations face their own set of challenges, primarily in demand forecasting and last-mile delivery. Research (Kumar et al., 2020) indicates that maintaining product quality at the retail level and managing inventory effectively require improved coordination between supply chain partners and better information sharing systems. These factors directly influence customer satisfaction and supply chain efficiency.

Weifang has established a comprehensive agricultural infrastructure anchored by the Jiale Agricultural Products Center, a 153,000-square-meter facility operating at EU export standards. The city's digital transformation is evident in its thriving e-commerce operations, with major enterprises processing around 21,000 daily orders through platforms like Tmall, Pinduoduo, and Douyin, generating annual sales exceeding 100 million RMB. This digital

ecosystem is supported by a sophisticated cold chain network, including a 41,000-square-meter smart storage facility with intelligent temperature control systems and modern refrigerated transport fleet (source: Weifang Municipal Bureau of Agriculture and Rural Affairs Official).

The city has successfully leveraged its agricultural advantages through specialized product development and innovative marketing strategies. Companies like Zhengde Supply Chain utilize Shouguang's rich agricultural resources to source and distribute popular products such as honey melons, mini cucumbers, and cherry tomatoes, achieving daily order volumes of 10,000 and monthly sales of over 20 million RMB in 2022. Local markets have also modernized their operations, exemplified by the Yijia'an Agricultural Trade Market's 10-million-yuan investment in advanced urban warehousing systems and e-commerce platforms, establishing Weifang as a leading agricultural distribution hub that effectively combines traditional farming expertise with modern market demands (source: Weifang Municipal Bureau of Agriculture and Rural Affairs Official).

This research focuses on Weifang's fresh produce supply chain, chosen for its representative challenges that reflect broader supply chain management issues faced globally. The region's ongoing struggles with perishability management—especially in implementing effective control systems—highlight universal challenges in fresh produce handling, as discussed in recent studies (Kirci et al., 2022). Furthermore, Weifang's significant sustainability concerns, evidenced by substantial food waste issues common across Chinese agricultural regions, underscore the need for effective management strategies (Xue et al., 2021).

Additionally, the scalability challenges within Weifang's FPSC—particularly in maintaining product freshness while expanding operations—illustrate fundamental issues in agricultural supply chain development, as noted in the literature (Blackburn & Scudder, 2009). These interconnected challenges position Weifang as a microcosm of broader fresh produce supply chain management issues, providing valuable insights that contribute to a more comprehensive understanding of fresh produce supply chain dynamics.

While practical challenges in FPSC management are well documented, theoretical gaps persist in understanding the interplay between management control systems, supply chain coordination, and collaboration (Jeschonowski et al., 2009). Current literature lacks comprehensive theoretical frameworks that integrate behavioural aspects of supply chain management with control mechanisms. Specifically, there is limited understanding of how principal-agent relationships influence collaboration effectiveness (Fayezi et al., 2012), and how behavioural factors impact channel coordination mechanisms. Recent studies further emphasize gaps in understanding collaborative theory and trust-building mechanisms in fresh produce supply chains, where complex relationships and control systems require more nuanced theoretical understanding (Novirani et al., 2024).

A critical review of existing literature reveals significant methodological limitations in FPSC research. Current empirical studies lack comprehensive approaches in examining the interplay between collaboration mechanisms and performance outcomes (Gajdić et al., 2023). Additionally, research methodologies have been insufficient in addressing the complexity of supply chain coordination, particularly in contexts involving risk and uncertainty (Panigrahi et al., 2024). Furthermore, existing studies show methodological weaknesses in examining the integration of control systems and coordination mechanisms,

especially in technology-enabled supply chains (Tort et al., 2022). These gaps highlight the need for more robust empirical research approaches that can better capture the complex dynamics of FPSC management and coordination.

In the context of global supply chain management, developed economies have set benchmarks for advanced logistical networks, highlighting a stark contrast with the challenges faced in the burgeoning market for fresh agricultural products in China. The Weifang area of Shandong Province, despite its prominence in fruit and vegetable production, is struggling with a series of systemic inefficiencies within its perishable goods supply chain.

Central to these challenges is the region's dependence on small-scale farming practices, which, while culturally ingrained, present considerable barriers to scaling operations. Such practices undermine management control mechanisms and curtail collaborative behaviour among stakeholders, leading to a fragmented supply chain that amplifies operational complexities and inflates costs (Hao et al., 2017)

Furthermore, the distribution phase of freshly harvested goods in Weifang involves a variety of unpredictable factors, including an oversupply of logistics personnel and widespread traffic congestion. These issues not only disrupt the meticulous management required for the maintenance of perishable product quality but also contribute to significant product losses (Zhang et al., 2020).

These logistical challenges complement the traditional marketing channels that dominate the region's fresh produce sector. Reliance on conventional markets and bulk distribution methods restricts diversification in retailing and sales scalability, whereas

opaque pricing structures and inconsistent quality controls erode consumer trust and competitive market standing.

The advent of the COVID-19 pandemic has further exacerbated these supply chain vulnerabilities, underscoring the need for robust local contingency planning and strengthened collaboration within agricultural value chains to mitigate disruptions and ensure stability (Yin et al., 2021).

This study contributes to supply chain management theory in three significant ways through the Weifang case. First, it provides an empirical testing ground for management control theory by examining how vertical management practices manifest in a complex agricultural supply chain context. The five aspects of vertical management (i.e., TM, SI, IM, CI, RM) are demonstrated through concrete examples in Weifang's FPSC. Second, the case advances collaboration theory by showing how horizontal management practices operate in a multi-stakeholder agricultural context. The coordination challenges and solutions among Weifang's farmers, distributors, and retailers provide valuable insights for understanding collaborative behaviour in supply chains. Third, this study extends stakeholder theory by integrating management control and collaboration among various stakeholders in the supply chain.

To increase the performance of Weifang's FPSC, a detailed understanding of management control systems and collaborative practices is essential. Actively addressing these key issues is critical to fostering sustainable agricultural growth, enhancing market robustness, and guaranteeing the steady provision of premium fresh agricultural products to consumers. The adoption of sophisticated management control mechanisms in the Weifang supply chain can lead to better coordination and cooperation among stakeholders. This

approach is expected to improve operational efficiency, reduce expenses, increase product standards, and solidify market presence. In addition, adopting such systemic reforms can consistently provide consumers with high-quality fresh produce, a cornerstone for the sustainable development and economic prosperity of the region.

1.4 Research Objectives

The present study aims to achieve the following objectives:

1.4.1 General Objective

The main objective of this study is to explore the relationships among fresh supply chain management control practices, collaboration behaviour, and fresh produce supply chain performance in the Weifang area.

1.4.2 Specific Objectives

The specific objectives of this study are as follows:

- i. To examine the relationship between top management and fresh produce supply chain performance.
- ii. To explore the relationship between supplier integration and fresh produce supply chain performance.
- iii. To investigate the relationship between internal management and fresh produce supply chain performance.
- iv. To analyse the relationship between customer integration and fresh produce supply chain performance.

- v. To study the relationship between risk management and fresh produce supply chain performance.
- vi. To assess the moderating effect of collaboration behaviour between management control practices (i.e., TM, SI, IM, CI, RM) and FPSC performance.

By including research on the fresh supply chain, this study intends to establish empirical correlations between supply chain management control practices, collaboration behaviour in supply chain management, and supply chain performance. It focuses on management collaboration, performance, and control of the fresh produce supply chain. Through a coherent framework, the goal is to discover an empirical proof of the links between these components. As a result, it seeks to offer a knowledge base to enhance the functionality of the local agricultural product supply chain.

1.5 Research Questions

On the basis of the problems outlined in Section 1.3, this study provides answers to the following research questions.

Do supply chain management control practices (i.e., TM, SI, IM, CI, and RM) affect the performance of the FPSCs in the Weifang area?

Does collaboration behaviour moderate the relationship between the management control practices (i.e., TM, SI, IM, CI, and RM) and the performance of FPSCs in Weifang city?

1.6 Significance of Study

This study substantially contributes to the advancement of theoretical frameworks and practical applications in the field of FPSC management.

1.6.1 Theoretical Significance

This study aims to clarify the correlation between fresh produce management control practices, collaboration behaviour, and the performance of the FPSC. It seeks to establish a comprehensive conceptual framework for understanding these interrelated factors. The correlation between the advancement of the FPSC and economic progress and quality of life in the surrounding area is significant. Collaborative efforts among different entities involved in the supply chain serve as a viable approach to improve the overall performance of the supply chain. The results of this study provide empirical evidence supporting the importance of collaboration behaviour in facilitating improvements in the performance of the fresh produce supply chain.

1.6.2 Managerial Significance

This study offers supply chain business managers useful academic resources, which is one of its main contributions. These companies use a variety of management strategies since agricultural products are always evolving and supply chain organisations operate in a dynamic environment. For firms involved in the agricultural product supply chain, determining the ideal level of administrative control and essential oversight presents major difficulties. Unfortunately, there has been little thorough research on these important aspects of supply chain management. This study explores control practices and collaboration behaviours throughout the fresh produce supply chain to fill this knowledge gap.

Additionally, this study has certain policy implications. By identifying crucial linkages in the supply chain for fresh products, government managers can efficiently distribute scarce resources and set priorities. This gives them the ability to enact targeted policies in key agricultural supply chain segments, producing more significant impacts and outcomes. By methodically investigating the unique concepts of supply chain management for agricultural products, this study aims to offer useful advice to supply chain managers and businesses in the agricultural sector.

The value of this research extends beyond organizational boundaries to benefit society at large and diverse stakeholders (Gokarn & Kuthambalayan, 2019). By improving FPSC management practices, this study contributes to enhanced food security, better resource utilization for environmental sustainability, and improved economic opportunities for local communities (Gokarn & Choudhary, 2021). The research addresses critical stakeholder concerns across the supply chain, from farmers to end consumers, while supporting public health objectives through better quality control and sustainable practices (Yontar & Ersöz, 2021). This comprehensive approach ensures that the findings have practical implications for social welfare and sustainable development in the agricultural sector.

1.7 Scope of the Study

This scholarly inquiry is fundamentally concerned with the array of factors that influence the management of the fresh produce supply chain within the Weifang area. This study aims to promote the development of local agricultural product supply chains by offering incisive management recommendations to a variety of stakeholders within the Weifang area's supply chain ecosystem. This is achieved through a meticulous analysis of

the factors that shape the management of fresh food supply chains. Furthermore, this dissertation examines the extent to which collaborative management practices impact the interplay between management control mechanisms and overall supply chain performance.

Weifang, which is located in Shandong Province, was selected as the main location for this investigation because of its substantial contribution to the production of fresh agricultural products, driven predominantly by SMEs. The study specifically targets those enterprises operating within the perishable goods supply chain, underscoring the importance of SMEs that are generally typified by employee counts ranging from 10--200.

Through this approach, the research aims to contribute substantive information on effective supply chain management practices that are responsive to both market demands and the nuances of small business operations within the agri-food sector.

1.8 Definition of Key Terms

1.8.1 Supply Chain

The supply chain is defined as a set of three or more (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finance, and/or information from a source to a customer (Mentzer et al., 2001).

1.8.2 Fresh Produce Supply Chain

The fresh produce supply chain encompasses the sequential activities involved in the transportation of fresh produce from the grower or farmer, who participates in the sale of their produce, to the primary processors responsible for processing the products before their packaging and subsequent distribution to various distributors (Anand & Barua, 2022). This encompasses the various stages involved in the lifecycle of fresh produce, spanning from its

cultivation or manufacturing to its ultimate consumption. This involves various stages in the life cycle of fresh produce, ranging from cultivation or manufacturing to ultimate consumption. The complexity of the fresh food supply chain is steadily growing as the sourcing of produce expands to encompass various regions around the world.

1.8.3 Supply Chain Management

Supply chain management refers to the management method of effectively organizing suppliers, manufacturers, warehouses, distribution centers, and channel providers together for product manufacturing, transshipment, distribution, and sales to minimize the cost of the entire supply chain system under the condition of meeting a certain level of customer service (Mentzer et al., 2001). SCM is the process of integrating the internal and external resources of an enterprise to meet the demands of consumers (Tian et al., 2010). An effective SCM can help achieve four objectives: shorten cash cycle times, reduce business risk, increase profitability, and provide stable revenue.

1.8.4 Management Control Practices

Management control is the process of influencing and supervising the behavior and decisions of organizational members to achieve organizational goals. Management control theory (MCT) is a discipline that studies the principles, methods, mechanisms, and effects of management control. Management control theory involves multiple fields, such as accounting, organisational behaviour, strategic management, and organisational culture (Demartini, 2014).

MCT encompasses the systematic use of a variety of scientific management control methods by organisations, with the aim of ensuring the congruence between their diverse activities and overarching strategic objectives. The crux of this theory lies in the translation

of an organization's strategic goals into actionable and tangible measures, coupled with the vigilant surveillance of the outcomes derived from these measures. This process facilitates the comprehensive evaluation and necessary refinement of organizational performance (Silva et al., 2021).

Management practices in FPSC have evolved into a comprehensive system that includes multiple integrated components to ensure both quality and operational efficiency. The integration of these components, supported by modern technologies (e.g., IoT sensors, blockchain traceability, real-time monitoring systems) and collaborative approaches, has become crucial to achieve superior supply chain performance and maintain product quality throughout the distribution network (Manning et al., 2013).

TM serves as a fundamental driver in the management of the fresh produce supply chain, directly influencing organizational sustainability and the implementation of quality practices (Siddh et al., 2021). Research demonstrates that effective leadership at the top level is crucial for operational coordination and strategic decision-making, with participative leadership styles showing particular effectiveness in achieving coordination goals (Akhtar et al., 2017).

SI focuses on developing close supplier-retail relationships and collaborative planning with upstream partners through mechanisms such as joint forecasting, shared quality control systems, and integrated logistics planning (Siagian et al., 2023).

IM encompasses organizational processes and systems that ensure efficient operations and quality control within the organization. Research demonstrates that effective internal management practices directly contribute to organizational sustainability and operational excellence through standardized processes and quality control measures (Gokarn & Kuthambalayan, 2019).

CI emphasizes downstream coordination and responsive customer relationship management (Zanquetto-Filho et al., 2003), incorporating practices such as demand forecasting, collaborative promotional planning, and real-time inventory visibility to ensure product availability while minimizing waste.

RM in FPSC encompasses comprehensive strategies and practices designed to identify, assess, and mitigate various risks across the fresh produce supply chain. Research shows that effective risk management practices are crucial for maintaining supply chain resilience and ensuring consistent product quality and availability (Gokarn & Kuthambalayan, 2019).

1.8.5 Management Collaboration

Management collaboration is the process of firms working together within a network of relationships (Batt & Purchase, 2004). Supply chain collaboration is a strategic endeavour that involves harmonizing the operations of enterprises at all nodes within the supply chain. This multifaceted approach encompasses the promotion of mutually beneficial outlooks; the pursuit of shared goals; the implementation of an impartial and equitable mechanism for both benefit and risk allocations; the intensification of collaboration on the basis of trust, commitment, and adaptable agreements; the establishment of an electronic information technology platform to facilitate real-time communication; and the redesign of business processes to prioritize customer-centric and collaborative operations (Colicchia & Strozzi, 2012).

1.8.6 Supply Chain Performance

Supply chain performance refers to the ability of a supply chain to effectively and efficiently meet customer requirements while achieving organizational goals. It encompasses various metrics and measures that evaluate the efficiency, effectiveness, and

adaptability of supply chain processes, including cost, quality, flexibility, resource utilization, and customer satisfaction (Maestrini et al., 2017).

1.9 Organization of Study

This paper consists of five chapters. Chapter 1, which serves as an introduction, describes the general status of fresh agricultural products in China, particularly in the Weifang area of Shandong. This section includes the problem statement, research objectives, research questions, definitions of key concepts, significance of the study, scope of the research, and arrangement of the chapters. Chapter 2 covers a review of the literature, foundational theories, and theoretical frameworks. Chapter 3 introduces the research methodology, including the study location, design, sampling techniques, questionnaires, measurements, and statistical analysis. The research findings are presented in Chapter 4, while Chapter 5 discusses the study conclusions.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Scholars have extensively explored how management practices affect fresh produce supply chains, focusing on key control mechanisms such as leadership, integration, and risk strategies. These elements are vital for supply chain success and for stakeholder collaboration. However, research tends to isolate these factors rather than examine their collective impact. There is a need for a deeper understanding of how such behaviour influences the effectiveness of management controls in the context of fresh produce supply chains.

This section aims to address these research gaps, critically evaluate the limitations of the literature, and chart new directions for inquiry. It sets the stage for a comprehensive analysis that will unfold in subsequent chapters, with the aim of enriching existing paradigms and setting solid groundwork for future research endeavours.

The chapters that follow rigorously dissect the theoretical foundations, identify key issues in supply chain management, and explore the research gaps previously outlined. By weaving together established theories of management control, management collaboration, and stakeholder, this study seeks to shed light on crucial factors and propose new areas for empirical investigation. The ultimate goal is to contribute significantly to the body of knowledge on supply chain management, particularly within the realm of fresh produce, thus improving both the academic literature and industry practice.

2.2 Overview of the Fresh Produce Supply Chain

In the Weifang area, there are three different forms of agricultural product supply chains: the classic agricultural supply chain, the agricultural supermarket-hooking agricultural product supply chain, and the e-commerce-governed agricultural product supply chain. (Yin, 2022).

2.2.1 Traditional Supply Chain Model

The first type of model is the traditional supply chain model, namely the farmers' market model. The traditional logistics model for fresh agricultural products in Shandong Province takes the farmers' market as the terminal, mainly including two markets: wholesale and retail, and is divided into four stages:

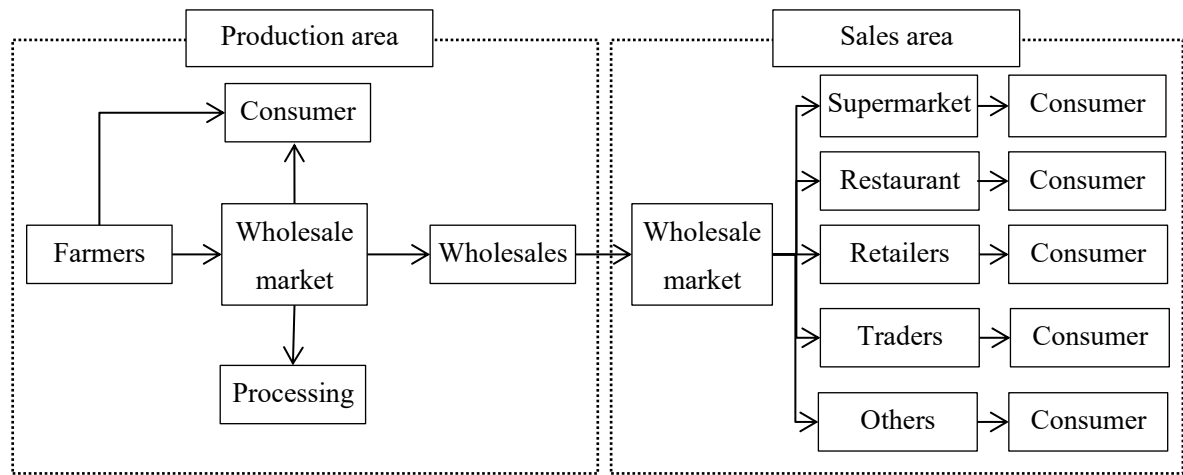


Figure 2.1: Traditional Supply Chain Model

The first stage involves farmers transporting agricultural products from the production area to the nearest farmers' market; the second stage involves vendors purchasing and transporting the products from the farmers' market to the wholesale market in the production area; the third stage involves the products being transported from the production area farmers' market and the production area wholesalers to the wholesale market in the sales

area; the fourth stage involves the wholesale market in the consumption area reaching consumers through individual vendors, supermarkets, etc. There are also overlapping characteristics between the various stages. (Zhao & Liu, 2011).

The primary advantage of the traditional agricultural product supply chain model lies in the strong convenience and acceptability for downstream consumers in buying and selling. However, its drawbacks include the fragmented and dispersed nature of upstream production and the lack of monitoring in the midstream circulation process.

2.2.2 Supermarket Supply Chain Model

The agricultural supermarket supply chain paradigm, often delineated as the supermarket supply chain archetype, represents an alternative model within the spectrum of supply chain configurations.

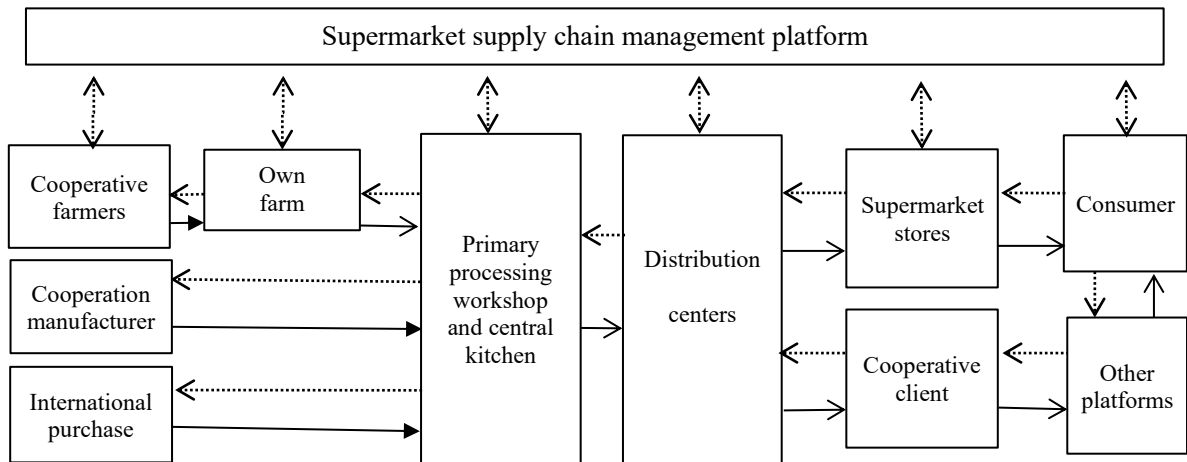


Figure 2.2: Supermarket Supply Chain Model

This framework consists primarily of two different models. The first model, utilized by companies such as JiaJiaYue and Yonghui Supermarket, follows a “farmers + base (association or government) + supermarket” structure. This setup encourages a three-way partnership involving farmers, supporting bases such as associations or government organizations, and retail supermarkets. The second model operates on an “agricultural +

supermarket + farmer” cooperation basis. This model is based on a collaborative trio that involves agricultural businesses, supermarkets, and cooperatives. It serves as the backbone for the supply chain's operational strategy, fostering a cohesive system of production and distribution (Wei et al., 2015).

2.2.3 E-commerce Supply Chain Model

The e-commerce-led supply chain represents the third archetype within the domain of fresh produce logistics. This intricate network is distinguished by its multifaceted nodes that extend from the cultivation of primary agricultural commodities to logistic handling, including storage and transportation, of processed goods ultimately sold to consumers through digital marketplaces (Yang et al., 2022).

The efficacy of supply chain operators is instrumental in dictating the profitability, resilience, and risk mitigation strategies inherent within the entire supply chain continuum. With the growing prominence of electronic commerce, this particular model is anticipated to gain a greater presence within the agricultural industry (Guo, 2021; Lin & Zhongwei, 2011; Zhang et al., 2023).

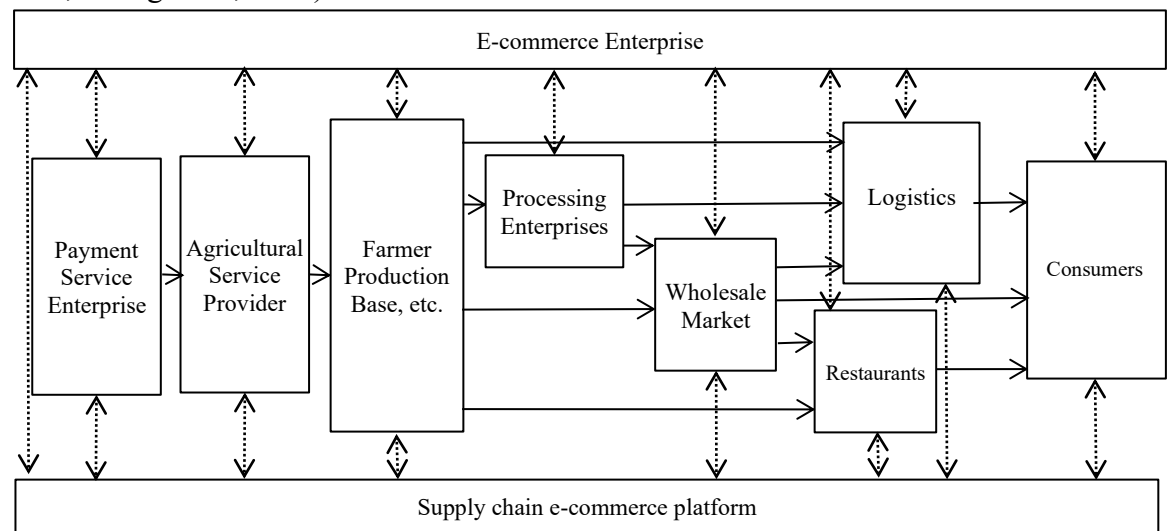


Figure 2.3: E-commerce Supply Chain Model

Figure 2.3 illustrates the agricultural product supply chain infrastructure. Solid lines indicate physical product flows, while dotted lines represent information flows. Agricultural production comprises a relatively small portion of e-commerce organizations' total output. The supply chain encompasses multiple stages: agricultural input suppliers initiate the process, farmers serve as intermediaries, and primary processing and storage facilities operate in the later phases. Products undergo preservation, management, and transfer procedures before final distribution to consumers via digital platforms. Understanding this supply chain framework is crucial for analyzing material and information flow dynamics within the e-commerce agricultural sector.

2.2.4 Discussion about the Supply Chain Models

The previously discussed supply chain models, while distinct in their approaches and focuses, share fundamental interconnections in their theoretical foundations. These models demonstrate complementary aspects of supply chain management, each contributing unique perspectives to our understanding of supply chain operations and management. The integration of different models requires clear definitions and measurements to effectively evaluate their combined impact on performance (Fabbe-Costes & Jahre, 2008).

Supply chain integration across these models reveals several key theoretical insights. First, the relationship between different models is not simply additive but synergistic, with each model's strengths potentially compensating for others' limitations. This integration allows organizations to develop more comprehensive and robust supply chain strategies that can address complex business environments through strategic purchasing, supply network coordination, and logistics integration (Chen & Paulraj, 2004).

The theoretical synthesis of these models demonstrates that effective supply chain management requires a balanced approach. While each model offers valuable insights, their integration provides a more complete framework for understanding supply chain dynamics. This integration helps bridge the gap between theoretical understanding and practical application, enabling organizations to select and combine elements from different models based on their specific needs and contexts. Modern supply chain integration increasingly relies on data-driven approaches to connect various theoretical frameworks, allowing for more dynamic and responsive supply chain systems (Tiwari, 2021).

Furthermore, the integration of these models highlights the importance of considering both operational and strategic dimensions in supply chain management. This comprehensive view enables organizations to better align their supply chain strategies with overall business objectives while maintaining operational efficiency. The success of such integration depends on clear understanding of how different models complement each other and contribute to overall supply chain performance.

2.3 Importance of Supply Chain Management

SCM is crucial for ensuring the integrity, freshness, and timely delivery of fresh agricultural products. The fundamental goal of SCM is to facilitate seamless, efficient, and well-coordinated operations throughout the entire lifecycle of fresh agricultural commodities, including stages such as production, transportation, handling, and sales (Jiang et al., 2020). A comprehensive analysis herein delves into the critical role of SCM in the cultivation and commercialization of fresh agricultural products.

SCM is indispensable in the production and marketing of fresh agricultural products, as it substantially mitigates waste and spoilage by guaranteeing efficient market delivery.

Enhanced inventory management strategies emerge from effective SCM, thus diminishing the risks associated with overstocking or understocking while simultaneously increasing profitability for stakeholders such as farmers and distributors (Pandey et al., 2013).

Through the integration and refinement of various segments within agricultural production, SCM guarantees the alignment of product quality with market demand (Wang, 2013). This involves meticulous oversight of elements, including seed selection, fertilization techniques, irrigation practices, and pest management, to produce products of maximum quantity and optimal quality.

Farmers can improve their production methodologies and minimize waste by adopting robust SCM protocols. This process involves refining the logistics associated with storage and transportation to guarantee swift market delivery and reduce postharvest losses (Busato & Berruto, 2006). SCM also empowers farmers to adapt their cultivation tactics and adopt new varieties or organic farming techniques in response to evolving market trends and consumer preferences.

SCM is instrumental in optimizing logistical operations, safeguarding product freshness and increasing availability (Gao, 2021). For consumers, the quality and freshness of fresh agricultural products are paramount. Consequently, effectively managing the phases of harvesting, transportation, and storage is critical. SCM ensures that commodities are harvested at peak ripening, transported rapidly to distribution centers, and transported efficiently to consumer markets. Furthermore, maintaining product freshness requires precise environmental control with respect to temperature and humidity levels. Precision in scheduling and logistic efficiency are vital at this time to preserve product quality and satisfy consumer expectations.

Effective sales and marketing strategies supported by SCM can also intensify the competitive advantage and marketability of fresh agricultural products. There is a concerted effort to synchronize production with sales, tailoring production plans to reflect market demands (Chabada et al., 2013). Sales teams can use data analytics and market insight to obtain early indications of market changes and changes in consumer behaviour. This information can then be promptly relayed to production units to facilitate adjustments to production schedules and approaches. Appropriate sales channels and strategies ensure optimal pricing and conditions, thus bolstering a firm's competitive standing and financial gains. SCM helps businesses make informed decisions in this regard.

Furthermore, SCM is integral in optimizing inventory levels and reducing costs by effectively managing the flow of goods from suppliers to customers (Zheng et al., 2021). This enables companies to minimize instances of stockouts and overstocking, which improves customer satisfaction and increases sales figures. By combining data analysis, market research, and SCM, companies are better positioned to make strategic decisions that lead to growth in a highly competitive market.

The reliability and traceability of fresh agricultural products are also fortified through SCM (Mainetti et al., 2013). Consumers are increasingly interested in the provenance of their food, including compliance with ethical and environmental standards and quality assurance. SCM offers precise documentation and monitoring for each stage of the production process, from seeding to sales, thus improving product traceability and strengthening consumer trust.

2.4 Fresh Produce Supply Chain Performance

FPSC performance refers to the comprehensive measurement and evaluation of how effectively and efficiently a supply chain manages fresh agricultural products from farm to end consumer, considering multiple dimensions of operational excellence, quality maintenance, and value creation (Susanto et al., 2020). This definition emphasizes that FPSC performance is not just about traditional efficiency metrics but encompasses a holistic view of how well the supply chain maintains product quality, creates value, ensures sustainability, and adapts to modern challenges while meeting stakeholder expectations (Jack et al., 2018).

Table 2.1: Representative Past Studies on the Fresh Produce Supply Chain

Authors	Variables	Sample	Findings
Uddin et al., 2010	Knowledge of asset management and transaction climate	315 firms in the beef industry of Western Australia and Queensland	Knowledge Asset Management is the strongest predictor of SC performance, followed by transaction climate and vertical coordination among chain members.
Odongo et al., 2016	Quality of supply chain relationship	150 agribusiness firms in the maize supply chain in Uganda.	For agribusiness managers to improve business performance, it is necessary to cultivate strong and mutual relationships with members of supply chain.
Kataike et al., 2019	Chain governance structures and chain performance	345 chain members (115 dairy farmers, 115 dairy cooperative managers and 115 processors)	The authors found a positive influence of relational governance on supply chain performance for all chain members.
Tran et al., 2019	Risk management and supply chain performance	625 managers samples from Vietnam.	Risks in the supply chain have both direct and indirect effects on business performance through intermediaries, which are trust and links in the management of the agricultural supply chain.
Hoang et al., 2022	Collaboration, supply chain risk, and supply chain performance	162 enterprises producing organic agricultural products.	supply chain risks negatively affect the performance of the supply chain of organic agricultural products. Close cooperation between members of the supply chain limits supply chain risks.
Lusiantoro et al., 2022	Information Sharing and Supply Chain Performance	197 small retailers of fresh produce (fruits and vegetables) retailers	The effect of information sharing on FPSC performance is fully mediated by cognitive and affective evaluations of the information sharing activity.

Table 2.2: continued

Waqas et al., 2023	Risk management; knowledge management	430 agro-preneurs of fresh fruits and vegetables	A negative correlation between supply chain risks and supply chain performance; that supply chain risk management mediates the relationship between supply chain risks and supply chain performance; that knowledge management moderates the relationship between supply chain risks and supply chain performance.
Yadav et al., 2023	Integration of the supply chain based on digital technologies, performance of the agri-supply chain	119 respondents from different departments of agri-firms	The results confirm that IoT-based digital technologies and supply chain processes (organization integration, information sharing, and customer integration) have a significant positive correlation.
Kumudumali et al., 2023	Green supply chain management practices in operational performance	275 farmers	The influence of green supply chain management practices leads to increased cost savings, improved quality of products, improved delivery time, and improved adaptability of change from one product to another.
Martnez-Falcó et al., 2023	Green Supply Chain Management and Performance	196 Spanish wineries	Green Supply Chain Management partially mediates the Green Intellectual Capital and Sustainable Performance relationship, and Green Agriculture positively but not significantly moderates the Green Intellectual Capital and Sustainable Performance relationship
Elshaer et al., 2023	Farm-to-fork sourcing, economic benefit, and environmental sustainability	298 farmers	The results of the study suggest that farm-to-fork sourcing has a positive impact on sustainable agriculture practices, and both perceived economic benefit and environmental sustainability play a moderating and mediating role in these relationships.

This process includes the evaluation of various key performance indicators and metrics to measure the effectiveness and success of the supply chain in achieving its goals. The effectiveness of a newly established supply chain is crucial, as it directly impacts the quality and availability of products, as well as overall customer satisfaction.

Uddin et al. (2010) evaluated 315 firms in the beef industry in Western Australia and Queensland and identified knowledge asset management as a critical predictor of supply chain performance. The study also noted the significant roles of the transaction climate and

vertical coordination between chain members, suggesting a multidimensional approach to improve supply chain efficiency.

Odongo et al. (2016) analysed data from 150 agribusiness firms in Uganda's maize supply chain. They recommended that agribusiness managers improve business performance by fostering strong mutually beneficial relationships with supply chain members, highlighting the critical importance of relational quality.

Kataike et al. (2019) conducted research with 345 members of the dairy supply chain and reported that relational governance positively influences chain performance among all members. This indicates the substantial impact that governance structures can have on the results of the entire supply chain.

Tran et al. (2019) evaluated 625 managers in Vietnam and revealed that supply chain risk affects business performance directly and indirectly through trust and links, underscoring the need for comprehensive risk management strategies that address both direct and relational elements.

Hoang et al. (2022) surveyed 162 companies that produce organic agricultural products and reported that supply chain risk negatively impacts the performance of organic product supply chains. The study also highlighted that closer cooperation between supply chain members could mitigate these risks, highlighting the role of collaboration.

Lusiantoro et al. (2022) focused on the role of information sharing among 197 small fresh produce retailers. Their findings suggested that the impact of information sharing on supply chain performance is fully mediated by cognitive and affective evaluations of

activity, pointing to the psychological and emotional aspects of how information is perceived within the supply chain.

Waqas et al. (2023) studied 430 agropreneurs of fresh fruits and vegetables and reported a negative correlation between supply chain risk and performance. Their research identified supply chain risk management as a mediating factor and knowledge management as a moderating factor, indicating a complex relationship between risk, knowledge, and performance.

Yadav et al. (2023) gathered insights from 119 respondents across different departments of agri-firms, confirming that IoT-based digital technologies positively correlate with supply chain processes, such as organisational integration and customer integration, emphasizing the growing importance of digital integration.

Kumudumali et al. (2023) reported on a study of 275 farmers and reported that green supply chain management practices lead to cost savings, improved product quality, and better adaptability to change, according to the trend towards sustainability.

Martínez-Falcó et al. (2023) researched 196 Spanish wineries and suggested that green supply chain management mediates the relationship between green intellectual capital and sustainable performance, with green agriculture having a positive, though not significant, moderation effect.

Elshaer et al. (2023) demonstrated through their study of 298 farmers that farm-to-fork sourcing positively influences sustainable agriculture practices, with both perceived economic benefits and environmental sustainability serving dual roles as moderators and mediators in these relationships.

2.5 Management Control Elements of the Fresh Produce Supply Chain

The management of the fresh produce supply chain includes processes ranging from the production to the consumption of fresh produce. The key interest in FPSCs is consumer satisfaction and revenue maximisation, with postharvest waste reduction being a secondary objective (Shukla & Jharkharia, 2013). Lack of demand forecasting, demand and supply mismatch, a less integrated approach, etc., are the main causes of concern (Krishna Manasvi & Matai, 2022).

This thesis conceptualizes the management controls of FPSCs into five key dimensions, framed through the perspective of control theory in management studies. Top management involves strategic governance and policy formulation, which are crucial for aligning the supply chain with overarching objectives. Supplier integration emphasizes building synergistic and compliant relationships with suppliers. Internal management focuses on optimizing internal operations and processes to enhance efficiency. Customer integration prioritizes incorporating consumer insights into supply chain activities to improve customer satisfaction and loyalty. Lastly, risk management underscores the importance of identifying and mitigating potential supply chain disruptions proactively. Collectively, these dimensions provide a comprehensive framework for ensuring the effectiveness and resilience of FPSCs.

Collectively, these five dimensions provide a comprehensive framework for ensuring the effectiveness and resilience of FPSCs. The framework acknowledges the complex interplay between different stakeholders and operational aspects while emphasizing the need for integrated approaches to management control.

2.5.1 Top Management

The top management consists of a cadre of senior managers who provide support and guidance in the management of the fresh food supply chain (Akhtar et al., 2016). This section underscores the profound influence and role these senior managers exert within the supply chain. Occupying pivotal executive roles (such as Chief Executive Officer, President, and Vice President), these individuals wield considerable decision-making authority and bear the onus of strategic planning within the enterprise.

The effective operation and synchronisation of the fresh food supply chain depends on the full participation of senior management. It is incumbent on them to design strategic decisions and policies that are consistent with the objectives and spirit of the supply chain. Furthermore, it is critical to allocate sufficient resources and investments to ensure holistic support and evolution of each facet of the supply chain (Siddh et al., 2022).

Furthermore, senior executives must prioritise risk management and quality control within the supply chain to ensure the safety and traceability of perishable commodities (Shukla et al., 2023). Effective communication and collaboration with various stakeholders in the supply chain are paramount. Such concerted efforts facilitate the collective resolution of challenges and the formulation of solutions to pressing issues.

In summary, the advocacy and direction of senior executives are instrumental in the success and sustained advancement of the fresh food supply chain. The efficiency, quality, and competitive edge of the supply chain are inextricably linked to the decision-making and leadership skills of these key individuals. Consequently, this article emphasises the crucial role and support provided by senior management in elucidating the performance and efficiency metrics of the fresh food supply chain.

Table 2.2: Representative Sample of Past Studies on Top Management

Authors	Perspective of Top Management
Ahire & Ravichandran, 2001	Top management refers to the highest level of managers in a company or organisation, usually including the chief executive officer (CEO), the chief operating officer (COO), the chief financial officer (CFO), and other senior managers. In the implementation of TQM, the leadership and commitment of top management are crucial to driving the success of TQM.
Flynn, 2005	The highest level of management in an organisation, such as the executive directors, presidents, chief executive officers, and other senior managers, is called top management. They are in charge of defining the organisation's strategy and goals and making sure that the departments and employees of the organization align with these goals.
Singh, 2008	According to the ISO 9000 standard, top management is in charge of demonstrating their commitment to quality, taking responsibility for subpar products, conducting routine reviews of the quality system, ensuring that the quality system is constantly improved, and confirming the efficacy of quality activities and systems through internal quality audits.
Charan et al., 2008	Top management should focus on improving the ability of drivers to drive, such as awareness of performance management systems (PMS) in supply chains, commitment from top management, consistency with strategic goals, funding for PMS implementation, and effective information systems. These enablers can help improve the performance and competitiveness of supply chains.
Shukla & Jharkharia, 2013	The top management is responsible for the integration and coordination of these processes, ensuring that the product maintains its quality throughout the supply chain. The review of the literature presented in this study delineates various strategies that top management could employ to optimise FPSC management.
Gokarn & Kuthambalayan, 2019	Top management can create sustainable fresh produce supply chains by effectively managing the supply, demand, and price uncertainties inherent in these products. Using unique resources and capabilities, top management can improve the resilience and sustainability of the supply chain, which is crucial for items with a short shelf life, such as fresh produce.
Ran & Chen, 2023	The top management must develop and implement strategies that prioritise the freshness of the produce from the farm to the table. This includes investing in technology and processes that can help extend shelf life and preserve quality, such as advanced packaging solutions or rapid logistics.

Top management, which includes roles such as CEOs, COOs, and CFOs, is recognised for its pivotal leadership role in the execution of total quality management (TQM). Their commitment is essential for the success of TQM, as highlighted by Ahire & Ravichandran (2001). Flynn (2005) expands on this by describing top management as the architects of an organisation's strategy and objectives, ensuring alignment across all departments and personnel.

Singh (2008) references the ISO 9000 standard to emphasise top management's responsibility for demonstrating a commitment to quality, handling product issues, regularly reviewing quality systems, and promoting continuous improvement through internal audits.

Charan et al. (2008) suggest that top management should increase key enablers, such as awareness of performance management systems, commitment to the cause, strategic alignment, funding for implementation, and robust information systems, to increase supply chain performance and competitiveness.

Shukla and Jharkharia (2013) assign top management the role of integrating and coordinating supply chain processes to preserve the quality of fresh produce throughout its journey. They advocate the use of strategic management to optimise FPSC management.

Gokarn and Kuthambalayan (2019) argue that top management can foster sustainable fresh produce supply chains by adeptly navigating the uncertainties of supply, demand, and pricing. Using unique resources and capabilities is the key to improving the resilience and sustainability of these time-sensitive supply chains.

Finally, Ran and Chen (2023) advise that top management should focus on strategies that ensure the freshness of products from the farm to the consumer. This involves investing in technologies and processes that can prolong shelf life and maintain high quality, including innovative packaging and expedited logistics.

2.5.2 Supplier Integration

Supplier integration is the strategic practice of incorporating suppliers into the broader structure of the supply chain to facilitate resource sharing and mitigate risks. Successful implementation of this procedure requires the development of robust

collaborative partnerships between companies and suppliers, which, in turn, improve the overall effectiveness and competitiveness of the entire supply chain through information exchange, coordinated planning, optimised logistics, and other strategies.

In the context of supplier integration, organisations must integrate suppliers into the comprehensive supply chain management process. This integration facilitates effective planning, coordination, and optimisation, thus enabling suppliers to deliver components or raw materials that meet the company's needs in terms of quality, cost-effectiveness, and timeliness (Li et al., 2023).

The successful implementation of supplier integration requires organisations to show specific talents and experience in supply chain management. Companies must develop effective procedures to evaluate and select suppliers, ensuring that the performance of suppliers in areas such as quality, pricing, delivery timeframes, and other relevant factors is determined by the enterprise's specific requirements (Gopal et al., 2022). Additionally, organisations must create robust supply chain management information systems to effectively promote information sharing and foster collaborative efforts with suppliers.

By implementing supplier integration, organisations have the opportunity to optimise resource allocation, achieve cost reduction, and improve overall operational efficiency (Sahu et al., 2023). The development of robust collaborative partnerships with suppliers is also crucial to improving the reputation and image of a company, thus increasing its competitiveness in the market.

Table 2.3: Representative Sample of Previous Studies on Supplier Integration

Authors	Perspective of Supplier Integration
Aggarwal & Srivastava, 2016	Supplier selection is one of the prerequisite factors for company profits; suppliers often do not trust buyers.
Zainol et al., 2019	External integration with suppliers, external integration with customers and supply chain risks, technological innovation, and the relationship among the variables that are focused and could produce promising business performance.
Pérez-Mesa et al., 2019	Improved and collaborative relationships and the integration of sustainability concepts between suppliers (marketing firms) and their clients could contribute to successfully meeting sustainability demands.
Gokarn & Kuthambalayan, 2019	Effective supplier integration can help bridge this information gap by ensuring that all parties have access to the necessary data to make informed decisions.
	The profit of a retailer can be enhanced by vertical integration between the other retailer and the supplier if the substitutability of the product is low.
Yu et al., 2020	Although some articles do not consider the direct integration of suppliers and retailers, suggesting that such integration could be a combination of horizontal and vertical integrations, others argue for the importance of coordination in the supply chain through portfolio contracts, which can include supplier agreements.
Ran & Chen, 2023	Effective models and methods are critical to support decision-making processes and optimise system performance, including the integration of suppliers to ensure a seamless flow from production to retail.

Aggarwal and Srivastava (2016) delineate the pivotal role of supplier selection in increasing corporate profitability while acknowledging the prevalent trust deficits between suppliers and buyers.

Gokarn and Kuthambalayan (2019) articulated the essence of supplier integration in improving information asymmetries, thus enabling informed decision-making processes.

Pérez-Mesa et al. (2019) underscore the need for fortified, collaborative relationships and the infusion of sustainability principles between suppliers and their clientele to fulfil sustainability imperatives.

Zainol et al. (2019) examine the implications of external integration with suppliers and customers, along with supply chain risk and technological innovation, on organisational performance metrics.

Yu et al. (2020) posit that vertical integration between retailers and suppliers can amplify retailer margins, particularly in contexts of minimal product substitutability. Furthermore, they suggest that the orchestration of supply chain coordination through portfolio contracts, including supplier agreements, is crucial to operational efficiency.

Ran and Chen (2023) advocate for the formulation of effective models and methodologies that improve decision making effectiveness and optimize systemic performance through supplier integration.

2.5.3 Internal Management

Within the realm of supply chain management, the concept of internal management refers to strategic processes of planning, organising, coordinating, and controlling manufacturing, procurement, and sales operations within an organisation (Phuatngam, 2010). The primary objective of internal management is to optimise operational efficiency and minimise expenses.

The planning process involves the development of production and procurement plans on a yearly, quarterly, and monthly basis, aligning them with the overarching strategic objectives of the organisation (Sledkov et al., 2022). The purpose of these plans is to establish proactive and systematic manufacturing and procurement processes within the organisation, to satisfy market demands, and to achieve strategic objectives. The importance of planning lies in its ability to facilitate the anticipation of forthcoming shifts in demand,

optimise resource allocation, mitigate waste and scarcity, and enhance market competitiveness.

Organisational management is the systematic arrangement of workers, equipment, and financial resources according to the production requirements and resource availability of a corporation to facilitate efficient and uninterrupted production operations (Ramdan et al., 2021). This includes the implementation of production workflows, the provision of personnel training, the acquisition of equipment, and the maintenance of machines. The importance of an organization is its ability to promote internal collaboration efficiency, optimise production processes, increase the talent and attributes, and guarantee product quality and quantity.

Coordination involves facilitating collaborative efforts between several departments within an organisation to achieve synchronization and cooperation in operations related to production, procurement, and sales (Sui & Zhao, 2012). The primary objective of coordination is to facilitate efficient collaboration among various internal departments, thus mitigating the occurrence of bottlenecks and delays in production or procurement procedures. The importance of coordination lies in its ability to facilitate internal information exchange within the supply chain, mitigate conflicts and misunderstandings, and improve the adaptability and responsiveness of the supply chain.

Control refers to the act of overseeing and regulating the manufacturing process to ensure that production timelines and quality adhere to predetermined plans and established standards (Schwartz et al., 2006). The aforementioned activities include monitoring production progress, quality control, inventory management, and logistics. The importance of control lies in its ability to rapidly identify and address faults within the manufacturing

process, improve the uniformity and dependability of products, and reduce costs associated with inventory and transportation.

Table 2.4: Representative Sample of Past Studies on Internal Management

Authors	Perspective of Internal Management
Han et al., 2013	The results suggest that internal integration and coordination of the buyer-supplier relationship are significantly related to firm performance in both relationships.
Liu, 2015	When examining a manufacturer of frozen corn cobs in China, it is found that internal quality management with preventive and traceability systems is closely related to product quality, while the effectiveness of supply chain quality management moderates the extent of such relationships.
Manning & Monaghan, 2019	Studies suggest that strengthening internal integration can help maintain the integrity of the supply chain by ensuring transparency and traceability from production to retail.
Gokarn & Kuthambalayan, 2019	By focussing on internal management, companies can better meet customer requirements and facilitate smoother external interactions.
Siddh et al., 2022	Internal management has indirect and direct influences on organisational sustainability.
Ran & Chen, 2023	Decision models such as supplier-led, retailer-led, and centralised decision-making are explored to understand how internal integration can impact overall coordination and quality maintenance of fresh products.
Le & Luan, 2023	Establishing internal governance policies can increase links in the supply chain and ensure sustainability.

Han et al. (2013) elucidate the profound link between internal integration and the coordination of the buyer-supplier relationship with organisational performance, affirming its significance in both domains.

Liu (2015) investigated a Chinese frozen corn kernel producer and revealed that internal quality management mechanisms, specifically preventive measures and traceability systems, are intricately associated with product quality. Furthermore, the efficacy of supply chain quality management plays a moderating role in these relationships.

Manning and Monaghan (2019) propose that fortifying internal integration fosters supply chain integrity, predominantly by improving transparency and traceability from inception to retail.

Gokarn and Kuthambalayan (2019) highlight the role of internal management in aligning with customer expectations and streamlining external stakeholder interactions.

Siddh et al. (2022) explore the nuanced impacts of internal management on organisational sustainability, noting both indirect and direct influences.

Ran and Chen (2023) explore decision-making frameworks such as supplier-led, retailer-led, and centralised models, analysing their influence on internal integration, coordination efficacy, and quality preservation of fresh produce.

Le and Luan (2023) advocate the establishment of internal governance policies as a strategy to improve supply chain links and strengthen sustainability efforts.

2.5.4 Customer Integration

Integration of customers into the supply chain refers to the assimilation of customer requirements, feedback, and participation throughout the supply chain, which establishes customers as indispensable components of the supply chain. The objective of this integration is to develop a supply chain that prioritises the needs and preferences of customers, thus improving customer satisfaction and loyalty. Additionally, integration aims to optimise the efficiency and efficacy of the supply chain (Marty, 2022).

The customer integration process should begin at the beginning of the supply chain, where careful attention must be paid to consumer requirements throughout the stages of product research and design. This involves incorporating client input into the design and development of the product. This objective can be achieved by employing many approaches, including market research, soliciting client input, and participating directly (Yu et al., 2013). Once the product development phase has been completed, it is imperative to maintain

customer integration throughout the supply chain, encompassing various stages such as production, logistics, sales, and service activities.

Table 2.5: Representative Sample of Past Studies on Customer Integration

Authors	Perspective of Customer Integration
Manikas et al., 2010	Most of the transactions are based on personal relationships built with suppliers and customers, while e-communication and e-transactions act complementarily if there exist.
Köber & Heinecke, 2013	Customer-orientated supply chains show poor performance with respect to service rate, delivery time, inventory level, and capacity utilisation.
Callado & Jack, 2017	Customer satisfaction, rather than financial sustainability, is the driving force of the discussion between supply chain partners.
Pérez-Mesa et al., 2019	From the point of view of the consumer, close supplier-retail relationships have solved food safety issues, but the implementation of sustainability in other activities and supply chain processes is a pending issue.
Gokarn & Kuthambalayan, 2019	Internal integration within a company is considered a necessary foundation for successful external customer integration. However, challenges such as food loss and waste in the supply chain can hinder efforts to achieve food and nutritional security, making customer integration even more critical to addressing these issues.
Aslam et al., 2023	This research has explored customer integration in the context of market orientation and supply chain strategy during the digital revolution. This study explores how digital technologies are reshaping customer integration and highlights the importance of aligning supply chain strategies with market-orientated practices to meet evolving customer demands effectively.

As shown in Table 2.5, the studies on customer integration cover various aspects and impacts within the supply chain.

Customer integration plays a crucial role in the production process, as it enables alignment between production activities and the demands of customers. For example, customised or on-demand production techniques can be used to meet specific consumer demands (Martinelli & Tunisini, 2019). Customer integration plays a crucial role in improving logistics services throughout the logistics process, thus facilitating the attainment of improved delivery speed and quality that align with customer requirements.

Integration of customers in the sales process has the potential to strengthen the relationship between customers and sales channels, increase sales effectiveness, and foster higher levels of customer satisfaction. Integrating customers into the service process can improve the provision of post-sales service and support, thus effectively addressing customer requirements and expectations.

Manikas et al. (2010) highlight that most transactions rely on personal relationships with suppliers and customers, with e-communication and e-transactions serving as supplementary, when available.

Köber and Heinecke (2013) find that customer-orientated supply chains often underperform in terms of service rates, delivery times, inventory levels, and capacity utilisation.

Callado and Jack (2017) emphasise that discussions among supply chain partners are driven more by customer satisfaction than financial sustainability.

Pérez-Mesa et al. (2019) noted that while close supplier–retailer relationships address food safety concerns from a consumer perspective, integrating sustainability into broader supply chain activities remains unaddressed.

Gokarn and Kuthambalayan (2019) argue that internal company integration is essential for successful external customer integration, although food loss and waste present challenges in achieving food and nutritional security.

Aslam et al. (2023) examine customer integration within market orientation and supply chain strategies amid the digital revolution, highlighting the reshaping of customer

integration through digital technologies and the need to align supply chain strategies with market-orientated practices.

2.5.5 Risk Management

Management of risk in the fresh food supply chain is crucial to minimizing costs and ensuring safety. This is essential due to the perishable nature of fresh goods and the potential damage to the reputation and image of the company.

Risk management involves identifying, evaluating, analysing, and controlling potential risks at various stages of the supply chain. Supplier risk management is crucial as it ensures the quality and safety of raw materials and products.

Table 2.6: Representative Sample of Previous Studies on Risk Management

Authors	The Perspective of Risk Management
Zhao et al., 2017	Five key resilience factors identified in the literature are traceability, knowledge management, collaboration, culture, and agility.
Jacxsens et al., 2017	Management of food safety and risk assessment are key concerns and studies have indicated that pathogenic microorganisms can survive on fresh produce throughout the supply chain. The literature suggests that recalls, such as those involving cauliflower-containing products due to contamination risks, underscore the importance of vigilant risk assessment practices.
Zhang et al., 2019	The increase in profit is attributed to productivity advantages, expansion of the farm size, and reduction of risk rather than because of price premiums or cost savings.
Waqas et al., 2020	The research concludes that supply chain risk management practices in the agri-fresh supply chain can add value to products and improve productivity.
Cao et al., 2020	An effective risk management mechanism requires visibility and risk communication, particularly in global fresh produce supply chains that are often dynamic and non-transparent.
García-Flores et al., 2021	The review of supply chain risk management has identified economic, environmental, or social factors as potential sources of disruption. Understanding which risks are most likely to impact a given supply chain is crucial to developing targeted resilience strategies.
Waqas et al., 2023	Effective risk management can mitigate the adverse effects of supply chain risks on performance, and the use of knowledge is crucial to managing these risks more effectively.

Table 2.6 offers a curated selection of studies that focus on risk management in various contexts.

Zhao et al. (2017) revealed five critical resilience factors: traceability, knowledge management, collaboration, culture, and agility.

Jacxsens et al. (2017) emphasised the importance of food safety management and risk assessment, particularly highlighting the survival of pathogenic microorganisms in fresh produce and the need for diligent recall practices.

Zhang et al. (2019) attributed profit increases to productivity improvements, farm size growth, and risk mitigation rather than price premiums or cost reductions.

Waqas et al. (2020) deduced that supply chain risk management practices in the fresh agricultural supply chain can increase product value and increase productivity.

Cao et al. (2020) argue for the necessity of risk visibility and communication within global fresh produce supply chains, which are characterised by dynamism and opacity.

Garca-Flores et al. (2021) categorize economic, environmental, and social factors as the main disruptors in supply chain risk management, suggesting the identification of significant risks to devise effective resilience strategies.

Waqas et al. (2023) proposed that efficient risk management can alleviate the negative impacts of supply chain risk on performance, stressing the importance of knowledge leverage for better risk management.

2.6 Collaboration Behaviour

Collaborative behaviour refers to the extent to which individuals work together, share information, make joint decisions, and support each other in a team setting. It involves creating an environment where team members can freely exchange knowledge and ideas,

which can improve both exploitative and explorative behaviours within the team (Salas-Vallina et al., 2023).

Collaborative actions within the fresh produce supply chain constitute an essential facet of effective supply chain management, as elucidated by Pérez-Mesa et al. (2019). Such behaviours are manifested through a diverse array of cooperative actions, including, but not limited to, information sharing, joint planning, collaborative operations, risk sharing, the promotion of communal growth, and the cultivation of long-term relationships. These concerted activities are instrumental in promoting frictionless exchange of information, reducing operational expenditures, increasing operational efficiency, strengthening risk management practices, and improving overall resilience and agility of the supply chain. The persistence of these collaborative behaviours is particularly pronounced within the supply chain of fresh fruits and vegetables (Pérez-Mesa et al., 2019).

Information exchange is posited as the cornerstone of collaborative behaviour within supply chains (Wang et al., 2016). It is incumbent on all stakeholders to participate in the rapid, precise, and transparent dissemination of data on demand, inventory, sales, and logistics. This practice is highly important within the supply chain of fresh produce due to the perishable nature of the products involved. The spectre of excess inventory devolving into waste is large and presents a tangible concern. Adherence to information sharing protocols can markedly refine the accuracy of demand forecasting, reconcile inventory with actual demand, and thus attenuate the incidence of waste.

The realisation of an optimal collaborative environment is further enhanced by the adoption of joint planning and cooperative operational efforts. As posited by Susanto et al. (2022), entities that encompass suppliers, manufacturers, distributors, and retailers are

poised to forge alliances aimed at devising holistic strategies for the production, procurement, storage, and sale of fresh produce. These alliances are also equipped to orchestrate logistics delivery coordination to transit durations and reduce associated costs. These partnerships are poised to substantially increase operational efficacy and customer satisfaction within the fresh produce supply chain network (Susanto et al., 2022).

Table 2.7: Representative Sample of Previous Studies on Collaboration Behaviour

Authors	The Perspective of Collaboration Behaviour
McLaren et al., 2002	The benefits of collaborative SCM include process, inventory and product cost reductions, as well as increased cycle times, service levels, and market intelligence.
Simatupang & Sridharan, 2004	Intense competition forces companies to participate in the supply chain collaboration with their upstream and downstream partners.
Squire et al., 2009	Supplier capabilities (flexibility, responsiveness, and modularity) directly impact buyer responsiveness, but the level of buyer-supplier collaboration moderates this relationship.
Aggarwal & Srivastava, 2016	Collaboration in the agrifood supply chain leads to reduced waste and better efficiency.
Li et al., 2018	Supply chain collaboration acts as a mediator between knowledge absorption, knowledge integration, and service innovation performance.
Samad et al., 2021	Collaborative capabilities had significant moderating effects on the association of green chain management and environmental, as well as economic performance.
Ruiz-Alba et al., 2023	Supply chain collaboration (SCC) is an important element that contributes to improved performance.
Sabir et al., 2023	The collaborative capabilities of organisations have been proposed as a moderator between SCM and organisational competence.

Furthermore, the development of a community is a fundamental aspect of collaborative behaviour (Scalia, 2018). Investment in collaboration in the exploration and advancement of new technologies, coupled with dedicated initiatives to improve human capital, enables improvements in supply chain efficiency and adaptability. The act of sharing resources plays an important role in improving the overall competitive advantage of the entire supply chain, thus promoting a mutually beneficial outcome for all involved entities.

McLaren et al. (2002) highlight the tangible advantages of collaborative SCM, noting significant reductions in process, inventory, and product costs, alongside improvements in

cycle times, service levels, and market intelligence. This comprehensive enhancement of SCM functions illustrates the fundamental role of collaboration in achieving operational efficiency.

In a similar vein, Simatupang and Sridharan (2004) argue that the pressures of intense competition compel companies to engage in collaboration with their supply chain partners. This necessity is positioned as a strategic response to market forces, highlighting collaboration as an essential component of competitive SCM strategies.

Building on this understanding, Squire et al. (2009) examined the relationships among suppliers' capabilities, such as flexibility, responsiveness, modularity, and buyer responsiveness. They reveal that although suppliers' capabilities intrinsically affect buyer responsiveness, the level of buyer–supplier collaboration significantly moderates this impact, suggesting a nuanced interaction between capabilities and collaborative practices.

Aggarwal & Srivastava (2016) contribute to the discourse by focussing on the agri-food sector, where they find that collaboration is directly correlated with reduced waste and improved efficiency. This sector-specific insight reinforces the notion that collaboration is particularly beneficial in contexts where product perishability is a concern.

By further exploring the role of collaboration in SCM, Li et al. (2018) identify it as a mediator that facilitates the translation of knowledge absorption and integration into service innovation performance. This mediating role of collaboration indicates its importance in the knowledge-to-innovation process within supply chains.

Samad et al. (2021) extend the conversation to environmental considerations, demonstrating that collaborative capabilities significantly moderate the relationship between

green chain management and both environmental and economic performance. This finding situates collaborative behaviour as a critical enabler of sustainable SCM practices.

Ruiz-Alba et al. (2023) affirm that supply chain collaboration is an indispensable element that contributes to improved performance metrics across the board. This perspective aligns with the contemporary emphasis on interorganizational cooperation to achieve competitive advantage.

Sabir et al. (2023) proposed that an organisation's collaborative capabilities may moderate the relationship between SCM practices and organizational competence. This underscores the potential of collaborative behaviour to influence broader organisational outcomes.

Table 2.8: Representative Literatures on Collaboration as a Moderator

Authors	Perspective of Collaboration Behaviour as a Moderator
Adams et al., 2014	Collaboration functions as a critical intermediary in enhancing the efficacy of integration efforts with relational technology. Strong collaborative relationships enhance technology integration, magnifying its benefits, while weak collaboration can impede technological adoption and lessen the positive impact relational technology has on organisational outcomes.
Chen et al., 2015	Environmental collaboration in supply chains acts as a significant moderator between environmental strategies and firm competitiveness, particularly through supplier and customer collaborations. Based on a survey of 162 Chinese manufacturing enterprises, this study examines how collaborative communication moderates GSCM's impact on performance. Key findings show that communication frequency significantly moderates internal environmental management's effect on environmental performance. Communication climate positively moderates both environmental and economic performance outcomes. The study emphasizes collaborative communication's crucial role in successful GSCM implementation
Pan et al., 2020	
Wang & Hu, 2020	The study introduces collaborative innovation capability as a key moderating factor. This capability significantly affects how well firms can translate collaborative activities into innovation performance. Higher levels of collaborative innovation capability strengthen the positive relationship between collaborative activities and innovation outcomes
Samad et al., 2021	Collaborative capacity plays a crucial role in shaping how green supply chain practices impact the performance of manufacturing firms. Its presence can magnify or diminish the benefits derived from sustainable practices.
Ruiz-Alba et al., 2023	Supply chain collaboration moderates the effect of intermediate and advanced services on performance and servitization consequences. They also find that advanced services and the consequences of servitization have a positive impact on performance, whereas base services do not have a significant effect.

The role of collaboration as a moderating factor has gained significant attention in recent business research, particularly in organizational performance contexts. Adams et al. (2014) established that collaboration functions as a critical intermediary factor in technology integration efforts, where strong collaborative relationships enhance technology integration effectiveness, while weak collaboration can impede technological adoption and diminish positive organizational outcomes.

In the environmental management domain, Chen et al. (2015) demonstrated that environmental collaboration in supply chains significantly moderates the relationship between environmental strategies and firm competitiveness. This understanding was further enhanced by Pan et al. (2020), who found that collaborative communication significantly moderates the relationship between Green Supply Chain Management and performance outcomes in Chinese manufacturing enterprises.

Wang and Hu (2020) contributed by introducing collaborative innovation capability as a key moderating factor, showing that higher levels of this capability strengthen the positive relationship between collaborative activities and innovation outcomes. Similarly, Samad et al. (2021) demonstrated that collaborative capacity plays a crucial moderating role in determining how sustainable practices impact manufacturing firm performance.

In service operations, Ruiz-Alba et al. (2023) provided evidence that supply chain collaboration moderates the relationship between service levels and performance outcomes, particularly effective with intermediate and advanced services. Across these studies, a consistent pattern emerges showing that collaboration acts as a positive moderator when properly implemented, with the strength of collaborative relationships determining the effectiveness of various organizational initiatives.

2.7 Theoretical Background of the Study

In supply chain management practices, the direction of management is used to divide the practices. Vertical management practices can be explained through management control theory (Krishnan & Winter, 2012; Li, 2009; Petrov & Gilmundinov, 2022; Ursino, 2015). In this study, vertical management practices are divided into five parts: top management, supplier integration, internal management, customer integration, and risk management. These are explained via control theory in management studies. Horizontal management practices refer mainly to collaborative behaviour between various companies in the supply chain. Therefore, it is explained through the collaboration theory of management studies (Basso et al., 2023; McAdam et al., 2017; Mjahed et al., 2021; Solaimani & van der Veen, 2022). Many companies in the supply chain together form a virtual alliance. Each company in the alliance belongs to stakeholders. Therefore, stakeholder theory is used to explain the performance of fresh food supply chains (Ahmed et al., 2020; Parmigiani et al., 2011; Qazi et al., 2022; Searcy, 2017). Table 2.9 presents a summary of the variables covered by control theory, collaboration theory, and stakeholder theory.

Table 2.9: Summary of Variables Covered by Theory

Theory Variables	Control Theory	Collaboration Theory	Stakeholder Theory
Top Management	√		
Supplier Integration	√		
Internal Management	√		
Customer Integration	√		
Risk Management	√		
Collaboration Behavior		√	
Fresh Produce Supply Chain Performance			√

Recent research has demonstrated the critical intersection of control mechanisms and stakeholder collaboration in agricultural supply chain management. Internal control systems have proven particularly vital during disruptive periods, with studies showing that robust control mechanisms significantly enhance supply chain management efficiency and capital allocation effectiveness. The research emphasizes how formal control structures help organizations maintain performance standards while facilitating stakeholder coordination (Otter & Robinson, 2024).

In the context of sustainable supply chains, performance measurement and management function as critical control mechanisms that facilitate multi-stakeholder collaboration. Research indicates that effective performance management systems are vital for implementing and sustaining sustainable practices, especially in SMEs, where stakeholder coordination plays a pivotal role (Panigrahi et al., 2024).

Research in contract farming has revealed how control theory and stakeholder collaboration intersect in transitional economies. The findings demonstrate that successful agricultural supply chains require both formal control mechanisms and effective stakeholder engagement strategies, particularly in developing markets where institutional frameworks may be less established (Valentinov et al., 2024).

A comprehensive review of recent research reveals significant developments in the application of stakeholder and collaboration theories in agricultural supply chains. In a study examining blockchain technology adoption in agri-food supply chains, researchers found that stakeholder management approaches significantly influence technology implementation success. The study demonstrated that successful cooperation between supply chain partners

requires careful consideration of stakeholder interests and relationship management strategies (Zhang, 2024).

Further research on multi-stakeholder partnerships in developing countries has shown how collective action among various stakeholders can improve agricultural value chains. Through a systematic literature review, the study revealed that partnerships involving diverse stakeholders lead to more sustainable and resilient agricultural systems, particularly when stakeholder interests are properly aligned and managed (Otter & Robinson, 2024).

A significant contribution to understanding collaboration in agri-food supply chains comes from a bibliometric analysis that examined the interplay between collaboration, trust, and performance. The research highlighted how trust-based relationships and collaborative practices have evolved in agricultural supply chains, demonstrating their crucial role in improving supply chain efficiency and effectiveness (Valentinov et al., 2024).

Recent work on transparency and stakeholder roles in digital agri-food supply chains has provided valuable insights into how information sharing affects trust and cooperation among stakeholders. The study found that digital technologies are transforming traditional stakeholder relationships, leading to new forms of collaboration and improved supply chain transparency (Kramer et al., 2021).

The collaboration mechanism in agricultural product supply chains has been further explored through game theoretical approaches, examining how different stakeholders interact to promote agricultural product development. This research demonstrated that proper alignment of stakeholder interests and collaborative mechanisms can significantly improve supply chain performance and stakeholder satisfaction (Alves et al., 2024).

2.7.1 Theory of Management Control

Control theory is a branch of engineering and mathematics that addresses the behaviour of dynamical systems. It involves designing and analysing control systems to achieve the desired behaviours in systems. This can include managing uncertainties, optimising performance, and addressing feedback loops (Ivanov et al., 2018).

The concept of management control involves the formal, information-based routines and procedures used by managers to maintain or alter patterns in organisational activities. These control systems are designed to guide behaviour and increase the likelihood of achieving organisational goals. In the context of innovation, management control systems play a crucial role in fostering collaboration, promoting information flows, and adapting to environmental uncertainty to support innovative initiatives (Barros & Ferreira, 2023; Lin et al., 2010). The process encompasses various subsystems, including planning, measurement, feedback, assessment, and incentives. In addition, the theoretical framework considers several elements, such as control mechanisms, cultural dynamics, and the influence of member behaviour on organisational control.

Management control theory seeks to achieve long-term sustainability for organisations by promoting internal coordination and consistency, fostering innovative thinking and continual development among members, and facilitating the adaptation of organizations to external environmental changes.

The application of management control theory is extensive, spanning multiple levels and departments within organisations (Berry et al., 2019), and encompasses the management of relationships with external stakeholders. Various entities, including enterprises, government institutions, and nonprofit organisations, can derive advantages from it. This

versatile theory is applicable to a wide range of organisations, encompassing various types and sizes.

To achieve efficient management control, various approaches have been proposed. Some commonly used methodologies include balanced scorecards, budget control, financial statement analysis, quality assurance, risk mitigation, and human capital management (Gigliani & Bedeian, 2019). The objective common to these methodologies is to assist organisations in the acquisition, examination, and application of data, as well as the evaluation of the effectiveness of various resources and efforts and the implementation of necessary modifications and improvements.

The utilisation or implementation of something in a practical or functional manner. The applicability of management control theory is widely observed in practical contexts. This theory is applied in different domains, including strategic management, project management, supply chain management, marketing management, and innovation management, to achieve organisational objectives (Dolgui et al., 2018; Ivanov et al., 2018). Using these apps, organisations can achieve their vision and mission and improve their competitive advantage and long-term viability, while also effectively addressing the demands and expectations of both consumers and society.

In essence, management control theory offers organisations a framework and strategies to effectively attain their objectives while simultaneously assisting them in sustaining competitiveness within a dynamic business landscape. Organisations can improve their ability to address difficulties and achieve sustainable success by effectively using the concepts, methods, and instruments offered by theory.

2.7.2 Theory of Management Collaboration

Collaborative theory elucidates the complex interactions between processes, outcomes, contextual variables, and actors within a cooperative framework. It is asserted that collaboration transcends a unidimensional construct, instead representing instead a dynamic, multifaceted process characterised by an amalgamation of influences and dimensions (Gray & Wood, 1991).

Extending this foundational perspective, the theory of management collaboration delves into the mechanisms through which organisations may enhance managerial effectiveness and efficiency. This enhancement is based on the strategic dissemination and cultivation of information, which requires cross-boundary cooperation and coordination. Integral to this theory are processes such as relationship cultivation, communication effectiveness, trust-building mechanisms, consensus formation, and decision-making protocols. Furthermore, this theoretical approach incorporates an analysis of environmental, strategic, structural, cultural, and technological impacts on collaborative efforts within management paradigms (Dania et al., 2018).

Clauss and Schumann (2020) articulated the primary objective of management collaboration theory as the bridge between theoretical research and pragmatic application. The motivation behind this objective is to promote evidence-based management practices, thus increasing the calibre of management innovation and addressing organisational and social needs. In this context, theory provides managers with robust methodologies to foster effective collaborative partnerships, navigate complex organisational challenges, and achieve collective objectives.

The scope of management collaboration is broad, encompassing a variety of practices within and outside organisational boundaries (Zou & Yu, 2008). These practices include, but are not limited to, team formation, project management, network establishment, alliance creation, partnership development, and other collaborative constructs. The versatility of this concept allows its application across diverse organisational forms, such as corporate enterprises, governmental agencies, nonprofit entities, and other organizational typologies.

Methodologies within the philosophy of management collaboration (such as evaluative collaboration, collaborative design principles, training protocols, consultative approaches, and collaborative platforms) are meticulously crafted to help organizations in the collection and use information. These methodologies also serve to evaluate and enhance collaborative effectiveness while facilitating adjustments based on performance outcomes.

The practical applications of the theory of management collaboration are extensive and impactful. As noted by Sungbae and Taesoo (2016), domains such as knowledge management, innovation management, change facilitation, strategic oversight, and human resources administration benefit from the application of collaborative principles. The overarching objective is to harness cooperation to fortify organisational learning and adaptability, thereby increasing competitive advantage and ensuring sustainable value creation.

In summary, the theory of management collaboration offers an integrative framework for achieving organisational objectives through strategic inter-departmental collaboration. Using the principles, methodologies, and tools propounded by this theory, organisations are equipped to navigate current business challenges and achieve long-term success.

2.7.3 Stakeholder Theory

Stakeholder theory, situated at the confluence of ethical considerations and managerial strategy, asserts the criticality of acknowledging the interests of all stakeholders in the decision-making processes of organisations. This theoretical approach expands the conventional scope of corporate success, which is traditionally encapsulated by shareholder value, to embrace the development of mutually beneficial interactions with a broad spectrum of stakeholders, including employees, consumers, suppliers, local communities, and society at large (Dao & Phan, 2023).

Within the domain of agricultural supply chain management, a central element involves the equitable allocation of benefits among all constituent stakeholders. This encompasses a range of considerations that span technological, political, organisational, and managerial dimensions (Fritz & Schiefer, 2008).

Stakeholders are defined as individuals and collectives that exert influence over or are impacted by organisational actions and the fulfilment of their objectives (Edward Freeman, 2010). The foundational premise of stakeholder theory advocates for a harmonisation of the disparate interests of stakeholders, advocating a shift from a singular focus on shareholder profit maximisation to a more inclusive consideration of broader societal and organisational welfare (Mcvea & Freeman, 2005).

Organisations are therefore advised to extend beyond a myopic focus on financial metrics and equally weigh their societal contributions. Managers are encouraged to recognise and address the needs of all entities significantly impacted by organisational activities and outcomes.

Stakeholder theory further posits that integrating a diverse array of stakeholder perspectives into organisational decision-making processes is not merely an ethical imperative but also constitutes a strategic asset that can bolster an organisation's competitive edge (Beck et al., 2023; Beck & Storopoli, 2021).

The relevance to supply chain collaboration emerges from its influence on stakeholder management strategies (Co & Barro, 2009). The dynamics of interactions among stakeholders within the supply chain, shaped by elements such as power dynamics, the immediacy of stakeholder concerns (urgency), the authenticity of their participation (legitimacy), and the effectiveness of stakeholder collectives (group efficacy), can sway an organisation's decision to pursue either confrontational or cooperative relationship management strategies with its stakeholders. These strategic choices carry significant practical consequences, particularly for organisations that are spearheading transformative initiatives or contending for powerful stakeholder tactics. The three approaches to stakeholder management (supplier relationships, customer relationships, and risk and reward sharing) have positive and significant effects on supply chain performance (Shahbaz et al., 2018).

However, stakeholder theory often circumscribes the stakeholder classification to the principal legitimate parties directly associated with the organisation. This delimitation arises from practical considerations; an excessive dispersal of organisational resources toward satisfying the heterogeneous interests of an expansive stakeholder group may impede the organisation's capacity to sustain its economic viability.

2.8 Theoretical Framework

2.8.1 Gaps in the Literature

The literature has examined the impact of supply chain management control practices on supply chain performance, and collaborative management behaviour within the supply chain has been analysed as a moderating variable in the relationship between supply chain management practices and supply chain performance.

A review of the literature reveals that numerous scholars have investigated the effects of top management (Adusei et al., 2023; Nawurunnage et al., 2023), supplier integration (Golrizgashti et al., 2022; Sutanto et al., 2023; Thongrawd et al., 2020), customer integration (Siagian et al., 2023; Zaid et al., 2021), internal management (Yang et al., 2021), and risk management (Khan et al., 2023; Misbauddin et al., 2023) on the performance of fresh produce supply chains.

However, few studies have specifically addressed the behaviour of managerial collaboration as a moderating variable between supply chain management activities and supply chain performance. Furthermore, while existing studies have identified a significant positive correlation between collaborative competencies and the economic performance of fresh supply chains (Samad et al., 2021). Furthermore, there is a lack of detailed analyses of the modulating role of these management activities individually.

Therefore, this study may represent a new investigation in the literature by analysing collaborative behaviour as a moderating variable to assess the impact of these five management activities on supply chain performance.

2.8.2 Justification of the Theoretical Framework

The research in this paper is based on three theoretical pillars that are critical in examining the performance of the fresh produce supply chain in the Weifang area of China. Management control theory, collaboration theory, and stakeholder theory are the main theories applied.

Management control theory is identified as an independent variable in this study. It encompasses five distinct components that are hypothesised to influence supply chain performance. The first component, top management, focusses on the strategic leadership and decision-making processes that guide the organisation's overall direction. The second component, supplier integration, examines the alignment and collaboration between the firm and its suppliers to improve operational efficiency. Internal management, the third component, addresses internal controls and organisational processes that ensure the effective execution of strategies. The fourth component, customer integration, looks at how customer feedback and requirements are integrated into supply chain operations. The final component, risk management, is concerned with identifying and mitigating potential disruptions within the supply chain.

The role of collaboration theory in this research is to act as a moderating variable. This theory highlights the importance of cooperative behaviour among different supply chain entities. This finding suggests that such collaborative interactions can significantly influence how management controls impact overall supply chain performance.

Stakeholder theory is the third theoretical lens through which this research is conducted. This emphasises the necessity of cooperation between all members of the supply chain. According to this theory, recognising and addressing the interconnected interests of

all stakeholders is vital to achieving collective objectives and improving supply chain performance.

By integrating these theories, this paper proposes a conceptual model in which management control practices affect the performance of the fresh produce supply chain. Collaboration behaviour is expected to moderate this relationship, potentially amplifying or diminishing the effects of management control practices on the basis of the level and quality of collaboration between stakeholders.

In summary, this theoretical framework sets the stage for investigating how management control practices impact the performance of fresh produce supply chains and how collaboration behaviour can influence this relationship in the context of the Chinese agricultural sector.

2.8.3 Description of Variables

The study examines multiple variables in the context of fresh produce supply chain management. The research framework incorporates five key factors of supply chain management control that serve as independent variables: top management, supplier integration, internal management, customer integration, and risk management.

In this study, the five factors of supply chain management control serve as independent variables, collaboration behaviour as the moderating variable, and FPSC performance as the dependent variable. These variables represent key aspects of supply chain management and their relationships will be examined to understand their impact on fresh produce supply chain operations.

2.9 Hypotheses Development

A hypothesis is a testable statement that provides a tentative explanation for a phenomenon or fact that has not yet been proven (Zafeiris et al., 2022). In the present study, previous research findings, as discussed in previous sections, are used to achieve research objectives and explore potential explanations for the relationships between the variables under investigation.

2.9.1 Top Management and Fresh Produce Supply Chain Performance

The integral function of top management in the domain of supply chain management is underscored by its pivotal role in supporting support, orchestrating resource distribution, and directing strategic imperatives. Their participation is an essential element to foster successful collaboration, accelerate the adoption of technological innovations, and improve overall supply chain performance metrics. Furthermore, the dedication of top management profoundly influences aspects such as employee commitment, judicious resource allocation, and the strategic decision-making process, which are indispensable for the effective governance of supply chain operations (Talib & Hamid, 2014).

Leadership within the supply chain environment is recognised for its ability to refine operational performance, fortify the buyer–supplier relationship, and advance sustainability objectives. The influence of disparate leadership styles is evident in their impact on the quality, timeliness, and financial robustness of supply chain systems. Additionally, leadership conduct is a catalyst for the adoption of environmental sustainability measures among supply chain components (Mokhtar et al., 2019).

In the context of fresh food supply chains, the influence of top management is manifested through the implementation of sustainable practices such as workforce training,

environmentally conscious design principles, and the integration of environmental management frameworks. These initiatives are instrumental in amplifying both economic and environmental sustainability metrics, reducing waste from fresh produce, and increasing stakeholder content (Liao et al., 2023).

The commitment of top management is also crucial to improving green procurement and production methodologies. Research indicates that an unwavering commitment of top management to environmental strategies significantly propels the adoption of green purchasing and production within an organisation. This loyalty not only facilitates resource allocation but also aids in the creation of strategies and policies that address environmental concerns, thus strengthening the organisation's ecological reputation and operational efficacy (Basana et al., 2022).

The symbiosis between top management and agri-fresh food supply chain quality (AFSCQ) is deemed critical to the fruitful materialisation of AFSCQ protocols. Support provided by top management is instrumental in influencing determinants such as process integrity, logistic excellence, and supplier quality standards. This backing enhances customer engagement, crystallises the organization's mission and vision, and wields a positive influence on human resource management. Furthermore, the participation of top management is a harbinger of cost-efficiency measures and sustainable initiatives within the agri-food supply chain ecosystem (Siddh et al., 2021).

The pursuit of superior performance in supply chain operations is inextricably linked to endorsement by senior management echelons (Xu & Zhao, 2022). This involves a proactive approach of senior executives to managing and steering supply chain functions with an emphasis on strategic congruence, resource management, and performance

monitoring (Hanna et al., 2010; Roh et al., 2016). Such support engenders an alignment with the overarching.

As a result, the following hypothesis is proposed:

Hypothesis 1 (H1). There is a positive relationship between top management and FPSC performance.

2.9.2 Supplier Integration and Fresh Produce Supply Chain Performance

Supplier integration is a critical construct in the discourse on supply chain management, which encompasses systemic interaction and collaborative efforts between an enterprise and its suppliers to ensure a seamless supply flow. This concept extends beyond simple transactional exchanges to include the mutual acquisition and dissemination of technical, operational, and financial intelligence. The literature posits that supplier integration profoundly influences supply chain performance; improves responsiveness, agility, and temporal efficiency; and simultaneously reduces transaction costs. This is achieved by attenuating uncertainties and optimising production expenditures, thereby simplifying upstream processes (Madzimore, 2020).

The ramifications of supplier integration for supply chain efficacy are substantial. Empirical studies have corroborated its positive impact on operational efficiency, adherence to production schedules, and systemic flexibility. By streamlining costs, refining production schedules and amplifying supply chain malleability, supplier integration contributes to an improvement in overall performance metrics (Danese, 2013).

The supplier integration process requires the establishment of robust and synergistic relationships between procurers and vendors within a supply chain, aimed at intricately

coordinated operations (Zi et al., 2022). This involves the exchange of information, the allocation of resources, and the consideration of risks to achieve optimal performance and enhance collaboration throughout the supply chain. On the contrary, the efficacy of a newly established supply chain for agricultural products depends on the ability of different stakeholders within the supply chain to achieve their respective goals throughout the entire production-to-consumption process. This comprises a variety of variables, including quality, cost, service, efficiency, and satisfaction.

A positive association has been identified between the degree of supplier integration and the effective performance of the supply chains of fresh agricultural products (Zheng et al., 2021). The benefits derived from supplier integration are manifold; they improve the preservation and quality of the product, thus reducing waste and mitigating losses. Additionally, supplier integration is instrumental in increasing profit margins by reducing costs associated with procurement, transportation, and storage.

Effective supplier management is essential in fresh produce supply chains, serving to stabilise supply continuity, maintain product quality, effectively manage costs, stimulate innovation, provide technical support, and navigate risks (Kashif & Al-Rawas, 2022; Zhang et al., 2011). The adoption of effective supplier management practices is instrumental in improving the stability, efficiency, and quality of agricultural products, thus driving competitive advantage and consumer satisfaction. Organisations can improve the performance of the fresh produce supply chain by forging lasting collaborative relationships with premium suppliers, improving procurement and production protocols, and mitigating inventory and operational hazards (Golrizgashti et al., 2022).

As a result, the following hypothesis is proposed:

Hypothesis 2 (H2). There is a positive relationship between supplier integration and FPSC performance.

2.9.3 Internal Management and Fresh Produce Supply Chain Performance

Internal management is fundamentally about collaboration and coherence between various departments and functional areas within an organisation. This concept, as outlined by Arshad Ali and Mahmood (2024), underscores the importance of a well-integrated internal structure in enhancing operational performance. It is posited that a unified approach to managing internal processes and goals significantly enhances an organization's efficiency and alignment with collective objectives.

The role of internal integration in the development of market knowledge and product development is particularly significant. Such integration fosters a collaborative atmosphere within the organisation, facilitating the exchange of ideas and knowledge between different departments. This synergy is crucial in amplifying an organisation's grasp of market dynamics and customer preferences, thereby enhancing its product innovation capability. The resulting market knowledge is not just a repository of information, but also a dynamic resource that empowers the organisation to anticipate and meet market demands with a flair.

In the supply chain of fresh produce, internal management practices embody a commitment to environmental stewardship and sustainability. Zhu et al. (2013) highlighted how ecodesign and internal environmental management, among other green SCM practices, positively influence supply chain performance. These practices are instrumental in optimising resource use, curtailing waste production, and minimising the costs associated with material procurement and waste management. The implications here are clear: Responsible internal management practices can produce ecological and economic benefits.

When the agri-fresh food supply chain is considered, the implications of internal management become even more pronounced. As noted by Siddh et al. (2021), internal management practices such as employing appropriate food processing technologies, maintaining stringent quality standards, and adept at facility location and inventory management are essential. These practices not only contribute to operational sustainability, but are also essential for ensuring the quality and efficiency of the supply chain, from farm to table.

In addition, internal integration enriches the quality of product development. When teams from different departments work together and leverage each other's expertise, they result in products that are not only innovative but also align with market requirements and customer expectations. Integration ensures that all aspects of product development are harmonised, leading to well-designed, functional, and market-ready products.

In light of these considerations, internal management emerges as a cornerstone of FPSC performance. Authors such as Curcio & Longo (2009) and Anesukanjanakul & Rattamane (2019) have highlighted the impact of internal management in enhancing production efficiency, reducing waste, and improving the overall competitiveness of the supply chain. Strategic allocation of resources, timely performance evaluation, fostering employee collaboration, and stringent quality control measures are not just operational tactics; they are the lifelines that ensure the delivery of high-quality agricultural products, meet customer demands, and increase the reputation and competitiveness of the FPSC.

As a result, the following hypothesis is proposed:

Hypothesis 3 (H3). There is a positive relationship between internal management and FPSC performance.

2.9.4 Customer Integration and Fresh Produce Supply Chain Performance

Customer integration in supply chain management refers to the degree of collaboration and interaction between a company and its customers. It involves activities such as information sharing, customer involvement in decision-making processes, and the establishment of close relationships to better understand and meet customer needs (Ruzo-Sanmartín et al., 2023)

Customer integration enhances supply chain performance by improving information accuracy, reducing production planning time, minimizing inventory obsolescence, increasing customer satisfaction, enhancing responsiveness, and lowering operational costs. These benefits contribute to a more efficient and effective supply chain.

Specifically, customer integration emphasizes collaborative efforts and information sharing with downstream customers, such as wholesalers and retailers, to identify market opportunities and ensure high levels of satisfaction through the provision of safe and high-quality food products. Notably, in this context, CI refers to the integration between a food processing enterprise and its distributors, rather than direct interaction with individual end consumers.

Zhao et al. (2021) reported that customer integration, along with internal and supplier integration, has a positive effect on agri-food product quality and financial performance in Chinese food processing businesses. This suggests that involving customers in the supply chain process can lead to improved financial performance. The study recommends paying attention to internal information exchange and strategic cooperation with suppliers, as well as implementing supply chain quality management to improve product quality and overall profitability.

By adopting customer integration, supply chain participants can customise their offers to meet specific consumer requests and include customer input (Ruzo-Sanmartín et al., 2023). This approach leads to greater customer appreciation and loyalty to these offerings. This integration also enables supply chain stakeholders to simultaneously improve the quality of fresh agricultural products and strengthen their brand image, resulting in increased customer trust and loyalty.

Furthermore, the incorporation of customers into the supply chain has a beneficial effect on the quality of service and the speed of response, ultimately leading to increased customer loyalty and the development of a positive reputation (Alam et al., 2019). By implementing customer integration, supply chain actors can effectively participate in prompt interactions with customers, providing easy and high-quality services. The inclusion of consumer integration enables supply chain participants to respond effectively to customer complaints and suggestions, enhancing their ability to resolve conflicts and ultimately amplifying client endorsements and word of mouth dissemination.

Finally, the integration of customers plays a crucial role in enhancing the potential for innovation and competitive advantage in the realm of newly developed agricultural products, thus increasing market visibility and profitability (Awwad et al., 2022; Siagian et al., 2022). By implementing customer integration techniques, stakeholders in the supply chain can effectively use customers as valuable sources of new ideas and collaborative participants in innovation initiatives.

As a result, the following hypothesis is proposed:

Hypothesis 4 (H4). There is a positive relationship between customer integration and FPSC performance.

2.9.5 Risk Management and Fresh Produce Supply Chain Performance

Risk management involves a methodical process to recognise, evaluate, regulate, and minimizing possible and actual hazards of the different participants involved in the supply chain. The primary objective of its implementation is to improve several performance metrics within the supply chain of fresh agricultural products.

First, the use of risk management strategies efficiently mitigates the negative impacts of losses and waste that are commonly associated with fresh agricultural products, thus resulting in an improved quality and safety profile (Waqas et al., 2023). Supply chain stakeholders effectively reduce the occurrence of spoilage, contamination, and damage by proactively managing risks at many stages, including manufacturing, processing, transportation, storage, and distribution. Consequently, this measure serves to protect the quality and hygiene of the product, which is in accordance with the health and safety demands of consumers.

Furthermore, the implementation of risk management measures leads to a decrease in expenses related to transportation and storage, thus increasing profitability and maximising returns on investment (Gaudenzi & Qazi, 2021). By participating in detailed risk management planning, supply chain participants can improve several aspects, such as transportation modes, routes, timings, and storage conditions. This optimisation process leads to a reduction in resource consumption, energy expenditures, environmental effects, and unexpected losses throughout the transit and storage stages. These measures effectively improve the economic sustainability and competitive position of the items.

Furthermore, the implementation of risk management strategies successfully mitigates the challenges posed by supply volatility and latency risks in the context of fresh

agricultural products (Zhang et al., 2020). As a result, this approach leads to improved service levels and increased customer satisfaction. Supply chain participants play a crucial role in maintaining the consistency and timeliness of product supply by proactively anticipating and responding to various factors, such as market demand fluctuations, supply disruptions, climatic variations, natural disasters, policy changes, and social disruptions. This enables them to meet the quantity and timing requirements of customers effectively.

FPSC performance is significantly influenced by risk management, as risk management has a direct effect on the ability of FPSC to withstand and recover from adverse events (Tran et al., 2019). Efficient risk management involves the identification and evaluation of various risks, including but not limited to supplier delays, weather-related calamities, and transportation challenges, to ensure the continuity and stability of operations (Waqas et al., 2023). Additionally, the scope of this approach encompasses risk mitigation strategies, maintaining business continuity, effective financial management, and preserving brand reputation. Through the use of proactive risk management strategies, the supply chain can effectively address unforeseen circumstances, ensure uninterrupted flow of company operations, and mitigate potential financial setbacks.

In conclusion, risk management practices help reduce the legal and social responsibility risks associated with newly produced agricultural products, promoting their long-term sustainability and positive effects on society. This promotes qualities such as environmental sustainability, fairness, and philanthropy, ultimately improving client loyalty and confidence in products. As a result, the following hypothesis is proposed:

Hypothesis 5 (H5). There is a positive relationship between risk management and FPSC performance.

2.9.6 Collaboration Behaviour, Top Management and Fresh Produce Supply Chain Performance

Research has shown that supply chain collaboration is a strategic tool that can significantly enhance the business performance of an organisation and its supply chain. Although firms strive to achieve higher levels of collaboration, many collaboration initiatives fail, suggesting that the quality of collaboration, potentially influenced by top management, is a critical factor for success (Fawcett et al., 2008).

The impact of supply chain collaboration on collaborative advantage and firm performance has been well documented. Collaboration in the supply chain is described as a process in which partners work together to achieve shared objectives, including the sharing of information, resources, and risks. This collaborative approach is seen as a pathway to achieving mutual goals, which could be indicative of how top management's engagement in collaboration behaviours could enhance FPSC performance (Cao & Zhang, 2011).

Another study highlights the importance of collaborative feedback and resource investments in establishing inter-firm collaboration. These findings suggest that these elements are influential in achieving successful performance of logistics services within the supply chain. This underscores the potential moderating role of collaboration behaviour in translating top management initiatives into effective supply chain performance (Lindsey Hall et al., 2022).

Furthermore, evidence suggests that supply chain collaboration directly improves collaborative advantage, which then positively impacts firm performance. Collaborative advantage acts as an intermediate variable that allows supply chain partners to realise synergies and create superior performance results. This finding supports the notion that

collaboration behaviour could moderate the effectiveness of top management strategies on FPSC performance. As a result, the following hypothesis is proposed:

Hypothesis 6 (H6). Collaboration behaviour moderates the relationship between top management and FPSC performance.

2.9.7 Collaboration Behaviour, Supplier Integration and Fresh Produce Supply Chain Performance

The literature suggests that collaboration behaviour can have a moderating effect on the relationship between supplier integration and supply chain performance. This means that the effectiveness of supplier integration in improving supply chain performance may depend on the level of collaborative behaviour exhibited by the partners involved. For example, in environments where collaboration is high, supplier integration efforts can yield better performance outcomes due to more effective communication, trust, and coordination (Hendijani & Saeidi Saei, 2020).

Furthermore, studies have indicated that supply complexity can moderate the relationship between supply chain integration and performance. In the case of fresh produce, where supply chains can be particularly complex due to perishability and demand variability, collaboration behaviour may play a crucial role in managing this complexity and improving the positive effects of supplier integration on performance (Gimenez et al., 2012).

In summary, while supplier integration is a fundamental strategy to improve FPSC performance, its success is likely enhanced by the presence of strong collaboration behaviour. This behaviour facilitates better alignment and responsiveness among supply chain partners, which is crucial in the fast-paced and unpredictable environment of fresh produce. Future research could empirically test this modulating effect by examining different

levels of collaboration behaviour and their impact on the relationship between supplier integration and supply chain performance outcomes. As a result, the following hypothesis is proposed:

Hypothesis 7 (H7). Collaboration behaviour moderates the relationship between supplier integration and FPSC performance.

2.9.8 Collaboration Behaviour, Internal Management, and Fresh Produce Supply Chain Performance

The empirical evidence from the study emphasises the importance of achieving a balance between internal and external collaboration efforts and supply chain performance. This suggests that when there is congruence between collaboration efforts and organisational capabilities, supply chain performance is positively impacted (Zhong et al., 2023).

Furthermore, research has examined the modulating role of external factors, such as demand uncertainty, in the relationship between supply chain integration and firm performance. Although not directly focused on internal management, these findings highlight the complex interplay between internal processes and external market conditions (Hendijani & Saeidi Saei, 2020).

Finally, Cao & Zhang (2011) discuss collaborative advantage, which comes from relational rents produced through strategic alliances and collaboration. This collaborative advantage can lead to improved firm performance and competitive positioning.

In conclusion, although there is empirical support for the positive impact of collaboration behaviour on supply chain performance, the evidence also indicates that successful collaboration is dependent on various factors, including alignment of goals, trust between partners, and external market conditions. For the fresh produce industry, where the

supply chain is particularly dynamic and time-sensitive, the promotion of effective collaboration behaviour could be a significant lever to improve internal management practices and achieve better overall performance. As a result, the following hypothesis is proposed:

Hypothesis 8 (H8). Collaboration behaviour moderates the relationship between internal management and FPSC performance.

2.9.9 Collaboration Behaviour, Customer Integration, and Fresh Produce Supply Chain Performance

An empirical study examined the effects of both internal collaboration and external collaboration on supply chain performance. Data from 205 companies in China were used and structural equation modelling was applied to test the hypotheses. The study indicates that there is a significant interaction effect between internal collaboration and external collaboration, which influences supply chain performance. This implies that when firms effectively manage both internal processes and external partnerships, they are likely to see better performance outcomes (Zhong et al., 2023).

Research on supply chain integration emphasises the importance of external integration in acquiring timely information on supplier activities and customer demands, leading to better coordination between supply chain members. This integration helps avoid inefficiencies and can improve overall supply chain performance, suggesting that collaboration behaviour plays a critical role in leveraging external information for better performance (Hendijani & Saeidi Saei, 2020).

An additional study focused on the influence of relationship commitment on supply chain performance, particularly in the context of customer integration. It disaggregates

customer integration into two dimensions, integration with the customer and integration by the customer, finding that both aspects are crucial to improving supply chain performance. This research makes a significant contribution by showing how deep relationships and customer-orientated processes can impact the efficiency and effectiveness of the supply chain (Ruzo-Sanmartín et al., 2023).

In summary, empirical evidence suggests that collaboration behaviour has a nuanced effect on the relationship between customer integration and fresh produce supply chain performance. Successful collaboration requires careful management of both internal processes and external partnerships. The literature indicates that while collaboration initiatives have the potential to improve performance, their success is contingent on proper implementation, understanding of the underlying mechanisms, and commitment to maintaining strong relationships with customers. These findings underscore the importance of strategic collaboration as a way to improve customer integration efforts and ultimately improve the performance of fresh produce supply chains.

As a result, the following hypothesis is proposed:

Hypothesis 9 (H9). Collaboration behaviour moderates the relationship between customer integration and FPSC performance.

2.9.10 Collaboration Behaviour, Risk Management, and Fresh Produce Supply Chain Performance

An empirical study has established that supply chain risk management mediates the relationship between supply chain risk and performance. Furthermore, knowledge management, as a form of collaboration, moderates the negative effects of supply chain risk on performance. This suggests that collaborative behaviours that facilitate knowledge

sharing and joint risk assessment can improve the effectiveness of risk management practices, leading to improved supply chain performance (Waqas et al., 2023).

This review focused on agricultural supply chain management from 2010-2020 and aimed to identify patterns and challenges within the industry. Although not specific to fresh produce, this review may include information on how collaboration impacts risk management in agricultural supply chains, which could be applied to the fresh produce sector. This underscores the importance of understanding the complexities of the supply chain to develop effective risk management strategies (Khandelwal et al., 2021).

Another study explored the value of collaborative risk management in multi-tier global fresh produce supply chains. It uses a mixed-method approach to understand the dynamics of collaboration between different levels of the supply chain. The findings of this study could demonstrate how collaborative efforts at various levels of the supply chain contribute to managing risks, such as those associated with perishability, demand variability, and supply disruptions (Cao et al., 2021). As a result, the following hypothesis is proposed:

Hypothesis 10 (H10). Collaboration behaviour moderates the relationship between risk management and FPSC performance.

2.10 Research Framework

In these ten hypotheses, the five factors of supply chain management control serve as independent variables, collaboration behaviour as the mediating variable, and FPSC performance as the dependent variable. To date, no researchers have empirically examined the relationships between the five factors of fresh produce supply chain management control, collaboration behaviour, and FPSC performance in a single model.

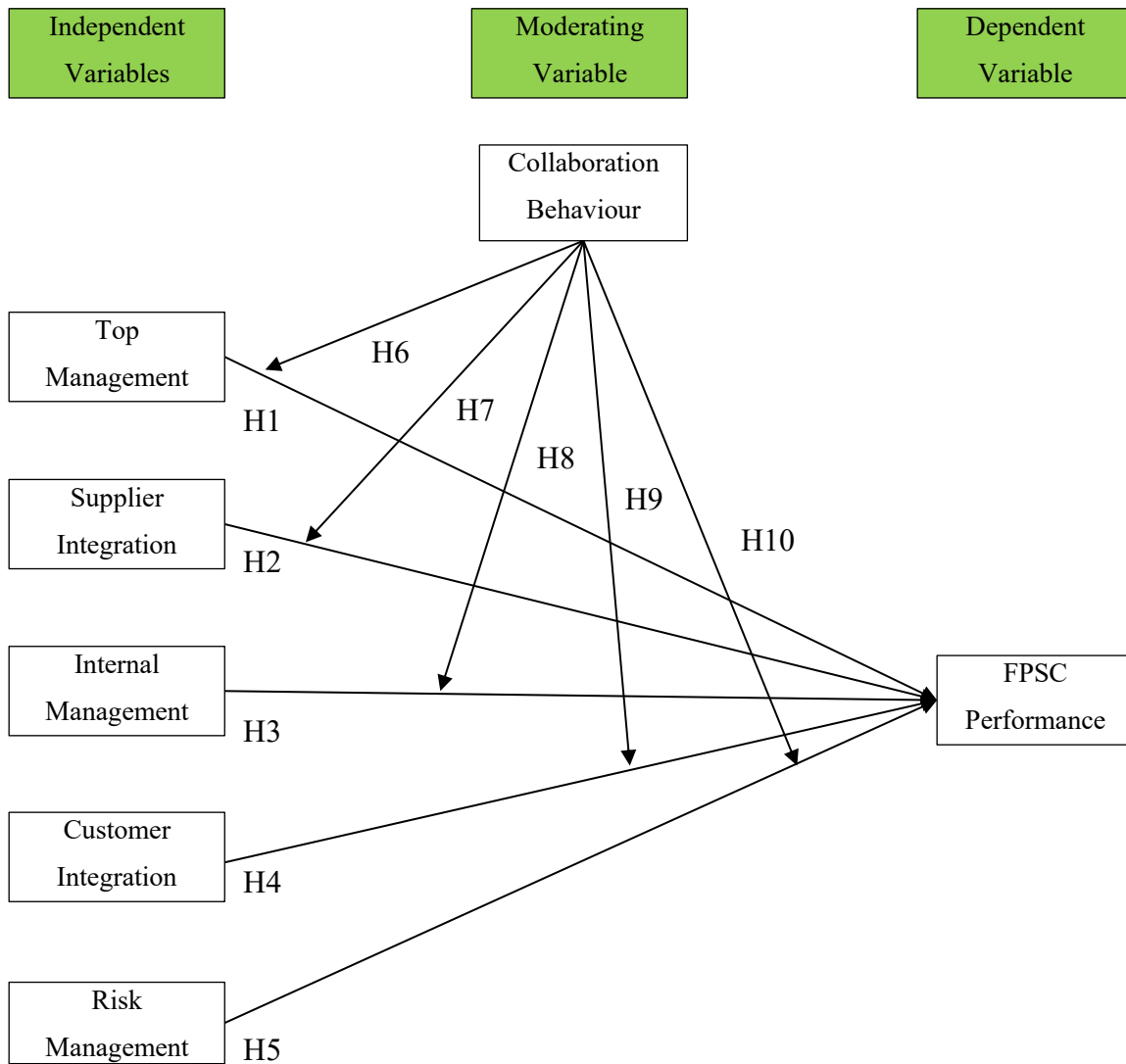


Figure 2.4: Research Framework

Source: Baah et al., 2022; Bae et al., 2023; Lusiantoro et al., 2022; Nayal et al., 2023; Siddh et al., 2022; Yadav et al., 2023

This model is a multiple regression model in which fresh produce supply chain performance is the dependent variable, and top management, supplier integration, internal management, customer management, and risk management are independent variables, with collaboration behaviour acting as a moderating variable. The purpose of the model is to explore how the behaviour of collaboration influences the relationships between various independent variables and the dependent variable.

The model assumes positive relationships between the independent variables and the dependent variable, which means that higher levels of the independent variables lead to higher levels of the dependent variable. You also assume that the collaboration behaviour moderates these relationships, meaning that higher levels of collaboration behaviour enhance these relationships.

2.11 Summary of the Chapter

This chapter reviews the concepts, constructs, and relationships used in the current study. It describes the interconnection between factors in the fresh supply chain and its performance. The importance of collaboration behaviour as a moderating variable for the relationship between the variables studied was also reviewed. In the next chapter, we will elaborate on the methods used in this study.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

Chapter 2 establishes the research framework and formulates hypotheses that underpin the theoretical foundations of this study. This chapter serves as a fundamental basis for empirical analysis by delineating the appropriate methodologies to be employed in testing the theory. Consequently, the following sections discuss key aspects, including research design, operational definitions of variables, instrumentation, data collection methods, sampling procedures, and data analysis techniques. By meticulously addressing these elements, this research aims to achieve rigour and validity in its investigation of the proposed hypotheses.

3.2 Research Philosophy

The epistemological stance of the investigator is fundamentally shaped by different philosophical presuppositions. These are pivotal to the axiomatic underpinnings of the current inquiry. The paradigmatic conventions and nuanced complexities inherent in sanctioned research methodologies, as well as the adjudication of methodological congruity about the research inquiries, are orchestrated by the interplay of philosophical and axiological tenets (Bryman, 2003). Furthermore, the axiological convictions of the investigator impinge on the characteristics, methodological strategies, and dissemination of the investigative results. Consequently, the philosophical postulates of the investigator, especially those that articulate the rationale and foundational tenets that undergird the selection of the research paradigm, are considered imperative and commendable.

3.2.1 Ontology

This investigation is anchored from a realist ontological perspective to elucidate the fundamental nature and operational dynamics of the fresh produce supply chain. From a realist vantage point, the supply chain is construed as an objective entity characterised by a network of interlinked actors whose interactions, influences, and collaborative endeavours are not merely abstract constructs, but palpable elements that define the essence of the supply chain.

The fresh produce supply chain is depicted as an inherently complex and fluid construct, traversing a multitude of phases, including procurement, production, distribution, storage, and commercialisation. It is infused with intrinsic characteristics such as logistic effectiveness, product integrity and safety, temporal immediacy, seasonal variability, and market volatility. These attributes are not peripheral; they are central to the operational and managerial acumen required for the functionality of the supply chain.

Within this multifaceted ecosystem, many stakeholders, from suppliers and growers to distributors, merchants, and beyond, play an integral role. Each entity is a cog in a larger mechanism, where its discrete functions and responsibilities coalesce into an interdependent whole. The orchestration of collaborative behaviour, information exchange, and synchrony in decision-making is not only beneficial, but also imperative for the seamless operation of this complex system.

Embracing a realist ontological stance not only demystifies complexity but also accentuates the interplay and synergy within the supply chain's relational fabric. Collaboration and dissemination channels between the myriad participants are not just

operational requirements; they are the lifeblood that ensures the vitality and robustness of the fresh produce supply chain.

3.2.2 Epistemology

This study adopts a post-positivist epistemological stance, which aligns with the quantitative research approach employed in this investigation. Post-positivism acknowledges that while objective reality exists, our understanding of it is inherently imperfect and probabilistic (Ryan, 2006). This philosophical position is particularly appropriate for this study as it supports the use of quantitative methods while maintaining that knowledge claims must be subjected to rigorous examination to ensure the closest possible alignment with reality (Maksimovic & Evtimov, 2023).

The post-positivist approach provides a strong foundation for the study's methodology, which employs structured survey questionnaires to collect numerical data and examine measurable relationships between variables in agricultural supply chain management. This epistemological position emphasizes the importance of empirical evidence and systematic data collection while recognizing that all measurement contains some degree of error (Cooper, 1997).

Furthermore, post-positivism supports the study's use of statistical analysis and hypothesis testing while acknowledging that our understanding of social phenomena is probabilistic rather than absolute. This approach enables the research to maintain objectivity through rigorous methodology and systematic data collection procedures, while recognizing that researchers' backgrounds and contexts may influence observations (Reimer, 1996). The post-positivist stance thus provides an appropriate philosophical foundation for the quantitative methodology employed in this study, supporting both the empirical

investigation and the systematic analysis of relationships between variables in agricultural supply chain management.

3.2.3 Axiology

The axiological underpinnings of this investigation are firmly anchored in the values of neutrality and objectivity, which are rigorously upheld throughout the investigative process. Central to our methodological deliberations is the ethical mandate to demonstrate empathy and to give all participants their due consideration. This is achieved concomitantly with adherence to strict ethical protocols and an unwavering commitment to methodological lucidity.

Our academic endeavour aims to contribute significantly to the discipline of supply chain management, with an emphasis on elucidating its societal implications and the pragmatic implementation of theoretical frameworks.

Within our methodological schema, the promotion of reflexive cognisance plays a critical role. It functions as a fulcrum for the identification and amelioration of potential biases, thereby safeguarding the veracity and dependability of our empirical evidence.

In summary, our axiological position advocates for a research paradigm that is predicated on objectivity and empathic engagement. It calls for ethical rigour and methodological perspicuity while remaining aware of the social reverberations inherent in the scrutiny of supply chain management mechanisms, cooperative dynamics, and performance metrics. It is with acute awareness of potential biases that we strive to provide contributions that enhance both theoretical understanding and practical application within the ambit of supply chain scholarship.

3.3 Research Design and Sample

As shown in Figure 3.1, the study process begins with a review of the literature informed by management theory.

The target population in this empirical study is the fresh produce supply chains in Weifang Area. The target respondents involve CEOs, senior level managers who have experience in the field of perishable agricultural supply chains.

The unit of analysis in this study was the focal firm, with one primary respondent contacted to share their perspectives on the study's constructs.

The list of companies was based primarily on the publication of the Weifang Municipal Development and Reform Commission.

The study employed purposive sampling techniques, with questionnaires distributed via email to all companies on the identified list.

The company contacts were also made aware of the potential benefits of the research for their company's development. With their support secured, the researcher distributed questionnaires to the CEOs or senior managers of these companies by email.

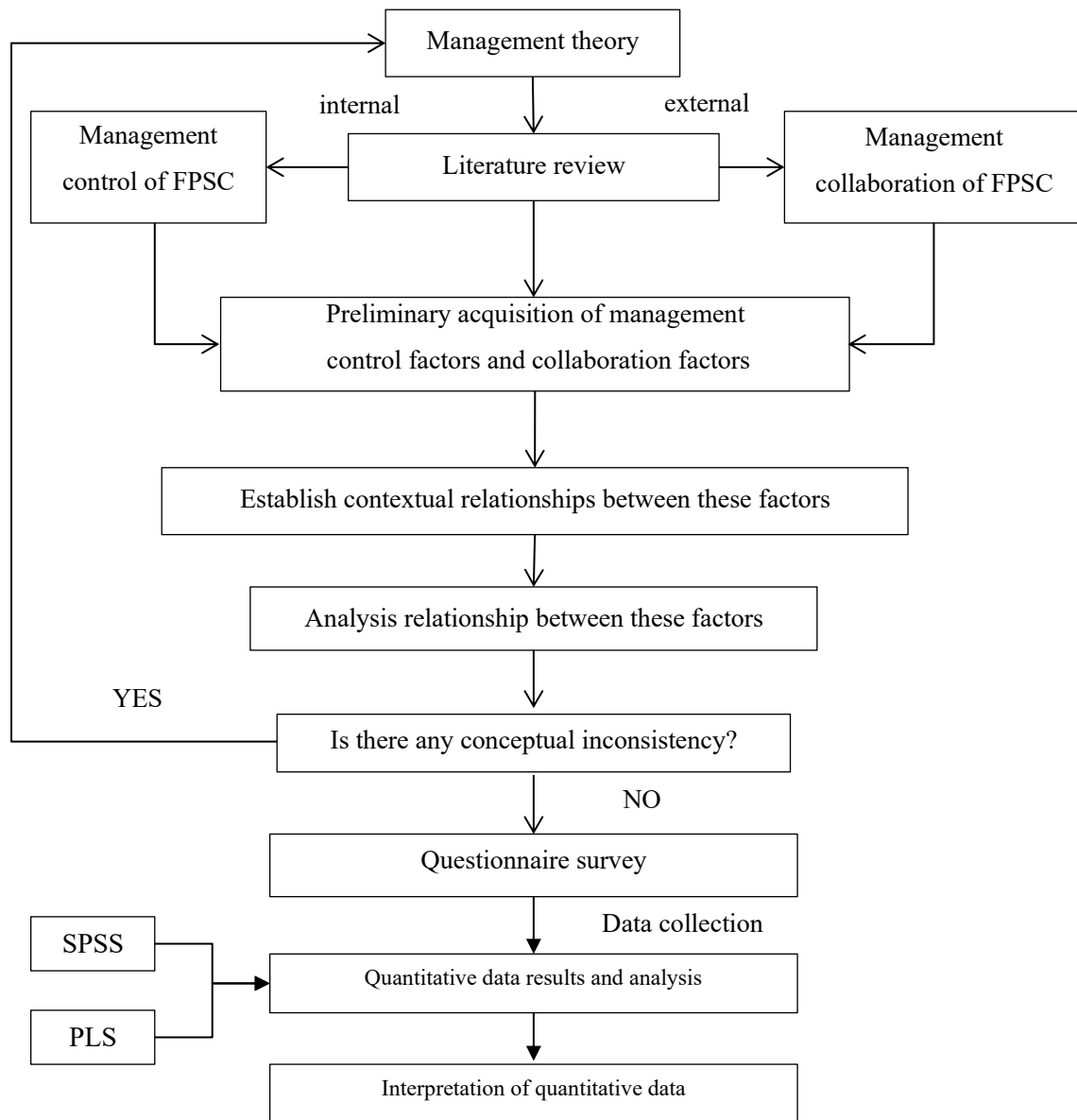


Figure 3.1: Research Design

As proposed by Sekaran (2000), a sample size ranging from 30--500 is considered suitable for academic research (Sekaran & Bougie, 2010). Several methods were used to determine the minimum sample size for this study, including:

- (i) a formula for calculating the minimum sample size by Hair, Black, Babin, Anderson & Tatham (2010); (ii) the "10 times" rule of thumb by Barclay, Higgins &

Thompson (1995) and Chin (1998); (iii) the use of G*power 3.1.9.2 software by Faul, Erdfelder, Buchner, Buchner & Lang (2009).

Initially, a formula developed by Hair et al. (2010) was used to calculate the minimum sample size, as shown in Equation 3.1.

$$\text{Variate Value} = X_n \times Y_n \quad \text{Equation 3.1}$$

where

X_n = Observation (Weight determined by multi – variate technique)

Y_n = Observed variables

Hence = 10×7 variables

Variate value = 70 respondents

Based on the results of the calculation of the above formula, at least 70 respondents are needed to meet the requirements of the model.

The "10 times" rule of thumb was subsequently employed to establish the minimum sample size necessary to accurately estimate the relationships via partial least-squares (PLS) analysis. Following the recommendation of Hair (2012), a minimum sample size of ten times the maximum number of independent variables was used in the outer and inner models. Consequently, the minimum sample size for this study was determined to be 50 (5×10 times = 50). Furthermore, the software G * power 3.1.9.7 (Faul et al., 2009) was used to calculate the minimum sample size, revealing that a minimum of 103 respondents were required to

test the model, as shown in Figure 3.2 ($f=0.15$ (medium), $\alpha=0.05$, number of predictors=7, power 80%).

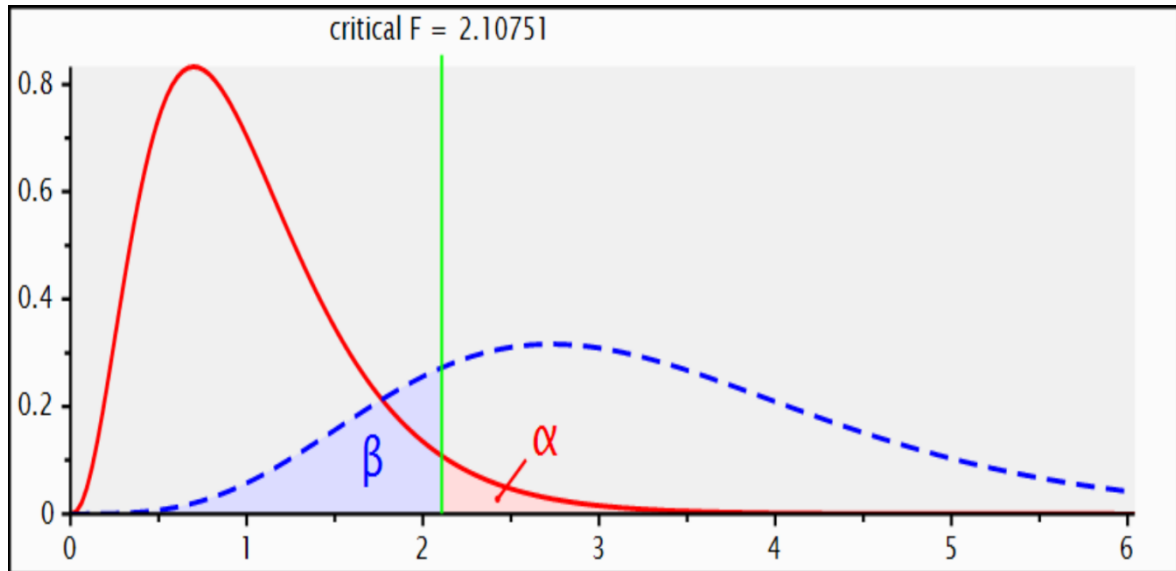


Figure 3.2: G-power Graph

In summary, considering the various techniques used to estimate the minimum sample size, the minimum sample size ranged from 50, 70, and 103 respondents. Consequently, it was determined that the minimum sample size for this study should exceed 50 respondents to ensure sufficient explanatory power to test the study framework.

3.4 Development of the Research Questionnaire

Table 3 presents the measurement items and their sources for all variables used in this study. The measurement items were adapted from previous studies and modified to fit the context of FPSC management.

The study includes five independent variables. TM contains 4 measurement items from Siddh et al. (2021), covering commitment to customer satisfaction, supplier relationship, innovation adoption, and human resource management. SI based on Uddin &

Akhter (2022), contains 5 measurement items addressing information exchange, inventory control, rapid response, network integration, and stable receipt of goods. IM employs 4 measurement items proposed by Siddh et al. (2022), including continuous process improvement, quality standards, storage conditions, and inventory management. CI utilizes 5 measurement items from Bae et al. (2023), focusing on production stage sharing, demand forecast feedback, payment process, market information sharing, and delivery monitoring. RM incorporates 7 measurement items developed by Nayal et al. (2023), covering delivery delays, storage capacity, demand volatility, forecasting issues.

CB functions as the moderating variable in this study, measured by 5 items developed by Baah et al. (2022). These items examine how the collaborative relationships between firms and their supply chain partners moderate the main relationships, specifically including: benefit and cost sharing (such as inventory cost savings and order change losses), joint knowledge acquisition and application, agreement on supply network improvements, accuracy and timeliness of information sharing, and collaborative management of inventory and demand forecasts.

FPSC Performance, as the dependent variable, is measured using 9 items proposed by Lusiantoro et al. (2022). These measurement items encompass key aspects of supply chain operations, including timeliness of order receipt, appropriateness of product dispatch, accuracy of order quantities, accuracy of delivery addresses, proper payment documentation, product quality assurance, quick delivery capabilities, and rapid response to customer complaints and inquiries, providing a comprehensive assessment of supply chain operational effectiveness.

Table 3.1: Initial Collection of Metrics

Constructs	Code	Measurement Items	Literature
Top Management (TM)	TM1	Commitment to Customer Satisfaction	Siddh et al., 2021
	TM2	Commitment to supplier relationship	
	TM3	Effective adoption of innovations	
	TM4	Management of human resource	
Supplier Integration (SI)	SI1	Exchange of harmonized information with suppliers	Uddin & Akhter, 2022
	SI2	Participation of suppliers in inventory control	
	SI3	Rapid response	
	SI4	Network integration with suppliers for stable purchases	
	SI5	Stable receipt of goods and services from suppliers	
Internal Management (IM)	IM1	Continuous process improvement for internal process control	Siddh et al., 2022
	IM2	Quality standards to ensure assured quality of food product	
	IM3	Standard conditions for food product storage and transportation	
	IM4	Inventory management	
Customers Integrations (CI)	CI1	Real-time sharing of our production stages with consumers	Bae et al., 2023
	CI2	Taking real-time feedback on demand forecasts from customers	
	CI3	Improving the payment collection process for customers	
	CI4	Real-time sharing of market information/trends from customers	
	CI5	Improving the product delivery process through real-time monitoring	
Risk Management (RM)	RM1	Delays in product delivery and pickup	Nayal et al., 2023
	RM2	Inadequate storage and delivery capacity	
	RM3	Demand volatility	
	RM4	Poor forecasting	
	RM5	Shortage of labour and driver	
	RM6	Road and border closures	
	RM7	Volatile fuel prices	
Collaboration Behaviour (CB)	CB1	Our firm and supply chain partners share benefits and costs (e.g. inventory cost savings and loss on order changes)	Baah et al., 2022
	CB2	Our firm and supply chain partners jointly search, acquire, assimilate and apply relevant knowledge	
	CB3	Our firm and supply chain partners have agreements on the relevance of improvements that benefit the whole supply network	

Table 3.1 continued

	CB4	Our firm and supply chain partners share accurate, timely and relevant information	
	CB5	Our firm and supply chain partners collaboratively manage inventory and demand forecasts	
	FP1	Receive orders every time.	
	FP2	Send the ordered products appropriately.	
	FP3	Send the exact amount of the order.	
	FP4	Send the order to the right address.	
FPSC Performance (FP)	FP5	Provide proper documents for payment.	Lusiantoro et al., (2022)
	FP6	Provide quality products.	
	FP7	Deliver products quickly.	
	FP8	Resolve customer complaints quickly.	
	FP9	Respond to customer inquiries quickly.	

From a control theory perspective, the measurement items for TM, SI, and IM reflect core control mechanisms in supply chain operations. TM items assess strategic commitments to customer satisfaction, supplier relationships, innovation adoption, and human resource management. SI measures focus on information exchange coordination, inventory control participation, and rapid response capabilities, while IM items emphasize process improvement, quality standards, and storage conditions - all representing key control points in supply chain operations (Ivanov et al., 2012).

CI and RM measurements demonstrate the operational control linkages with end users and risk mitigation strategies. CI items capture real-time production sharing, demand forecast feedback, and payment process improvements, while RM items address various control elements from delivery delays to fuel price volatility. These measurements reflect how organizations implement control mechanisms to manage both customer relationships and operational risks (Chen & Paulraj, 2004).

The CB and FPSC Performance measurements encompass the collaborative and performance aspects of supply chain management. CB items focus on benefit-cost sharing, knowledge acquisition, and information sharing between partners, while FP items comprehensively evaluate order fulfillment, product quality, delivery speed, and customer service responsiveness. This measurement framework ensures that each item accurately reflects its theoretical foundation while providing reliable tools for empirical research in fresh produce supply chain management (Jagtap & Kamble, 2015).

To enhance accessibility, we engaged language experts to translate our original English questionnaire into Chinese. To ensure translation accuracy, this Chinese version was then re-translated to English by independent translators. The two English versions were carefully compared to identify discrepancies or inconsistencies.

3.5 Measurement

This study used a 7-point Likert scale to measure the independent and moderating variables. The names of the five independent variables are top management, supplier integration, internal management, customer integration, and risk management. The moderating variable is the collaborative behaviour. A 7-point Likert scale was used to measure the performance of the fresh produce supply chain.

In addition, personal and demographic information related to age, gender, academic qualifications, company type, and work experience was also collected.

3.5.1 Measurement of Top Management

Four items arranged in random order on the questionnaires were used to measure top management in fresh produce supply chain management practices. The elements are adapted

from the work of Siddh et al. (2021) and are presented in Appendix A. These items were evaluated using a 7-point Likert scale. Respondents were asked to rate their perceptions on a 7-point Likert scale, with 7=strongly agree, 6 = agree, 5 = slightly agree, 4 = neutral, 3 = slightly disagree, 2 = disagree and 1=strongly disagree, for all four items. A higher score indicates that the company attaches more importance to the role of top management in supply chain management activities.

3.5.2 Measurement of Supplier Integration

Five items arranged on random order in the questionnaires were used to measure supplier integration in fresh produce supply chain management practices. The elements are adapted from the work of Uddin and Akhter (2022) and are presented in Appendix A. These items are assessed using a 7-point Likert scale. Respondents were asked to rate their perceptions using a 7-point Likert scale with 7=strongly agree, 6 = agree, 5 = slightly agree, 4 = neutral, 3 = slightly disagree, 2 = disagree and 1 = strongly disagree for all five elements. A higher score indicates that the organisation places greater emphasis on supplier integration within the area of supply chain management activities.

3.5.3 Measurement of Internal Management

Four items arranged in random order on the questionnaires were used to measure internal management in the practice of managing the supply chain of fresh produce. The elements are adapted from the work of Siddh et al. (2022) and are presented in Appendix A. These items were evaluated using a 7-point Likert scale. The respondents were asked to rate their perceptions on a 7-point Likert scale, with 7=strongly agree, 6 = agree, 5 = slightly agree, 4 = neutral, 3 = slightly disagree, 2 = disagree and 1=strongly disagree, for all four

items. A higher score means that the organisation places greater emphasis on internal management within the area of supply chain management activities.

3.5.4 Measurement of Customer Integration

Five items arranged on random order in the questionnaires were used to measure customer integration in fresh produce supply chain management practices. The elements are adapted from the work of Bae et al. (2023) and are presented in Appendix A. These items were evaluated using a 7-point Likert scale. Respondents were asked to rate their perceptions using a 7-point Likert scale with 7=strongly agree, 6 = agree, 5 = slightly agree, 4 = neutral, 3 = slightly disagree, 2 = disagree and 1 = strongly disagree for all five elements. A higher score indicates that the organization places greater emphasis on customer integration within the area of supply chain management activities.

3.5.5 Measurement of Risk Management

Seven items arranged in random order on the questionnaires were used to measure risk management in the practice of managing the supply chain of fresh produce. The elements are adapted from the work of Nayal et al. (2023) and are presented in Appendix A. These items were evaluated using a 7-point Likert scale. The respondents were asked to rate their perceptions on a 7-point Likert scale, with 7=strongly agree, 6 = agree, 5 = slightly agree, 4 = neutral, 3 = slightly disagree, 2 = disagree and 1=strongly disagree, for all seven items. A higher score indicates greater recognition of risk management in fresh agricultural product management practices by the company.

3.5.6 Measurement of Collaboration Behaviour

Five items arranged on random order in the questionnaires were used to measure collaboration behaviour in fresh produce supply chain management practices. The elements

are adapted from the work of Baah et al. (2022) and are presented in Appendix A. These items were evaluated using a 7-point Likert scale. Respondents were asked to rate their perceptions using a 7-point Likert scale with 7=strongly agree, 6 = agree, 5 = slightly agree, 4 = neutral, 3 = slightly disagree, 2 = disagree and 1 = strongly disagree for all five elements. A higher score indicates greater recognition of the collaboration behaviour in the management practices of fresh agricultural products by the company.

3.5.7 Measurement of Fresh Produce Supply Chain Performance

Nine items arranged in random order on the questionnaires were used to measure collaboration behaviour in the practice of managing the fresh produce supply chain. The elements are adapted from the work of Lusiantoro et al. (2022) and are presented in Appendix A. These items are evaluated using a 7-point Likert scale. Respondents were asked to rate their perceptions via a 7-point Likert scale with 7=strongly agree, 6 = agree, 5 = slightly agree, 4 = neutral, 3 = slightly disagree, 2 = disagree and 1=strongly disagree for all nine items. A higher score indicates a higher level of performance in the fresh agricultural product supply chain and, conversely, a lower score.

3.6 Pre-Study

A preliminary study was initially conducted in Weifang with local companies to assess the impact of several components on the performance of the agricultural product supply chain, with a specific focus on management control and management collaboration. In the first phase of this study, semi-structured interviews were conducted, the results of which informed the design of the theoretical framework. The interview questions were customised to the realities of the fresh produce supply chain, exploring perceptions of the

impact of top management, supplier integration, internal management, customer integration, risk management, collaboration behaviour on supply chain performance.

During the interview process, the executives interviewed were able to respond to the questions. Consequently, these variables were validated by local business managers. Therefore, the constituent elements could be used to develop the theoretical framework and questionnaire design for this study.

Table 3.2: Interview Questions for Pre-Study

Numb ers	Interview Questions	Variable
1	Do you think top management influences the performance of the fresh produce supply chain in your company's region?	Top management
2	Do you think that supplier integration influences the performance of the fresh produce supply chain in your company's region?	Supplier integration
3	Do you think internal management influences the performance of the fresh produce supply chain in your company's region?	Internal management
4	Do you think customer integration influences the performance of the fresh produce supply chain in your company's region?	Customer integration
5	Do you think risk management influences the performance of the fresh produce supply chain in your company's region?	Risk management
6	In your company's region, do you think collaboration behaviour affects supply chain management control practices and the performance of the fresh produce supply chain?	Collaboration behaviour
7	What do you think is the relationship between the performance of the fresh produce supply chain and the control of supply chain management and collaborative management?	FPSC performance

In the second phase, on the basis of the variables identified in the first stage of the preliminary study, management personnel from the main enterprises within the Weifang fresh agricultural product supply chain were approached to complete questionnaires. This was done to verify that the questionnaire items were relevant to the supply chain of fresh produce in the Weifang area. All items were adapted from the literatures (Siddh et al.,2021; Uddin & Akhter, 2022; Siddh et al., 2022; Bae et al., 2023; Nayal et al.,2023; Baah et al., 2022, Lusiantoro et al.,2022).

3.7 Pre-Test

A pilot test was conducted before the actual data collection period. This pilot test represents the final phase, which is designed to verify the suitability of the questionnaire for the target respondents. According to the study (Johanson & Brooks, 2009), the sample size for a pilot test can be small. Consequently, a questionnaire was administered to current managers within the fresh produce supply chain in Weifang. The primary objective of the pilot test was to ensure that the respondents understood all the questions and rating scales, as most of the scales used to measure the constructs in this study were adapted to the supply chain of context of the fresh produce in the Weifang area.

Table 3.3: Outcomes of the Pre-test Questionnaire

No.	Original Questions	R1	R2	R3	R4	R5	Comments/Changes Made
1	About Stakeholders	What is the meaning of stakeholders?					Adjusting "stakeholders" to "partners" makes it easier to understand.
2	Strict quality standards have been established.		Not clear				strict product quality standards have been established
3	Shared Costs and Benefits			Shared costs and benefits with whom?			Shared costs and benefits with partners
4	Our firm and our supply chain partners jointly search, acquire, and maintain Assimilate and apply relevant knowledge.				What does assimilate mean?		Our company and our supply chain partners jointly seek, acquire, learn, and apply relevant knowledge.
5	Our company and its supply chain partners share accurate, timely, and relevant information.					Does relevant information mean helpful information?	Our company and its supply chain partners share relevant, accurate, timely, and useful information.

Notes: R1=Respondent 1, R2 = Response 2, R3=Respondent 3, R4=Respondent 4, R5=Respondent 5

A pilot test was conducted in February 2023, before the actual data collection period. This pilot test, the final phase of the research design, was used to confirm the applicability of the questionnaire to the target respondents. Consequently, a questionnaire was administered to current managers within the fresh produce supply chain in Weifang city. The primary purpose of this pilot test was to ensure that the respondents clearly understood all the questions and scales, since most of the scales used to measure the constructs in this study were specifically developed for the context of the supply chain of fresh fruits and vegetables in the Weifang area. The pilot test was designed to eliminate any ambiguity or confusion regarding the questions. Although the items have demonstrated reliability, cultural differences may lead to comprehension challenges for the respondents in Weifang.

3.8 Data Analysis Technique

The present study employs a two-fold approach to data analysis. The initial section of this study focuses on quantitative analysis and aims to investigate the influence of five control factors for supply chain management on the performance of fresh agricultural produce. To achieve the intended objective, the statistical analysis of the collected data was carried out via SPSS 26.0 software. The questionnaire data were subjected to reliability testing to ascertain their reliability and consistency. The next step involves the use of SmartPLS 4.0 software to perform structural model analysis. This analysis aims to validate the data hypotheses and calculate the fit of the model. This study aims to examine the relationships between control factors in supply chain management and the performance of fresh agricultural produce.

In the following section, the investigation establishes the validating function of collaboration behaviour as a moderator. In this study, SPSS 26.0 software was used once

more to perform multiple hierarchical regression analyses. The purpose of this analysis is to examine the potential moderating impact of digital governance. This section specifically examines the impact of digital governance on the correlation between control factors in supply chain management and the performance of fresh agricultural products. This study aims to investigate the influence of collaboration behaviour on the relationship between supply chain management control factors and the performance of fresh agricultural produce. By conducting a rigorous data analysis, we seek to improve our understanding of supply chain management in the context of fresh agricultural produce.

Using these two data analysis methodologies, our objective is to obtain detailed research results that will serve as substantial points of reference for the implementation and decision-making processes in the management of the supply chain for fresh agricultural products. Research findings will make a positive contribution to the optimisation and improvement of agricultural supply chains, thus supporting the sustainable development of the agricultural industry.

3.8.1 Descriptive Statistics

In this study, descriptive analysis methods, such as calculating means and standard deviations, were used to investigate and establish the fundamental characteristics of the respondents. Descriptive analysis offers a straightforward summary of the demographic characteristics of the respondents by presenting the values in tabular form and providing information on specific respondent attributes. The results are classified by age, gender, level of education, type of company, and years of experience.

3.8.2 Common Method Variance

The variance of the common method (CMV) refers to the variance attributed to the measurement method itself rather than to the constructs that the measures represent. In simpler terms, CMV can create misleading internal consistency, potentially resulting in common-method bias (Craighead et al., 2011). Measurement errors may inflate or deflate the observed relationships between constructs, leading to Type I (α) and Type II (β) errors. To address this issue, Harman's single-factor analysis is commonly employed as a statistical remedy to assess whether a single factor accounts for the majority of the variance in the data (Sarstedt et al., 2016). A factor explaining more than 50% of the variance indicates the presence of common method bias (Winkelbach et al., 1994).

3.8.3 Reliability Analysis

Reliability analysis evaluates the stability and consistency of measurement tools, such as questionnaires, to ensure that they produce consistent results over time, on various occasions, and among different individuals. A tool demonstrating high reliability is deemed effective because of its consistency, whereas a tool with low reliability is ineffective because of its lack of consistent output.

Cronbach's alpha is a statistic that measures the internal consistency of elements in a questionnaire or test, indicating how well a set of elements measures a single concept or characteristic. Cronbach's alpha coefficient ranges from 0 to 1, with values closer to 1 signifying greater consistency. A high Cronbach's alpha value suggests that the items reliably measure the same underlying concept. This coefficient is widely used to evaluate the reliability and validity of questionnaires or tests (Sijtsma, 2009).

In general, a Cronbach alpha coefficient greater than 0.8 is indicative of very good reliability for a test or scale. Coefficients greater than 0.7 are considered acceptable, while those greater than 0.6 suggest that the scale requires a revision but it still has some value. Coefficients below 0.6, however, may indicate that the scale needs to be redesigned (Santos, 1999).

3.8.4 Multicollinearity Statistics

Multicollinearity statistics serve a critical function in the realm of multiple regression analysis by identifying and quantifying the extent of collinearity between independent variables. The presence of high multicollinearity is known to precipitate instability in regression coefficients, inflate standard errors, and attenuate the explanatory capacity of predictor variables within the model. The recognised statistical metrics for diagnosing multicollinearity include the correlation coefficient, the variance inflation factor (VIF), and the condition index. The correlation coefficient is instrumental in gauging the linear interdependencies between independent variables, where elevated values are emblematic of pronounced correlations. In contrast, the VIF elucidates the level of collinearity by calculating the extent to which the variance of an independent variable is amplified because of its linear association with other predictors in the model. A VIF that exceeds thresholds of 5 or 10 is generally indicative of severe collinearity, which warrants remedial measures in the analytical process (Kim, 2019).

3.8.5 Structural Equation Modelling

Structural equation modelling (SEM) is a statistical analysis technique used to study relationships between multiple variables, including both observed and unobserved variables,

within a single model. The model can encompass linear and nonlinear paths and is capable of testing both direct and indirect effects (Hasman, 2015).

The primary objective of SEM is to maximise the explained variance between observed variables (also known as manifest variables) and latent constructs or factors. This approach proves to be especially beneficial for analysing complex models or when working with smaller sample sizes. Within the SEM framework, PLS is an approach that can manage both linear and nonlinear relationships and exhibits a lower sensitivity to multicollinearity issues than other modelling techniques, such as ordinary least squares regression (Riou et al., 2016).

SEM decomposes the covariance among the observed variables into components to estimate the relationships between the latent constructs and the observed variables. The methodology seeks to identify a set of latent variables that account for the maximum covariance present in the observed data, which involves iterative adjustment of latent variables to optimise the fit between the observed variables and their estimated relationships.

A significant advantage of SEM is its ability to estimate intricate models that encompass both observed and unobserved variables. SEMs are typically represented through path diagrams that illustrate variable relationships along with their respective coefficients. Furthermore, SEM is frequently used in conjunction with other statistical methods, such as factor analysis and regression analysis, and can be applied to assess mediating and moderating effects.

3.8.6 Partial Least Squares

Partial least squares is a statistical method that is used to model relationships between sets of variables. It is commonly used in fields such as social sciences, finance, and marketing research. PLS is a versatile technique that can be applied to both exploratory and predictive analysis (Ringle et al., 2023).

The main objective of PLS is to maximise the explained variance between observed variables (manifest variables) and latent constructs or factors. It is particularly useful when dealing with complex models or smaller sample sizes. Compared with other modelling techniques, such as ordinary least squares regression, PLS can handle both linear and nonlinear relationships and is less sensitive to issues such as multicollinearity (Henseler & Schubert, 2023).

PLS works by decomposing the covariance between observed variables into components that are used to estimate the relationships between latent constructs and observed variables. The method tries to find a set of latent variables that can explain the maximum covariance in the observed data. This involves iterative adjustment of latent variables to maximise the fit between the observed variables and the estimated relationships.

One of the main advantages of PLS is that it allows for the estimation of complex and large models with fewer observations. It is also suitable for situations where there are many interrelated variables or when the assumptions of traditional techniques are violated. PLS can be used for both exploratory purposes, such as exploring relationships and identifying important variables, and for predictive purposes, such as building models to make predictions (Hair Jr. et al., 2014).

3.9 Content Validity

Content validity refers to the extent to which a measurement instrument, such as a questionnaire, effectively captures all relevant dimensions of the construct it aims to evaluate. The process of designing a questionnaire is crucial in research, as it ensures that the questions asked are both meaningful and representative of the phenomenon being studied (Lietz, 2010). In this study, the validity of the content is extremely important, as it guarantees that the questionnaire accurately reflects the operational aspects of the supply chain of fresh agricultural products (Nolte et al., 2015).

To increase the validity of the questionnaire content, we invited an expert panel consisting of two university professors, two agricultural company managers, and a representative from the local government department to conduct a comprehensive review and engage in discussions regarding its content. Collective experience and diverse perspectives of the panel members facilitated a thorough examination of the questionnaire items. The unanimous consensus among the expert panel was that most of the questions effectively captured the operational aspects of the supply chain of fresh agricultural products.

Following extensive deliberations with the panel of experts, we implemented certain modifications to the questionnaire to improve its validity. For example, we adjust the term “stakeholders” by replacing it with ‘relevant enterprises in the supply chain’ to more accurately reflect the specific research context. Furthermore, in the subsequent sections of the survey, we incorporated explanations for each phase of the supply chain, such as "during the input stage", to enhance the comprehensibility of the questionnaire and facilitate a more exhaustive and nuanced evaluation of supply chain efficacy across various stages. The revisions made to the questionnaire items, informed by the recommendations and points of

view of the experts, have improved their ability to fully capture the intricacies and subtleties of managing the supply chain for fresh agricultural products. These modifications have improved the questionnaire, strengthened its validity as a content, and ultimately increased the precision and reliability of the research findings.

3.10 Summary of the Chapter

This chapter elucidates the research methodologies used in the current study. The research methodology employed a two-stage sampling strategy, beginning with the implementation of stratified sampling, which was subsequently followed by cluster sampling. The operationalisation of each variable was carried out by conducting a comprehensive examination of the relevant literature. The chapter additionally provides further details regarding the procedures employed for data collection, as well as the techniques utilised for data analysis. The fourth chapter will encompass the presentation of the results derived from the analysis of the collected data.

CHAPTER 4

RESULTS

4.1 Introduction

This chapter outlines the attributes of the sample and provides descriptive statistics on the variables, elucidates the methodology used for sample selection, and presents the findings and discussions resulting from the statistical analysis of the data. In addition, this study provides an overview of the statistical analysis methods used and offers a rationale for each step taken. The following section will examine the statistical findings and theoretical framework. Finally, an overview of the results is provided.

4.2 Profile of Respondents

The questionnaire distribution process consisted of two phases. In the first phase, which took two weeks in September 2023, research questions were sent to all 1,539 companies in the region using publicly available contact information. After this initial contact, 300 companies expressed their willingness to participate. In the second phase, which lasted approximately one month from September to October 2023, questionnaires were sent to the CEOs or senior executives of these 300 companies. We received 191 responses, but due to incomplete answers in some questionnaires, the final valid sample consisted of 173 questionnaires.

However, in a single instance, the responses exhibited a linear trend. Straightlining is observed when a given respondent consistently selects a neutral response for all questions. The consensus among academics is that straight lines have the potential to significantly

undermine the quality of data. Consequently, this particular scenario was eliminated from the analysis (Hair et al., 2019).

After data selection, 173 respondents from the sampling survey were considered suitable for the final analysis, resulting in an effective response rate of 57.67%.

Table 4.1: Demographic Profile of Respondents

Demographic Variable	Category	Frequency	Percent
Gender	Male	107	61.8
	Female	66	38.2
Age	≤ 35	37	21.4%
	36-45	57	32.9%
	46-54	46	26.6%
	≥ 55	33	19.1%
Education	Associate Degree	45	26.0
	Bachelor's Degree	82	47.4
	Master's Degree and Above	46	26.6
Company Type	Vegetables and Fruits	143	82.7
	Vegetables and Fruits, Supporting Services	30	17.3
Working Experience	Less than 5 years	35	20.2%
	5-10 years	52	30.1%
	10-15 years	51	29.5%
	More than 15 years	35	20.2%

As shown in Table 4.1, there are a total of 173 observations. Among these, 61.8% of the observations are male, with a count of 107 individuals, whereas 38.2% of the observations are female, comprising 66 individuals.

The table shows the age distribution among a sample of 173 individuals. The majority of the sample falls within the age range of 36--45 years, with a frequency of 57 and a valid percentage of 32.9%. The second-largest group falls within the age range of 46--54 years, with a frequency of 46 years and a valid percentage of 26.6%. The smallest group falls within the age range of 55 years and older, with a frequency of 33% and a valid percentage of 19.1%. The cumulative percentage shows the percentage of individuals in each age group and all age groups below it.

Furthermore, the frequencies and percentages of respondents with different educational backgrounds are presented in the sample. A total of 173 individuals participated in the survey, with 45 individuals holding an associate degree (26.0%), 82 individuals holding a bachelor's degree (47.4%), and an additional 46 individuals holding a master's degree or higher (26.6%).

It reveals the presence of two distinct categories. The first category, vegetables and fruits, has a frequency of 143, representing 82.7%. The second category, Support Services, has a frequency of 30, which represents 17.3%.

Additionally, the table displays the working experience of the participants, the frequency of occurrence, and the corresponding percentage. A total of 173 participants were included in the analysis. The results revealed that 20.2% of the participants had less than 5 years of working experience, 30.1% had 5--10 years of experience, 29.5% had 10--15 years of experience, and 20.2% had more than 15 years of experience. The data indicate that the distribution of work experience among the participants is relatively uniform, with no dominant range. Most of the participants (approximately 79.8%) had more than 5 years of

working experience, and approximately 49.7% had more than 10 years of working experience.

4.3 Statistical Overview of the Variables

During the preliminary data analysis, the researcher used the arithmetic mean, which is usually known as the mean or average, to evaluate the measure of central tendency.

Furthermore, the utilization of the standard deviation was used to assess the dispersion of the data. The mean represents the central tendency of the responses provided by the respondents, whereas the standard deviation provides information on the dispersion of the responses relative to the mean. Table 4.2 presents the results of the descriptive statistical analysis.

The table displays the scores for various variables related to different aspects of a fresh produce supply chain. Each variable is categorized into a specific aspect, such as top management, supplier integration, internal management, customer integration, risk management, collaboration behaviour, and fresh produce supply chain performance.

In the table provided, the first column represents the different variables that are being analysed, such as TM (top management), SI (supplier integration), IM (internal management), CI (customer integration), RM (risk management), CB (collaboration behaviour), and FP (fresh supply chain performance). The second column represents the average score obtained for each variable, measured on a scale of 1--7, with 1 being "Strongly disagree" and 7 being "Strongly agree". The third column represents the standard deviation for each variable. A higher standard deviation indicates greater variation in the responses received for that particular variable.

Table 4.2: Descriptive Statistics

Items	Mean	Std. Deviation
TM1	5.2	1.596
TM2	5.03	1.414
TM3	5.09	1.518
TM4	5.24	1.461
SI1	4.91	1.524
SI2	4.88	1.45
SI3	5.02	1.594
SI4	5.05	1.566
SI5	4.77	1.436
IM1	4.46	1.601
IM2	4.75	1.597
IM3	4.71	1.516
IM4	5.18	1.576
CI1	4.66	1.600
CI2	5.19	1.568
CI3	4.86	1.465
CI4	4.79	1.56
CI5	4.9	1.55
RM1	4.74	1.69
RM2	4.69	1.697
RM3	4.77	1.593
RM4	4.83	1.618
RM5	4.88	1.566
RM6	4.87	1.635
RM7	4.95	1.647
CB1	4.65	1.595
CB2	5.09	1.558
CB3	5.12	1.745
CB4	5.03	1.649
CB5	5.17	1.604
FP1	4.75	1.678
FP2	4.8	1.605
FP3	4.92	1.585
FP4	4.94	1.611
FP5	4.88	1.615
FP6	4.79	1.633
FP7	4.92	1.608
FP8	4.3	1.668
FP9	4.46	1.683

Note: TM=Top Management, SI=Supplier Integration, IM=Internal Management, CI=Customer Integration, RM=Risk Management, CB=Collaboration Behaviour, FP=Fresh Produce Supply Chain Performance. The scale for the variables was as follows: 1=Strongly Disagree, 7=Strongly Agree.

On the basis of the information provided, the table shows average scores and standard deviations for various variables. The average scores generally range from 4.6 to 5.2, indicating a generally neutral to slightly positive perception of these factors. However, it is important to pay attention to the standard deviations, as they indicate the level of agreement or disagreement among the respondents.

The variable TM4 has an average score of 5.24, suggesting that respondents generally agree with the corresponding statement about TM. The standard deviation of 1.461 indicates some variation in the responses. In contrast, the variables FP8 and FP9 have lower average scores of 4.3 and 4.46, respectively, indicating lower agreement or satisfaction with these aspects. The higher standard deviations of 1.668 and 1.683 for these variables suggest a higher level of variation in the responses received.

Analysing both the average scores and standard deviations provides a more comprehensive understanding of the perceptions of the respondents and the level of agreement or disagreement within the data.

4.4 Common Method Variance

The potential for common-method variance exists when data are collected simultaneously from the same respondents through the use of self-administered questionnaires. Therefore, in this research, Harman's single-factor test was implemented as a cautious strategy to minimize the potential impact of CMV or common-method bias.

Harman's single-factor test is a statistical method used for the identification and management of potential CMV. This method aims to detect the correlation in responses from the same respondent when they answer different questions due to bias or a shared method.

The presence of common technique bias can be identified when the initial component accounts for more than 50% of the variance (Winkelbach & Walter, 2015).

Table 4.3: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.108	31.046	31.046	12.108	31.046	31.046
2	4.415	11.320	42.366	4.415	11.320	42.366
3	3.167	8.121	50.487	3.167	8.121	50.487
4	2.598	6.661	57.148	2.598	6.661	57.148
5	2.415	6.194	63.342	2.415	6.194	63.342
6	2.356	6.042	69.384	2.356	6.042	69.384
7	2.034	5.215	74.599	2.034	5.215	74.599
8	.677	1.737	76.336			
9	.672	1.722	78.058			
10	.636	1.632	79.690			
11	.590	1.512	81.201			
12	.550	1.411	82.612			
13	.503	1.291	83.903			
14	.440	1.128	85.031			
15	.425	1.091	86.122			
16	.395	1.013	87.135			
17	.382	.980	88.114			
18	.363	.930	89.045			
19	.352	.902	89.947			
20	.333	.853	90.801			
21	.328	.842	91.642			
22	.307	.787	92.430			
23	.278	.712	93.141			
24	.272	.698	93.840			
25	.255	.655	94.495			
26	.246	.632	95.127			
27	.236	.604	95.731			
28	.206	.529	96.259			
29	.189	.486	96.745			
30	.181	.463	97.208			
31	.171	.438	97.646			
32	.162	.415	98.062			
33	.145	.372	98.434			
34	.132	.338	98.772			
35	.124	.318	99.090			
36	.112	.287	99.377			
37	.094	.240	99.617			
38	.076	.194	99.812			
39	.073	.188	100.000			

Note: Extraction Method is Principal Component Analysis

This approach aims to help researchers identify the presence of potential method bias issues, ensuring the accuracy and reliability of research results. Harman's single-factor test was conducted to examine common method bias in the collected data. The results of the unrotated exploratory factor analysis revealed 7 factors with characteristic roots greater than 1, and the rate of explanation of the maximum factor variance was 31.046%. When this value is less than 0.5, it indicates that there is no significant common method bias in this study. The findings are shown in Table 4.3.

4.5 Assessment of the Measurement Model

The data were subjected to analysis via SmartPLS 4.0, multiple analyses were performed to establish the psychometric qualities of the instruments used in this study.

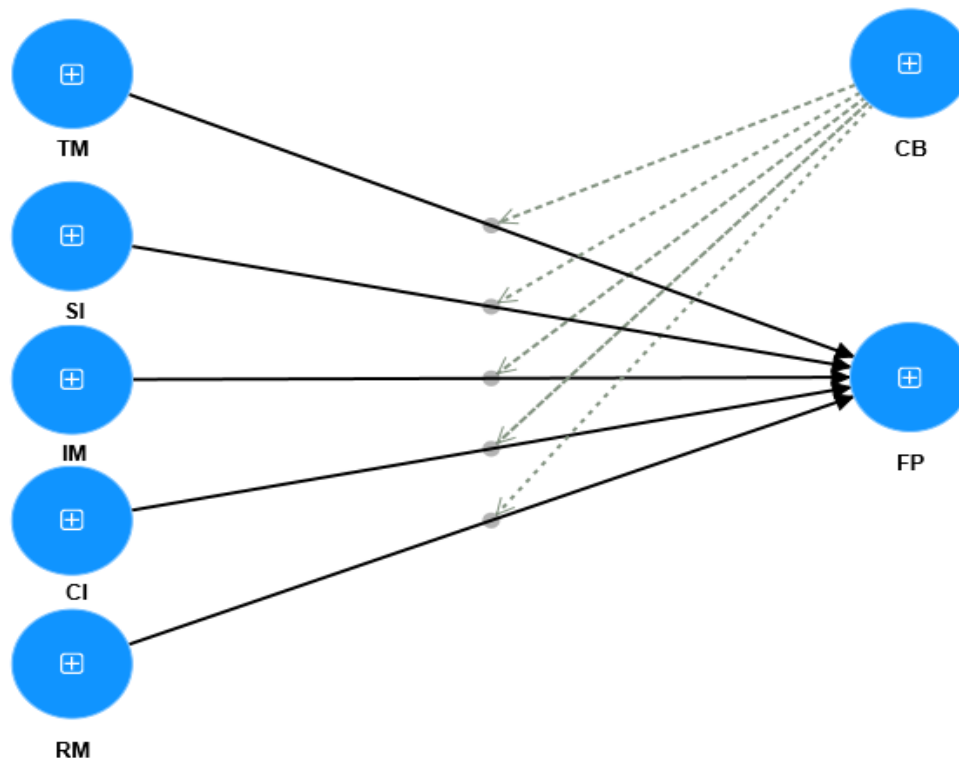


Figure 4.1: Conceptual Model

Note: TM=Top Management, SI=Supplier Integration, IM=Internal Management, CI= Customer Integration, RM=Risk Management, CB=Collaboration Behaviour, FP=Fresh Produce Supply Chain Performance.

A comprehensive assessment of the measurement model was conducted to determine the precision and validity of the instruments in accurately capturing the target variables (Sekaran & Bougie, 2010). The reliability analysis was used to determine the reliability of the internal consistency of the instruments, and the validity of the construction was assessed through the examination of convergence validity and discriminant validity. The conceptual framework of this investigation is depicted in Figure 4.1.

4.5.1 Loadings and Cross Loadings

Table 4.3 presents the item loadings and cross-loadings, illustrating the correlation of each item with its intended construct (item loadings) and with other constructs (cross-loadings). Hair et al. (2019) recommend that standardized loading estimates should be at least 0.5 but ideally 0.7 or higher. The loading value for top management ranged from 0.857 to 0.909, the loading value for supplier integration ranged from 0.868 to 0.907, the loading value for internal management ranged from 0.877 to 0.917, the loading value for customer integration ranged from 0.838 to 0.898, the loading value for risk management ranged from 0.789 to 0.870, the loading value for collaboration behaviour ranged from 0.832 to 0.914, and the loading value ranged from 0.775 to 0.903.

Additionally, cross-loadings were calculated to detect any issues with specific items. As shown in Table 4.4, the cross-loadings for all the items that measure a construct were consistently higher than their cross-loads with other constructs. This suggests that the model's constructs exhibit strong construct validity in this study.

Table 4.4: Loadings and Cross Loadings

	TM	SI	IM	CI	RM	CB	FP
TM1	0.868	0.252	0.294	0.216	0.155	0.182	0.314
TM2	0.909	0.254	0.256	0.169	0.108	0.157	0.313
TM3	0.874	0.249	0.163	0.212	0.128	0.217	0.367
TM4	0.857	0.298	0.196	0.262	0.073	0.183	0.308
SI1	0.353	0.907	0.397	0.265	0.321	0.167	0.439
SI2	0.24	0.868	0.358	0.346	0.371	0.203	0.411
SI3	0.219	0.892	0.346	0.274	0.348	0.162	0.5
SI4	0.244	0.883	0.288	0.273	0.231	0.22	0.443
SI5	0.283	0.907	0.384	0.328	0.354	0.157	0.448
IM1	0.193	0.4	0.883	0.237	0.21	0.17	0.44
IM2	0.255	0.358	0.917	0.243	0.296	0.101	0.477
IM3	0.263	0.327	0.903	0.257	0.281	0.122	0.472
IM4	0.203	0.341	0.877	0.28	0.235	0.057	0.427
CI1	0.237	0.356	0.357	0.898	0.307	0.163	0.387
CI2	0.16	0.247	0.272	0.851	0.297	0.188	0.332
CI3	0.168	0.252	0.214	0.841	0.282	0.148	0.284
CI4	0.209	0.224	0.175	0.838	0.192	0.201	0.345
CI5	0.262	0.327	0.179	0.848	0.293	0.154	0.344
RM1	0.215	0.363	0.227	0.331	0.899	0.035	0.412
RM2	0.111	0.264	0.246	0.196	0.806	-0.117	0.293
RM3	0.125	0.274	0.284	0.284	0.836	0.019	0.402
RM4	0.09	0.304	0.198	0.229	0.832	0.04	0.268
RM5	0.08	0.363	0.263	0.269	0.820	-0.014	0.274
RM6	0.089	0.253	0.115	0.259	0.789	-0.029	0.235
RM7	0.043	0.31	0.301	0.281	0.870	-0.026	0.395
CB1	0.206	0.212	0.112	0.164	0.013	0.914	0.193
CB2	0.143	0.18	0.146	0.167	-0.073	0.832	0.15
CB3	0.277	0.171	0.139	0.237	0.043	0.868	0.182
CB4	0.135	0.168	0.09	0.138	0.001	0.879	0.121
CB5	0.144	0.151	0.065	0.156	-0.043	0.872	0.188
FP1	0.288	0.362	0.416	0.390	0.293	0.204	0.799
FP2	0.311	0.462	0.478	0.393	0.376	0.175	0.903
FP3	0.419	0.300	0.38	0.250	0.304	0.083	0.787
FP4	0.314	0.343	0.368	0.200	0.307	0.212	0.775
FP5	0.292	0.452	0.428	0.358	0.305	0.124	0.830
FP6	0.277	0.360	0.390	0.264	0.399	0.107	0.817
FP7	0.32	0.463	0.411	0.348	0.351	0.162	0.766
FP8	0.251	0.439	0.456	0.356	0.289	0.138	0.791
FP9	0.246	0.458	0.343	0.303	0.306	0.217	0.787

Notes: TM=Top Management, SI=Supplier Integration, IM=Internal Management, CI=Customer Integration, RM=Risk Management, CB=Collaboration Behaviour, FP=Fresh Produce Supply Chain Performance.

4.5.2 Convergent Validity

Following this, the researcher proceeded to examine the convergence validity.

Table 4.5: Results of the Measurement Model

Constructs	Code	Loadings	CR	AVE
Top Management (TM)	TM1	0.868	0.930	0.769
	TM2	0.909		
	TM3	0.874		
	TM4	0.857		
Supplier Integration (SI)	SI1	0.907	0.951	0.795
	SI2	0.868		
	SI3	0.892		
	SI4	0.883		
	SI5	0.907		
Internal Management (IM)	IM1	0.883	0.942	0.802
	IM2	0.917		
	IM3	0.903		
	IM4	0.877		
Customer Integrations (CI)	CI1	0.898	0.932	0.732
	CI2	0.851		
	CI3	0.841		
	CI4	0.838		
	CI5	0.848		
Risk Management (RM)	RM1	0.899	0.942	0.700
	RM2	0.806		
	RM3	0.836		
	RM4	0.832		
	RM5	0.82		
	RM6	0.789		
	RM7	0.87		
Collaboration Behaviour (CB)	CB1	0.914	0.942	0.763
	CB2	0.832		
	CB3	0.868		
	CB4	0.879		
	CB5	0.872		
FPSC Performance (FP)	FP1	0.799	0.944	0.651
	FP2	0.903		
	FP3	0.787		
	FP4	0.775		
	FP5	0.83		
	FP6	0.817		
	FP7	0.766		
	FP8	0.791		
	FP9	0.787		

Convergent validity involves examining the degree of agreement across multiple items that measure the same idea (Ramayah et al., 2011). This phenomenon is substantiated

when the findings of two separate instruments measuring identical variables demonstrate a significant correlation (Sahoo, 2019). The evaluation of convergent validity involved the examination of factor loadings, composite reliability (CR), and extracted average variance (AVE). Table 4.4 displays detailed information, such as loadings for each item, the CR, and the AVE. Notably, the loading of each item exceeded the suggested level of 0.5 (Hair et al., 2015).

On the other hand, the AVE measures the amount of variance that a latent variable component captures from its indicators (Chin, 2010).

According to the contents of Table 4.5, the loadings for each item are higher than 0.5, as suggested by Hair et al. (2019). The CR value for top management was 0.930, that for supplier integration was 0.951, that for internal management was 0.942, that for customer integration was 0.932, that for risk management was 0.942, that for collaboration behaviour was 0.942, and that for fresh produce supply chain performance was 0.944. In this study, the CR value, which indicates the degree to which the construct indicators reflect the latent variable, ranges from 0.930 to 0.951, exceeding the commonly accepted rule of thumb of 0.70. In summary, on the basis of the values of the CR and loadings, each indicator of the variables demonstrates good internal consistency or sufficient convergence.

On the other hand, the AVE measures the extent to which the latent variable explains the overall variability in the indicators. The AVE value for top management was 0.769, that for supplier integration was 0.795, that for internal management was 0.802, that for customer integration was 0.732, that for risk management was 0.7, that for collaboration behaviour was 0.763, and that for fresh produce supply chain performance was 0.651. The values of these indicators range from 0.651 to 0.802, surpassing the suggested threshold of 0.5 for the

AVE. This indicates that these indicators possess high internal consistency and reliability, as higher AVE values suggest that the variation in these indicators is caused mainly by themselves rather than other factors. This finding also implies that these indicators have greater accuracy in assessing or predicting the target variable (Higgins et al., 2003; Thompson et al., 1994).

4.5.3 Reliability Test

The researcher used Cronbach's coefficient alpha to assess the item consistency of the measurement items. Table 4.6 presents the loadings and Cronbach's coefficient alpha values, which ranged from 0.900--0.936, exceeding the cut-off value of 0.70 (Bollen, 2014). In this study, the Cronbach's coefficient alpha value for top management was 0.900, that for supplier integration was 0.936, that for internal management was 0.918, that for customer integration was 0.908, that for risk management was 0.929, that for collaboration behaviour was 0.923, and that for fresh produce supply chain performance was 0.933. Thus, the items for each of the factors are reliable.

Table 4.6: Results of the Reliability Test

Construct	Cronbach's alpha	Loading Range	Number of Items
TM	0.900	(0.857, 0.909)	4
SI	0.936	(0.868, 0.907)	5
IM	0.918	(0.877, 0.917)	4
CI	0.908	(0.838, 0.898)	5
RM	0.929	(0.789, 0.899)	7
CB	0.923	(0.832, 0.914)	5
FP	0.933	(0.766, 0.903)	9

Notes: TM=Top Management, SI=Supplier Integration, IM=Internal Management, CI=Customer Integration, RM=Risk Management, CB=Collaboration Behaviour, FP=Fresh Produce Supply Chain Performance.

4.5.4 T-Value

Table 4.7: Summary Results of the Model Constructs

Construct	Standard deviation	T statistics
CB1 <- CB	0.044	20.860
CB2 <- CB	0.05	16.554
CB3 <- CB	0.042	20.552
CB4 <- CB	0.057	15.361
CB5 <- CB	0.044	19.814
CI1 <- CI	0.014	63.077
CI2 <- CI	0.026	33.105
CI3 <- CI	0.027	31.389
CI4 <- CI	0.030	27.895
CI5 <- CI	0.022	39.143
FP1 <- FP	0.029	27.572
FP2 <- FP	0.015	60.680
FP3 <- FP	0.030	26.260
FP4 <- FP	0.036	21.809
FP5 <- FP	0.024	34.447
FP6 <- FP	0.027	30.614
FP7 <- FP	0.030	25.408
FP8 <- FP	0.033	23.776
FP9 <- FP	0.030	25.846
IM1 <- IM	0.016	54.691
IM2 <- IM	0.013	68.987
IM3 <- IM	0.015	61.888
IM4 <- IM	0.018	49.422
RM1 <- RM	0.013	70.008
RM2 <- RM	0.031	25.894
RM3 <- RM	0.022	38.277
RM4 <- RM	0.030	28.022
RM5 <- RM	0.026	31.161
RM6 <- RM	0.033	23.753
RM7 <- RM	0.019	46.535
SI1 <- SI	0.014	65.457
SI2 <- SI	0.019	46.679
SI3 <- SI	0.014	62.715
SI4 <- SI	0.014	62.611
SI5 <- SI	0.013	70.614
TM1 <- TM	0.020	42.398
TM2 <- TM	0.013	69.194
TM3 <- TM	0.024	36.524
TM4 <- TM	0.027	31.516

Notes: TM=Top Management, SI=Supplier Integration, IM=Internal Management, CI= Customer Integration, RM=Risk Management, CB=Collaboration Behaviour, FP=Fresh Produce Supply Chain Performance.

Table 4.7 presents a concise overview of the findings of the measurement model. The results indicate that all the constructs examined, including top management, supplier integration, internal management, customer integration, risk management, collaboration behaviour and fresh produce supply chain performance, were deemed valid measures on the basis of estimated parameters and statistical significance. This suggests that the measurement elements used in the study effectively captured and explained the different aspects of these constructs.

4.5.5 Discriminant Validity

To ensure discriminant validity, the researcher utilized the Fornell–Larcker criterion and cross-loadings. The Fornell–Larcker criterion states that the square root of the average variance extracted (AVE) should have a higher loading than the highest correlation between the construct and any other construct in the model (Hair et al., 2015).

As shown in Table 4.8, each of the elements on the principal diagonal is greater than the off-diagonal elements on their corresponding row and column.

The square root of the AVE for customer integration in the fourth row and column was 0.855, which was greater than those of the off-diagonal elements in the corresponding rows, such as 0.245, 0.332, and 0.283, and was greater than those of the off-diagonal elements in the corresponding columns, such as 0.320, 0.200 and 0.399. Furthermore, the square root of the AVE for top management was 0.877, that for supplier integration was 0.892, that for internal management was 0.895, that for customer integration was 0.855, that for risk management was 0.837, that for collaboration behaviour was 0.874, and that for fresh produce supply chain performance was 0.807; these values are higher than those of the constructs in the corresponding rows and columns.

Table 4.8: Discriminant Validity-Fornell-Larcker Criterion

	TM	SI	IM	CI	RM	CB	FP
TM	0.877						
SI	0.299	0.892					
IM	0.257	0.397	0.895				
CI	0.245	0.332	0.283	0.855			
RM	0.133	0.365	0.287	0.320	0.837		
CB	0.212	0.203	0.126	0.200	-0.012	0.874	
FP	0.373	0.505	0.508	0.399	0.404	0.196	0.807

Note: The diagonal entries in the table represent the square root of the average variance extracted (AVE) for each construct, whereas the other entries represent the correlations between the different constructs. TM=Top Management, SI=Supplier Integration, IM=Internal Management, CI= Customer Integration, RM=Risk Management, CB=Collaboration Behaviour, FP=Fresh Produce Supply Chain Performance.

To further assess discriminant validity, the heterotrait-monotrait (HTMT) ratio analysis was conducted, a method recognized as a stringent criterion in PLS-SEM (Henseler et al., 2015; Hair et al., 2019). As presented in Table 4.9, all HTMT values ranged from 0.071 to 0.546, significantly below the conservative threshold of 0.90 (Hair et al., 2019), thereby providing robust evidence of discriminant validity between constructs. The highest HTMT ratio was observed between TP and IM at 0.546, while the lowest was between RM and CB at 0.071. These findings further substantiate the discriminant validity of the measurement model, complementing the earlier Fornell-Larcker criterion and cross-loading analyses (Henseler et al., 2015).

Furthermore, as shown in Table 4.4, all of the indicator loadings on a construct were higher than all of the cross loadings with other constructs. For example, the indicator TM4 (0.857) has the highest value for the loading with its corresponding construct, whereas all of the cross-loadings with other constructs are considerably lower (e.g., SI=0.298, IM=0.196, CI=0.262, RM=0.073, CB=0.183, FP=0.308). Therefore, cross-loadings and the Fornell-Larcker criterion in this study provide evidence of discriminant validity.

Table 4.9: Heterotrait-monotrait Ratio (HTMT)-Matrix

	CB	CI	IM	RM	SI	TM	TP
CB							
CI	0.216						
IM	0.137	0.307					
RM	0.071	0.344	0.3				
SI	0.218	0.358	0.43	0.39			
TM	0.226	0.268	0.284	0.14	0.328		
TP	0.206	0.425	0.546	0.417	0.535	0.407	

Note: TM=Top Management, SI=Supplier Integration, IM=Internal Management, CI=Customer Integration, RM=Risk Management, CB=Collaboration Behaviour, FP=Fresh Produce Supply Chain Performance.

The loadings of various elements, along with the beta values given for the variables under investigation, are depicted in Figure 4.2.

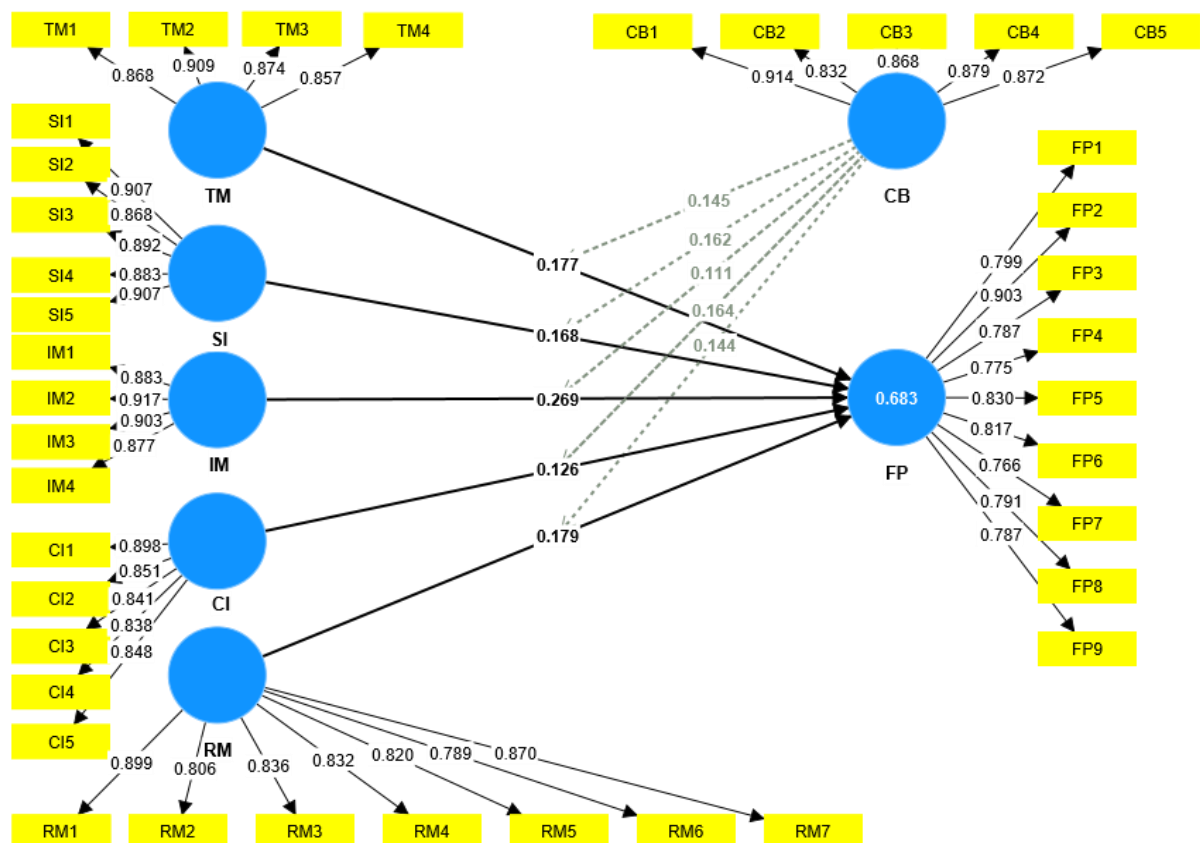


Figure 4.2: Conceptual Model Research Model with Beta Values

In summary, the measurement methodology used in this investigation demonstrated notable levels of reliability and construct validity. The aforementioned claim is supported by considerable evidence of reliability, as well as strong indications of convergent and discriminant validity.

4.6 Assessment of the Structural Model

After the reliability and validity of the constructs assessed in this study were established, the subsequent phase involved the assessment of the output of the structural model. The present structural framework incorporates the hypothesized interrelationships among the exogenous and endogenous variables within the model. The internal structure of this study was examined in a more accessible manner.

The structural model was initially examined by the researcher to detect any potential concerns about collinearity. A thorough assessment was subsequently conducted, which included the use of blindfold methodologies. The evaluation involved measuring the importance and relevance of the components of the structural model, as well as assessing the coefficients of determination (R^2), predictive utility (Q^2), and effect sizes (f^2).

4.6.1 Multicollinearity

To determine the existence of collinearity concerns within the structural model, the researcher performed a comprehensive analysis of the model. The objective of this analysis was to verify the absence of collinearity issues in the structural model. According to Hair et al. (2019), it is important to carefully examine collinearity since ordinary least squares regressions are used to estimate path coefficients for each endogenous latent variable about its corresponding preceding constructs.

Table 4.10: Collinearity Assessment

Code	Tolerance	VIF
TM1	0.390	2.567
TM2	0.299	3.350
TM3	0.416	2.401
TM4	0.431	2.319
SI1	0.266	3.762
SI2	0.328	3.049
SI3	0.305	3.282
SI4	0.331	3.024
SI5	0.273	3.662
IM1	0.358	2.796
IM2	0.276	3.625
IM3	0.309	3.232
IM4	0.353	2.833
CI1	0.324	3.088
CI2	0.394	2.536
CI3	0.386	2.589
CI4	0.441	2.270
CI5	0.424	2.357
RM1	0.280	3.566
RM2	0.428	2.336
RM3	0.403	2.482
RM4	0.368	2.714
RM5	0.390	2.561
RM6	0.424	2.356
RM7	0.340	2.945
CB1	0.272	3.674
CB2	0.436	2.295
CB3	0.382	2.618
CB4	0.304	3.287
CB5	0.377	2.656
FP1	0.400	2.500
FP2	0.235	4.247
FP3	0.452	2.210
FP4	0.424	2.356
FP5	0.359	2.788
FP6	0.387	2.583
FP7	0.498	2.008
FP8	0.438	2.283
FP9	0.443	2.257

Notes: TM=Top Management, SI=Supplier Integration, IM=Internal Management, CI=Customer Integration, RM=Risk Management, CB=Collaboration Behaviour, FP=Fresh Produce Supply Chain Performance.

As suggested by Hair et al. (2019), the presence of a tolerance value equal to or less than 0.20, along with a VIF beyond 5.00, can be considered reliable indicators of the existence of noteworthy collinearity or multicollinearity issues among the independent variables. The results of the collinearity assessment for this investigation are presented in Table 4.10. Significantly, the tolerance values linked to each building exceed the threshold of 0.20, although the VIF values remain below 5.00.

On the basis of these findings, it can be concluded that there are no indications of potential collinearity issues within the scope of this study.

4.6.2 Bootstrapping

The concept of bootstrapping is utilized as a resampling method to generate several subsamples from an empirical distribution of the observed data. Each of these subsamples is then used for model estimation, as emphasized by Chow (2011). Within the framework of partial least squares, the utilization of a nonparametric bootstrap process is employed to evaluate the statistical significance of different coefficients, encompassing outer weights, outer loadings, and path coefficients.

Consistent with this methodology, the researcher employed bootstrapping with 5000 subsamples to thoroughly examine the path coefficient (β) and verify the hypotheses offered.

4.6.3 Hypothesis Testing

The measuring model used in this work demonstrated satisfactory levels of reliability, convergent validity, and discriminant validity, thus offering a robust basis for evaluating the suggested hypotheses through PLS modelling (Hair et al., 2019). To achieve

this objective, the researchers used SmartPLS 4.0 as the software tool to evaluate the 10 proposed relationships that encompassed many factors, such as top management.

To evaluate these hypotheses, we used t values, adhering to the criterion that a hypothesis is considered supported if its corresponding t value exceeds 1.645, indicating significance at the 0.05 level (Hair et al., 2011).

4.6.4 Findings of the Hypothesis Testing

The findings of the hypothesis testing are concisely described in Table 4.11, while the t values associated with each variable are represented in Figure 4.3.

Hypothesis 1 (H1). There is a positive relationship between top management and FPSC performance.

Hypothesis 1 examined the relationship between top management and FPSC performance. As indicated in Table 4.11, top management clearly positively influences the performance of the fresh produce supply chain ($\beta = 0.105$, $t=3.647$), surpassing the suggested threshold of 1.645 performance ($p < 0.05$). Thus, the relationship between top management and fresh produce supply chain performance was supported.

Hypothesis 2 (H2). There is a positive relationship between supplier integration and FPSC performance.

Hypothesis 2 examined the relationship between supplier integration and FPSC performance. As indicated in Table 4.11, the integration of the supplier clearly positively influences the performance of FPSC performance ($\beta = 0.126$, $t=2.620$), surpassing the suggested threshold of 1.96 ($p < 0.05$). Thus, the relationship between supplier integration and fresh produce supply chain performance was supported.

Hypothesis 3 (H3). There is a positive relationship between internal management and FPSC performance.

Hypothesis 3 examined the relationship between internal management and FPSC performance. As indicated in Table 4.11, internal management clearly exerts a positive influence on FPSC performance ($\beta = 0.269$, $t=4.817$), surpassing the suggested threshold of 1.96 ($p < 0.05$). Thus, the relationship between internal management and fresh produce supply chain performance was supported.

Hypothesis 4 (H4). There is a positive relationship between customer integration and FPSC performance.

Hypothesis 4 examined the relationship between customer integration and FPSC performance. As indicated in Table 4.11, internal integration clearly positively influences FPSC performance ($\beta = 0.179$, $t=2.297$), surpassing the suggested threshold of 1.96 ($p < 0.05$). Thus, the relationship between customer integration and fresh produce supply chain performance was supported.

Hypothesis 5 (H5). There is a positive relationship between risk management and FPSC performance.

Hypothesis 5 examined the relationship between risk management and FPSC performance. As indicated in Table 4.11, risk management clearly exerts a positive influence on FPSC ($\beta = 0.168$, $t=3.054$), surpassing the suggested threshold of 1.96 ($p < 0.05$). Therefore, the relationship between risk management and fresh produce supply chain performance was supported.

Hypothesis 6 (H6). Collaboration behaviour moderates the relationship between top management and FPSC performance.

Hypothesis 6 examined the moderating effect of collaboration behaviour between top management and FPSC performance. The test results revealed that collaboration behaviour actually positively moderates the relationship between top management and FPSC performance ($\beta = 0.145$, $t = 2.947$), surpassing the suggested threshold of 1.96 ($p < 0.05$). Thus, the positive moderating effect of collaboration behaviour on the relationship between top management and fresh produce supply chain performance was supported.

Hypothesis 7 (H7). Collaboration behaviour moderates the relationship between supplier integration and FPSC performance.

Hypothesis 7 examined the moderating effect of collaboration behaviour between supplier management and FPSC performance. The test results revealed that collaboration behaviour indeed positively moderates the relationship between supplier integration and FPSC performance ($\beta = 0.162$, $t = 2.458$), surpassing the suggested threshold of 1.96 ($p < 0.05$). Thus, the positive moderating effect of collaboration behaviour on the relationship between supplier integration and fresh produce supply chain performance was supported.

Hypothesis 8 (H8). Collaboration behaviour moderates the relationship between internal management and FPSC performance.

Hypothesis 8 was designed to investigate the possible moderating role of collaboration behaviour in the relationship between internal management and FPSC performance. The empirical findings, derived from rigorous statistical analysis, do not provide substantial support to assert the presence of a significant moderating influence exerted by collaboration behaviour on the link between internal management and FPSC performance ($\beta = 0.111$, $t = 1.893$), not exceeding 1.96 ($p > 0.05$). Therefore, the moderating effect of collaboration behaviour on the relationship between internal management and fresh produce supply chain performance was not supported.

Hypothesis 9 (H9). Collaboration behaviour moderates the relationship between customer integration and FPSC performance.

Hypothesis 9 examined the moderating effect of collaboration behaviour between customer management and FPSC performance. The test results revealed that collaboration behaviour actually positively moderates the relationship between customer integration and FPSC performance ($\beta = 0.164$, $t = 3.246$), surpassing the suggested threshold of 1.96 ($p < 0.05$). Thus, the positive moderating effect of collaboration behaviour on the relationship between customer integration and fresh produce supply chain performance was supported.

Table 4.11: Path Coefficients and Hypothesis Testing

Hypotheses	Relationship	β	T statistics	P values	Decision
H1	TM -> TP	0.105	3.647	0.000	Supported
H2	SI -> TP	0.126	2.620	0.009	Supported
H3	IM -> TP	0.269	4.817	0.000	Supported
H4	CI -> TP	0.179	2.297	0.022	Supported
H5	RM -> TP	0.168	3.054	0.002	Supported
Moderating Effects of Collaboration Behaviour					
H6	CB x TM -> TP	0.145	2.947	0.003	Supported
H7	CB x SI -> TP	0.162	2.485	0.013	Supported
H8	CB x IM -> TP	0.111	1.893	0.058	Not Supported
H9	CB x CI -> TP	0.164	3.246	0.001	Supported
H10	CB x RM -> TP	0.144	2.606	0.009	Supported

Notes: TM=Top Management, SI=Supplier Integration, IM=Internal Management, CI=Customer Integration, RM=Risk Management, CB=Collaboration Behaviour, FP=Fresh Produce Supply Chain Performance.

Hypothesis 10 (H10). Collaboration behaviour positively moderates the relationship between risk management and FPSC performance.

Hypothesis 10 examined the moderating effect of collaboration behaviour on the relationship between risk management and FPSC performance. The test results revealed that customer behaviour actually positively modulates the relationship between risk management and FPSC performance ($\beta = 0.144$, $t = 2.606$), surpassing the suggested threshold of 1.96 ($p < 0.05$).

0.05). Therefore, the positive moderating effect of collaboration behaviour on the relationship between risk management and the performance of the fresh produce supply chain was supported.

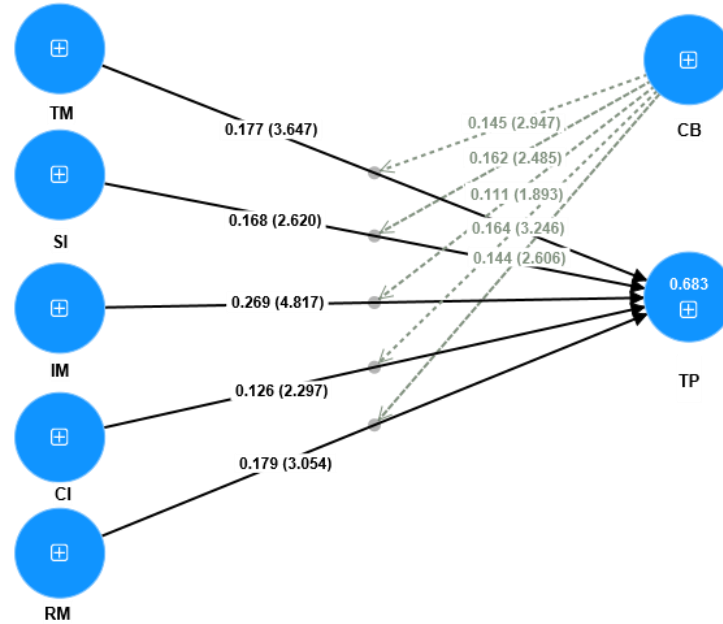


Figure 4.3: Research Model with T Values

Notes: TM=Top Management, SI=Supplier Integration, IM=Internal Management, CI=Customer Integration, RM=Risk Management, CB=Collaboration Behaviour, FP=Fresh Produce Supply Chain Performance.

4.6.5 Coefficient of Determination (R^2) and Predictive Relevance (Q^2)

The model's predictive accuracy was evaluated by calculating the coefficient of determination (R^2). As shown in Figure 4.3, the combined impact of the five exogenous constructs, top management support, supplier integration, internal management and customer management, accounted for 68.3% of the variance in firm performance. According to Hair et al. (2019), the R^2 value of 0.683 for FPSC performance was considered moderate.

In addition, the researcher performed data analysis via Stone–Geisser's Q^2 value. The predictive relevance measure, known as Q^2 , is used to forecast indicator data points in both

the endogenous construction reflective measurement models and the endogenous single item construct reflective measurement models. Hair et al. (2014) suggested that a Q^2 value greater than zero ($Q^2 > 0$) indicates the predictive validity of the path model for the construct. Importantly, the calculation of Q^2 was expedited by employing the blindfold approach, a methodology for reusing samples.

In this study, the parameters selected for the calculation of Q^2 were the number of folds = 10 and the number of repetitions = 10, which yielded a Q^2 value of 0.617.

4.6.6 Effect Size (f^2)

A measure of the significant impact of an external construct that has been left out of the model is called effect size, which is sometimes written as f^2 (Hair. et al., 2014). Equation (4.1) was used to calculate the effect size in the context of this investigation.

$$f^2 = \frac{R_{included}^2 - R_{excluded}^2}{1 - R_{included}^2} \quad \text{Equation 4.1}$$

The variables $R_{included}^2$ and $R_{excluded}^2$ denote the R^2 values associated with the endogenous latent variable, taking into account whether a particular exogenous latent variable is included or removed from the model. According to Cohen's classifications (1992), the proposed standards for f^2 are 0.02, 0.15, and 0.35, representing small, medium, and large effects of the exogenous latent variable, respectively (Cohen, 1992).

Among the exogenous variables, such as top management ($f^2 = 0.082$), a small effect size was evident concerning PFSC performance. Furthermore, factors such as supplier integration ($f^2 = 0.06$), customer integration ($f^2 = 0.171$), and risk management ($f^2 = 0.077$) exhibited small to medium effect sizes with respect to PFSC performance. In

contrast, variables such as internal management demonstrated a medium to large effect size on PFSC performance ($f^2 = 0.171$).

Table 4.12: Effect Size on FPSC Performance

Hypotheses	Relationship	f^2	Effect Size
H1	TM -> TP	0.082	Small to Medium
H2	SI -> TP	0.060	Small to Medium
H3	IM -> TP	0.171	Medium to Large
H4	CI -> TP	0.038	Small to Medium
H5	RM -> TP	0.077	Small to Medium
Moderating Effects of Collaboration Behaviour			
H6	CB x TM -> TP	0.053	Small to Medium
H7	CB x SI -> TP	0.053	Small to Medium
H8	CB x IM -> TP	0.028	Small to Medium
H9	CB x CI -> TP	0.073	Small to Medium
H10	CB x RM -> TP	0.050	Small to Medium

Notes: TM=Top Management, SI=Supplier Integration, IM=Internal Management, CI=Customer Integration, RM=Risk Management, CB=Collaboration Behaviour, FP=Fresh Produce Supply Chain Performance.

This comprehensive analysis of effect sizes is provided in Table 4.12. Among the five variables considered to moderate the effects, the interaction between collaboration behaviour and top management exhibited an effect size ranging from small to medium with respect to the dependent variable FPSC ($f^2 = 0.053$). Among the quartet of variables investigated, encompassing the interplays of collaboration behaviour with supplier integration ($f^2 = 0.053$), internal management ($f^2 = 0.028$), customer integration ($f^2 = 0.073$), and risk management ($f^2 = 0.050$), each interaction exhibited effect sizes that ranged from small to medium range in connection with the dependent variable, FPSC performance.

4.7 Summary

The preceding chapter presented empirical support for the reliability, convergent validity, and discriminant validity of the model, as well as an examination of the proposed

hypotheses. Consequently, these findings affirm the efficacy of the research model. The findings of the research suggest that, among the 10 hypotheses examined, 9 were found to be justified. This study makes a valuable contribution to the existing body of knowledge on management control, collaborative behaviour, and fresh supply chain performance in the specific context of fresh agricultural development in the Weifang region. The following chapter provides an examination of the hypotheses that were evaluated, followed by an exploration of the theoretical and practical consequences. Additionally, the limitations of this study are discussed, along with recommendations for future research endeavours.

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 Introduction

This chapter presents a comprehensive discussion of the research findings on fresh produce supply chain performance. The aim of this is to synthesize the insights gathered from the data and provide a cohesive understanding of how various management practices and collaboration behaviours impact the efficiency and effectiveness of the supply chain.

The chapter discusses the implications of these findings, providing both theoretical and practical perspectives that underline the importance of strategic management and collaboration in the fresh produce industry. Recommendations are then proposed to guide practitioners in improving supply chain performance. The chapter also acknowledges the limitations of the current study, setting the stage for future research directions that can be built upon this work. Finally, a conclusion is drawn, encapsulating the key messages and lessons from this research endeavour.

5.2 Discussion

5.2.1 Top Management and Fresh Produce Supply Chain Performance

The empirical evidence from the current study supports the assertion that top management plays a critical role in enhancing FPSC performance. This is in line with previous research, which has consistently highlighted that top management support is positively and directly linked to firm performance outcomes, as identified in a systematic review of the literature (Basana et al., 2022; Hanna et al., 2010; Lee & Joo, 2020; Siagian et al., 2023; Xu & Zhao, 2022). However, the exact mechanisms through which this

relationship operates often require further exploration, suggesting that top management's influence may manifest through various pathways within an organization (Gera et al., 2022).

The study's results also resonate with empirical findings that underscore the importance of top management in managing uncertainties in fresh produce supply chains, which are intrinsically due to the perishability and quality variation of the products (Gokarn & Kuthambalayan, 2019). By actively participating in strategic decision making and resource allocation, top management not only addresses these uncertainties but also promotes sustainability within the supply chain.

Furthermore, research indicates that specific practices such as customer focus and supplier management have direct and indirect influences on organisational success, whereas top management leadership and commitment are crucial for indirect and direct positive impacts on operational success. This suggests that the commitment of top management to FPSC quality practices is instrumental in achieving operational excellence and enhancing supply chain integration via information technology.

The findings of this research also align with models proposing that FPSC performance is positively associated with the overall performance of the firm and that uncertainties within the supply chain can negatively moderate the positive relationships between firms' capabilities and FPSC performance. This highlights the significance of top management in mitigating negative impacts and leveraging firm capabilities to enhance FPSC performance.

In conclusion, the discussion around Hypothesis 1 is enriched by both empirical data from the current study and theoretical frameworks established by prior research. The alignment between these sources underscores the validity of the hypothesis and the vital role

that top management plays in driving FPSC performance through strategic leadership, resource stewardship, and a commitment to sustainability and quality practices.

5.2.2 Supplier Integration and Fresh Produce Supply Chain Performance

This finding suggests a beneficial link between supplier integration and the performance of the fresh produce supply chain. To validate this, it is essential to harmonize empirical data with theoretical frameworks and insights from prior research.

The findings of this study confirm that supplier integration significantly improves FPSC performance, echoing the sentiments in the literature that highlight the importance of supplier integration in improving responsiveness and agility and reducing transaction costs in supply chains (Kim, 2013). These improvements are attributed to better collaboration and information sharing between companies and their suppliers, which streamlines upstream processes and optimizes production expenditures.

Empirical evidence supports the notion that supplier integration positively impacts operational efficiency and schedule adherence, thus contributing to the overall performance of the supply chain (Flynn et al., 2010). This is consistent with previous studies that have found that supplier integration is instrumental in reducing costs, enhancing production scheduling, and increasing the flexibility of supply chains, thus improving performance metrics (Molinaro et al., 2022).

The research also aligns with studies that have demonstrated the benefits of long-term relationships and collaboration between suppliers and buyers, including improved supply chain performance through enhanced information sharing and better IT capabilities (Prajogo & Olhager, 2012). This suggests that the process of supplier integration involves

not only immediate transactional benefits but also long-term strategic relationships that can yield sustainable performance improvements.

Additionally, supplier integration is critical for effectively managing procurement, transportation, and storage costs, which ultimately enhances product preservation and quality while reducing waste and losses (Hendijani & Saeidi Saei, 2020). This is particularly vital in fresh produce supply chains, where product quality and shelf life are of utmost importance.

In summary, it is supported by both the empirical evidence presented in this study and the extensive research documented in the literature. The positive relationship between supplier integration and FPSC performance is clear, indicating that effective supplier management practices are essential for stabilizing supply continuity, maintaining product quality, managing costs, fostering innovation, providing technical support, and navigating risks within the fresh produce supply chain. This contributes to a competitive advantage and increased consumer satisfaction, which are key drivers of success in the industry.

5.2.3 Internal Management and Fresh Produce Supply Chain Performance

The assertion of a beneficial correlation between internal management and the performance of the fresh produce supply chain underscores the importance of streamlined internal operations within companies. These results can be situated within the larger field of scholarly work that has examined different aspects of internal management and their influence on the effectiveness of supply chains.

Research has consistently highlighted that effective process management within firms can lead to enhanced performance outcomes. Gera et al. (2022) suggest that there is a

positive and direct effect of process management on firm performance, although some studies also report a negative or nonexistent relationship. This underscores the complexity of internal management and its varied impacts on the effectiveness of the supply chain.

The concept of internal and external collaboration that contributes to supply chain performance further supports the findings of this study. The literature indicates that a high fit between internal collaboration and external collaboration is likely to result in higher levels of supply chain performance (Zhong et al., 2023). This aligns with the current study's assertion that internal integration, which enhances collaboration and coherence among various departments, is instrumental in improving FPSC performance.

Furthermore, managing uncertainties in fresh produce supply chains is critical for sustainability, with perishability and quality variation being intrinsic characteristics of fresh produce (Aramyan et al., 2007). Effective internal management is the key to mitigating these uncertainties, thus contributing to the robustness and reliability of the supply chain.

Supply chain integration, which includes internal management as a core component, has been widely recognized as crucial for generating efficient material and knowledge flows and leveraging core competencies within the supply chain. This perspective is in harmony with the study findings that emphasize the role of internal management in fostering market knowledge, product development, and environmental stewardship, all of which are essential for the success of the FPSC.

These findings emphasize the strategic importance of internal management in enhancing FPSC performance. Research suggests that by fostering a collaborative environment, facilitating knowledge exchange, and committing to sustainable practices, organisations can significantly improve their operational efficiency, product quality, and

overall competitiveness. This comprehensive approach to internal management is not only an operational strategy but also a foundational practice that ensures that high-quality agricultural products are delivered efficiently and sustainably from farm to table.

5.2.4 Customer Integration and Fresh Produce Supply Chain Performance

Customer integration is a multifaceted construct that involves sharing information, involving customers in decision making, and establishing close relationships with them. This approach is not only beneficial but also essential for understanding and meeting customer needs, which in turn improves supply chain performance. Studies have shown that relationship commitment and customer integration can lead to improved supply chain performance by enhancing information accuracy, reducing production planning time, and increasing responsiveness (Ruzo-Sanmartín et al., 2023).

Research has also indicated that customer integration allows firms to better predict changes in customer demand patterns and respond to their specific needs (Aslam et al., 2023). This level of responsiveness is crucial for customization and product diversity, which are increasingly demanded by customers. The ability to adapt to customer preferences and integrate their feedback into the supply chain process leads to increased satisfaction and loyalty.

Moreover, the study by Zhao et al. (2021), as mentioned in the hypothesis, provides empirical support for the positive impact of customer integration on product quality and financial performance in agri-food processing businesses. This is crucial evidence that involving customers in the supply chain process can lead to improved financial outcomes (Prajogo & Olhager, 2012).

The literature further suggests that the incorporation of customers into the supply chain has a beneficial effect on service quality and response speed, leading to increased customer loyalty and a positive reputation (Mentzer et al., 2000). By effectively responding to customer complaints and suggestions, supply chain actors can enhance conflict resolution capabilities, amplifying client endorsements and word-of-mouth promotions.

Innovation is another area where customer integration has been shown to have a positive effect. Engaging customers as collaborative participants in innovation initiatives can lead to the development of new products that meet market demands and provide competitive advantages (Ruzo-Sanmartín et al., 2023).

By synthesizing these findings, it becomes clear that customer integration is a strategic imperative for FPSC performance. It not only contributes to operational efficiency but also drives innovation, enhances customer satisfaction, and leads to better financial performance. The discussion should emphasize that customer integration is not a one-off interaction but rather a strategic orientation that requires ongoing commitment and alignment with broader supply chain goals.

Conclusively, this validation reinforces the idea that FPSCs can significantly benefit from integrating customers into their operational framework. This integration is essential for staying attuned to market demands, fostering customer loyalty, driving innovation, and ultimately enhancing FPSC performance.

5.2.5 Risk Management and Fresh Produce Supply Chain Performance

The empirical validation demonstrates that effective risk management is crucial in mitigating potential and actual hazards within the FPSC. This aligns with research that has

confirmed a negative correlation between supply chain risk and performance, emphasizing the mediating role of risk management in improving supply chain outcomes (Waqas et al., 2023).

Risk management strategies, as outlined in the hypothesis, address the unique challenges associated with fresh agricultural goods, such as spoilage, contamination, and damage. This proactive approach not only protects product quality and hygiene but also aligns with consumer health and safety expectations. Studies have shown that managing risks related to transportation and storage can lead to cost reductions, thereby increasing profitability and returns on investment (Gokarn & Kuthambalayan, 2019).

Moreover, risk management is particularly effective in mitigating supply volatility and latency risks, which are prevalent in the FPSC because of the perishable nature of the products (Waqas et al., 2023). By enabling supply chain participants to anticipate and respond proactively to market demand fluctuations and other disruptions, risk management contributes to improved service levels and customer satisfaction.

Finally, the practice of risk management extends to reducing legal and social responsibility risks associated with fresh agricultural products (Munir et al., 2020). By promoting environmental sustainability, fairness, and philanthropy, risk management practices enhance customer loyalty and trust in products.

In summary, the discussion should encapsulate how risk management is an integral component of FPSC performance, contributing to enhanced quality and safety profiles, reduced costs, improved customer satisfaction, operational resilience, and long-term sustainability. The positive relationship between risk management and FPSC performance

is clear, indicating that proactive risk management is not just a strategic advantage but also a necessity for the viability and success of fresh produce supply chains.

5.2.6 The Moderating Role of Collaboration Behaviour between Top Management and Fresh Produce Supply Chain Performance

The data analysis corroborated the hypothesis, reinforcing the strategic role of supply chain collaboration as a tool for enhancing business and supply chain performance. The literature has long recognized that while firms may strive for higher levels of collaboration, the quality of such collaboration is a determinant of success, which is significantly influenced by top management's approach.

The impact of supply chain collaboration on collaborative advantage and firm performance is well established. Collaboration within the supply chain, characterized by partners working together to share information, resources, and risks, leads to mutual benefits and can be a reflection of how top management's engagement in collaborative behaviours can enhance FPSC performance (Hendijani & Saeidi Saei, 2020). This suggests that the quality of top management's involvement in collaboration is critical for realizing these advantages.

Another study emphasized the importance of collaboration and highlighted that collaborative feedback and resource investments are key in establishing effective interfirm collaboration, suggesting that these elements play an influential role in achieving successful logistics service performance within the supply chain (Ho et al., 2020). This finding underscores the potential moderating role of collaboration behaviour in translating top management initiatives into effective supply chain performance.

Additionally, there is evidence that SCC directly improves collaborative advantage, which in turn positively impacts firm performance. Collaborative advantage serves as an intermediary that enables supply chain partners to realize synergies and create superior performance outcomes (Akhavan et al. 2023). This finding supports the hypothesis that collaboration behaviour could moderate the effectiveness of top management strategies on FPSC performance.

In synthesizing these findings, the discussion should highlight that collaboration behaviour is not merely an adjunct to top management strategies but also a critical moderating factor that can amplify or diminish the effectiveness of these strategies on FPSC performance. The empirical evidence from this study, supported by existing research, demonstrates that proactive and engaged collaboration behaviours at the top management level are instrumental in achieving higher FPSC performance.

In conclusion, H6's validation through data analysis provides a strong argument for emphasizing the role of top management in fostering a collaborative culture within the supply chain. It is imperative for top management to not only initiate but also actively participate in collaboration behaviours to unlock the full potential of supply chain performance. This strategic alignment between top management initiatives and collaborative behaviour within the supply chain is essential for driving FPSC performance.

5.2.7 The Moderating Role of Collaboration Behaviour between Supplier Integration and Fresh Produce Supply Chain Performance

A previous literature review provided a theoretical foundation for this hypothesis, suggesting that the quality of collaboration, characterized by effective communication, trust, and coordination, can significantly influence the success of supplier integration efforts in

enhancing supply chain performance (Hendijani & Saeidi Saei, 2020). This is particularly relevant in complex supply environments such as those of fresh produce, where the perishability of goods and variability in demand pose unique challenges (Gimenez et al., 2012).

The empirical evidence supports this view and shows that high levels of collaboration lead to better performance outcomes from supplier integration. This is because collaborative behaviour facilitates better alignment among supply chain partners and enhances responsiveness, which is essential in the dynamic environment of fresh produce.

The research highlights that in contexts where supply chains are characterized by high complexity, structured communication and collaborative practices are even more critical to managing this complexity effectively. However, in environments with high supply complexity, certain forms of structured communication aimed at achieving supply chain integration might negatively impact cost performance, suggesting a nuanced relationship between collaboration behaviour and performance outcomes (Gimenez et al., 2012).

Furthermore, the literature proposes that there are different types of supplier integration, such as relational and operational integration, each with distinct activities and potential impacts on supply chain performance. Relational integration emphasizes commitment and trust, whereas operational integration focuses on the day-to-day management of supply chain activities (Molinaro et al., 2022). The moderating role of collaboration behaviour is likely to vary depending on which type of integration is being pursued.

Additionally, while supply chain collaboration is widely recognized as a tool for improving business performance, it is also acknowledged that not all collaboration initiatives

succeed. The effectiveness of such initiatives is contingent upon how they are implemented and the degree to which they lead to higher levels of performance (T. Ho et al., 2020).

In conclusion, the validation provides valuable insights for practitioners and researchers alike. For practitioners, this underscores the importance of fostering a collaborative culture and investing in relationship-building activities with suppliers to maximize the benefits of integration efforts. Researchers suggest a fruitful avenue for future studies to explore the conditions under which collaboration behaviour most effectively moderates the relationship between supplier integration and FPSC performance.

Supplier integration is not a standalone solution; its effectiveness is significantly enhanced when coupled with strong collaboration behaviour. This interplay between supplier integration and collaboration behaviour is critical for achieving superior FPSC performance in the face of the supply complexity and demand variability inherent in the fresh produce industry.

5.2.8 The Moderating Role of Collaboration Behaviour between Internal Management and Fresh Produce Supply Chain Performance

The analysis of the data suggested that collaboration behaviour moderates the relationship between internal management and fresh produce supply chain performance, which is not supported. This outcome warrants a critical examination of the potential factors that may have influenced these results.

First, the empirical evidence from Zhong et al. (2023) suggested that congruence between collaboration efforts and organizational capabilities positively impacts supply chain performance. However, the lack of support for H8 indicates that this congruence might not have been present or sufficiently strong within the studied context. It is possible that internal

management practices were not adequately aligned with the collaborative behaviours expected or required to generate a positive effect on FPSC performance.

Second, the research of Hendijani and Saeidi Saei (2020) highlighted the moderating role of external factors such as demand uncertainty on the SCI and firm performance relationship. While H8 was not directly focused on internal management, it is plausible that external market conditions, such as demand uncertainty, could have overshadowed the potential benefits of collaboration behaviour on internal management effectiveness.

Moreover, the concept of collaborative advantage discussed by Cao and Zhang (2011) suggests that strategic alliances and collaboration can lead to improved firm performance. The lack of support of H8 may imply that the relational rents expected from such alliances were not realized, potentially due to a lack of trust among partners, misaligned goals, or insufficient strategic management of the alliances.

A literature review of the factors affecting supply chain collaboration identified many factors that could influence the success of collaborative efforts (Ho et al., 2023). Some of these factors may have been barriers in the present study, such as cultural differences, communication issues, or conflicting objectives among supply chain partners.

Furthermore, collaboration within the supply chain emphasizes the need for firms to focus on core capabilities while partnering with others to achieve efficiency (Kovács et al., 2017). If internal management practices did not effectively leverage core capabilities or if partnerships were not with valuable suppliers and customers, this could explain why collaboration did not produce the expected moderation effect.

Finally, the behavioural antecedents of collaboration and supply chain integration are crucial but often overlooked (Wang et al., 2023). These antecedents may not have been adequately addressed in the FPSC context, leading to a lack of a significant moderating effect of collaboration behaviour.

In conclusion, while collaboration behaviour has been empirically shown to positively impact supply chain performance, its success and influence can be mitigated by various factors. These include but are not limited to the alignment of internal and collaborative efforts, trust among partners, strategic management of alliances, and external market conditions. For future research and practice within the fresh produce industry, it would be beneficial to explore these areas further to better understand how to foster effective collaboration behaviour that aligns with internal management practices to enhance overall FPSC performance.

5.2.9 The Moderating Role of Collaboration Behaviour between Customer Integration and Fresh Produce Supply Chain Performance

The validation provides a nuanced understanding of the role of collaboration behaviour in enhancing the relationship between customer integration and fresh produce supply chain performance. This hypothesis is substantiated by the empirical study of Zhong et al. (2023), which examined the interaction effects of internal and external collaboration on supply chain performance via structural equation modelling with data from 205 firms. The study's findings are consistent with the perspective offered by McKinsey, which posits that effective supply chain collaboration can lead to significant reductions in inventories and costs and improvements in speed, service levels, and customer satisfaction.

Furthermore, the empirical evidence aligns with the findings presented in Springer's study on supply chain collaboration and performance. This study suggests that while striving for higher levels of collaboration can be a competitive advantage, the success of these initiatives often hinges on their execution (Ho et al., 2020).

Additionally, research by Hendijani and Saeidi Saei (2020) emphasized the importance of external integration for acquiring timely information about supplier activities and customer demands, which is crucial for higher coordination among supply chain members. This form of integration is essential for avoiding inefficiencies and improving overall supply chain performance, further suggesting that collaboration behaviour is critical in leveraging external information for better performance.

The study by Ruzo-Sanmartín et al. (2023) contributes to this discussion by demonstrating how relationship commitment, particularly in the context of customer integration, influences supply chain performance. The differentiation between 'integration with the customer' and 'integration by the customer' reveals that both dimensions are vital for enhancing performance, resonating with the insights provided by Enable, which outlines the benefits of supplier collaboration, such as improved communication, risk management, and competitive advantage.

In summary, these findings underscore the importance of strategic collaboration as a means to increase customer integration efforts and improve the performance of FPSCs. The literature indicates that while collaboration initiatives have the potential to improve performance, their success is contingent upon proper implementation, understanding of the underlying mechanisms, and commitment to maintaining strong relationships with customers.

Therefore, confirming accentuates the imperative for managers within the fresh produce sector to cultivate a culture of collaboration that is both internally focused and externally oriented. This strategic approach is vital for improving overall FPSC performance and maintaining a competitive edge in the dynamic market for fresh produce.

5.2.10 The Moderating Role of Collaboration Behaviour between Risk Management and Fresh Produce Supply Chain Performance

Confirmation through data analysis establishes a significant moderating role of collaboration behaviour in the relationship between risk management and fresh produce supply chain performance. This hypothesis is grounded in empirical evidence suggesting that knowledge management, as a form of collaborative behaviour, can mitigate the adverse effects of supply chain risk on performance, as found in the study by Waqas et al. (2023).

The literature by Khandelwal et al. (2021) provides a broader context within the agricultural supply chain management domain, identifying patterns and challenges that are not exclusive to but include the fresh produce sector. The insights derived from this review emphasize the critical nature of understanding supply chain complexities to devise robust risk management strategies. This understanding is essential for addressing the unique challenges faced in the fresh produce sector, such as perishability and demand fluctuations.

Research by Cao et al. (2021) further explores the effectiveness of collaborative risk management, particularly in decentralized multitier global supply chains that are characteristic of the fresh produce industry. The study's mixed-methods approach sheds light on how collaboration across different tiers can help manage risks associated with perishability, demand variability, and supply disruptions.

In light of these findings, it is evident that collaborative behaviours are instrumental in enhancing the effectiveness of risk management practices within FPSCs. Collaborative risk management has been identified as a key component of supply chain risk management strategies, offering a framework for joint risk assessment and knowledge sharing that leads to improved performance outcomes, as discussed in the systematic literature review by Emerald Insight (Friday et al., 2018).

The review on collaborative decision-making in supply chain management corroborates the importance of collaborative approaches towards sustainable development and highlights the role of collaborative risk management in enhancing environmental performance and risk management (Wang et al., 2023).

Finally, studies on driving collaborative supply risk mitigation in buyer–supplier relationships suggest that collaborative risk identification and the perception of supply risks significantly affect risk mitigation efforts (Mwesiumo et al., 2021).

In summary, the successful validation of H10 underscores the importance of strategic collaboration in managing risks within FPSCs. This highlights that collaborative behaviours can serve as a buffer against the negative impacts of supply chain risks on performance, suggesting an integrated approach to risk management that leverages collective knowledge and capabilities. This finding has profound implications for managers and practitioners in the fresh produce industry, suggesting that fostering a collaborative culture and establishing joint risk management practices are crucial for enhancing FPSC resilience and performance.

5.3 Implications

5.3.1 Theoretical Implication

The theoretical implications in the supply chain management literature are rich and continually shifting, mirroring the field's inherent dynamism. Recent research contributions have enhanced our understanding of SCM theory across several key domains:

In the realm of supply chain performance and management practices, investigations have delved deeply into the connections between how supply chains are managed and their resultant performance. However, the findings have been mixed, indicating that our theoretical models might be missing crucial variables or failing to take into account the full breadth of context-specific dynamics. This gap in the literature calls for a more elaborate theoretical approach that can grasp the complexity of supply chain interactions and their performance implications (Gera et al., 2022).

The research in management control theory for fresh produce supply chains reveals several key insights. Studies show that internal management control ($\beta = 0.269$) has a stronger impact on performance compared to customer ($\beta = 0.179$) and supplier integration ($\beta = 0.126$), challenging traditional control theory's emphasis on external integration (Shukla & Jharkharia, 2013). The unique characteristics of fresh produce, including perishability and seasonality, require significant adaptations to conventional control mechanisms (Waqas et al., 2023). Temporal considerations have emerged as crucial factors, affecting control effectiveness across different time horizons, from immediate shelf-life constraints to seasonal fluctuations (Jiang et al., 2024). Recent methodological advances have led to the development of specialized measurement scales and modified performance metrics specifically designed for perishable products (Zheng et al., 2017). These developments

collectively demonstrate that while traditional control theory principles remain relevant, their application in fresh produce supply chains requires substantial modification to address the dynamic nature of perishable product management and the complex interplay of various control mechanisms (Song & He, 2019).

The study makes significant contributions to collaboration theory by revealing the nuanced dynamics of collaborative behavior in fresh produce supply chains. Specifically, it extends collaboration theory by demonstrating that the moderating effects of collaborative behavior are not uniform across different management control practices. While collaboration significantly enhances the effectiveness of top management, supplier integration, customer integration, and risk management practices, its interaction with internal management processes shows no significant moderation effect. This finding challenges the traditional assumption that collaboration universally enhances all aspects of supply chain operations, suggesting instead that collaborative mechanisms may be more effective in external-facing processes rather than internal operations (Cao & Zhang, 2011). This distinction advances our understanding of the boundary conditions of collaboration theory and provides a more refined framework for analyzing when and how collaborative approaches can most effectively enhance supply chain performance (Fawcett et al., 2012). Furthermore, the study enriches collaboration theory by identifying specific pathways through which collaborative behavior influences supply chain outcomes, particularly in the context of perishable goods management where time-sensitive coordination is crucial (Hudnurkar et al., 2014). This nuanced perspective contributes to the ongoing discourse on the contextual factors that influence the effectiveness of supply chain collaboration (Soosay & Hyland, 2015).

This study advances stakeholder theory by providing empirical evidence of how different stakeholder relationships interact and influence performance in fresh produce supply chains. The findings extend stakeholder theory by demonstrating that the effectiveness of stakeholder management is contingent upon the level of collaborative behaviour present in the supply chain network. Specifically, the study reveals that while traditional stakeholder theory emphasizes the importance of managing relationships with all stakeholders the impact of these relationships varies significantly across different management control practices (Edward Freeman, 2010). The results show that collaborative behaviour particularly strengthens the relationship between external stakeholder management (suppliers and customers) and supply chain performance, while having less impact on internal stakeholder relationships. This finding enriches stakeholder theory by suggesting a hierarchical structure of stakeholder relationships in supply chains (Harrison et al., 2015), where the value created through external stakeholder engagement is amplified by collaborative behaviours. Furthermore, the study contributes to stakeholder theory by demonstrating how the integration of multiple stakeholder interests through collaborative mechanisms can lead to enhanced supply chain performance, particularly in the context of perishable goods where stakeholder interdependence is high (Bridoux & Stoelhorst, 2014). This advances our understanding of how stakeholder relationships can be effectively managed in complex supply chain networks where multiple interests need to be balanced simultaneously (Jones et al., 2018)

5.3.2 Practical Implication

In the realm of fresh produce supply chain management, practical implications drawn from theoretical insights are critical for ensuring operational efficiency and competitive advantage. The empirical evidence pointing to the pivotal role of top management suggests

that leaders must take an active role in strategic initiatives that enhance supply chain performance. This involves a hands-on approach to decision-making, resource allocation, and a commitment to integrating quality practices throughout the supply chain.

The significance of supplier integration also translates into practical actions. Businesses are encouraged to foster deeper relationships with their suppliers, facilitating open communication and collaboration that can lead to better alignment of objectives, improved quality control, and more efficient logistics.

Internal management practices are equally influential in determining the success of fresh produce supply chains. Organizations should focus on streamlining their internal processes, ensuring that all departments and teams work cohesively towards shared supply chain goals. This internal harmony is critical for swiftly responding to market changes and maintaining a steady flow of fresh produce.

Customer integration is another area with direct practical applications. By engaging customers in the supply chain process, businesses can better understand and meet consumer demands, leading to increased satisfaction and loyalty. This could involve incorporating customer feedback into product development and supply chain planning, thus creating a more responsive and consumer-driven business model.

Risk management strategies are essential for navigating the uncertainties inherent in dealing with perishable goods. Practical steps include implementing robust safety protocols, investing in technology for better traceability, and developing contingency plans to address potential disruptions in the supply chain.

Finally, the overarching theme of collaboration behaviour demonstrates a complex dynamic in supply chain relationships. While it significantly enhances the effectiveness of external partnerships (with suppliers and customers) and strengthens top management's impact on performance, its interaction with internal management processes showed no significant moderating effect. This finding suggests that collaboration behaviour primarily acts as a catalyst for external relationships, rather than internal operational processes. Such selective effectiveness highlights the need for a nuanced approach to collaboration, particularly in distinguishing between its roles in external partnerships versus internal operations.

5.3.3 Policy Implication

Based on our empirical findings, we propose several policy recommendations for enhancing supply chain performance. First, policymakers should establish regulatory frameworks that incentivize and facilitate external collaboration among supply chain partners, while respecting the autonomy of internal operations. Second, government agencies should develop support programs and guidelines that help organizations, especially SMEs, to build effective risk management capabilities and collaborative partnerships. Third, industry regulators should implement standardized performance evaluation systems that enable organizations to benchmark both their collaborative practices and operational efficiency against industry standards. Finally, we recommend the establishment of industry-specific knowledge sharing platforms and support mechanisms that can help organizations navigate the complexities of supply chain collaboration while maintaining operational independence. These policy initiatives should be supported by appropriate funding mechanisms and regular effectiveness reviews to ensure sustained impact.

5.4 Recommendations

In light of the discussions about fresh produce supply chain management, several comprehensive recommendations have emerged. These recommendations are crafted to guide practitioners and organizations in enhancing their supply chain effectiveness and resilience.

Organizations should ensure that their leadership is deeply involved in the strategic management of the supply chain. This involves a commitment from top management to lead with a vision that integrates quality and sustainability into the core of supply chain operations. Leaders need to be proactive in making strategic decisions that address the unique challenges of managing fresh produce, such as perishability and variable quality.

Building robust relationships with suppliers is crucial. Organizations are advised to establish strong partnerships that extend beyond transactional interactions to collaborative engagements. These partnerships could take the form of long-term agreements that include shared objectives, risks, and rewards, fostering a sense of mutual investment in each other's success.

The optimization of internal processes is a key area for action. Companies should strive for excellence in their internal operations by embracing continuous improvement and innovation. This could involve regular training for staff, adopting cutting-edge technologies, and creating an environment that supports seamless communication between different departments.

Engaging customers directly in the supply chain process is another vital recommendation. By integrating customer insights and feedback, businesses can better align

their offerings with market demands. This customer-centric approach can lead to improved service quality and increased customer satisfaction.

Risk management should be a priority, particularly in an industry where factors such as spoilage and demand fluctuations can have significant impacts. Companies should develop and implement strategies that anticipate and mitigate these risks, ensuring a resilient supply chain capable of withstanding various challenges.

Cultivating a culture of collaboration is essential. Encouraging teamwork across all levels within the organization, as well as with external partners, can lead to more innovative solutions and a more agile supply chain. This collaborative approach should be reinforced through regular communication, joint problem-solving initiatives, and recognition of collective achievements.

Investment in technology is also recommended to increase supply chain visibility and efficiency. Advanced technologies such as blockchain, IoT devices, and AI-driven analytics can provide companies with tools to better forecast demand, track products, and optimize operations.

Finally, embedding sustainable practices into every aspect of the supply chain is not only beneficial for the environment but also increasingly expected by consumers and regulators. Efforts should be made to reduce waste, conserve resources, and work with suppliers who are committed to sustainable operations.

By following these recommendations, organizations can strengthen their supply chains against current and future challenges, ensuring that they can deliver fresh produce efficiently and sustainably to meet the evolving demands of the market.

5.5 Limitations

In expanding upon the limitations of the study, it is essential to delve into the nuances of each constraint and explore how they can be constructively addressed in future research endeavours.

The study's exclusive focus on the Weifang region presents a limitation in terms of geographical representation. This specificity may not capture the full array of challenges and practices that are present in other regions with different supply chain dynamics. Future research should aim to include a more diverse array of locations, potentially conducting comparative studies across various countries or regions. This broader inclusion would help determine if the patterns observed in Weifang are consistent elsewhere, thereby enhancing the generalizability of the findings.

Another limitation is the study's treatment of collaboration behaviour as a moderating factor without exploring the intricacies of how this collaboration works in practice. To gain a deeper understanding, subsequent studies could investigate the specific processes and structures that facilitate effective collaboration within supply chains. This could involve case studies of successful collaborative efforts or longitudinal research to observe how collaboration evolves and its impact on supply chain performance over time.

Methodologically, the study could be enhanced by adopting a mixed-methods approach that combines quantitative data with qualitative insights. This would allow for a richer exploration of the phenomena under study and provide a more comprehensive understanding. Employing advanced statistical techniques could also offer new perspectives on the complex interplay between different supply chain management factors.

In addressing these limitations, researchers have the opportunity to build upon the foundations of the current study, offering more robust and widely applicable insights into fresh produce supply chain management. By doing so, they can contribute to a body of knowledge that not only advances academic theory but also provides practical, actionable strategies for practitioners in the field.

5.6 Directions for Future Research

In considering the future trajectory of research in the domain of fresh produce supply chain management, several promising avenues emerge from the current study's insights and limitations.

One area ripe for exploration is the impact of regional differences on supply chain dynamics. The current focus on the Weifang region provides a detailed snapshot, but extending research to include multiple regions, both within and beyond national borders, could uncover whether the factors influencing supply chain performance are universally applicable or contextually bound.

Given the transient nature of supply chain management practices, longitudinal research could offer invaluable insights into the evolution of these practices and their long-term outcomes. Such studies would track changes over time, providing a clearer picture of the sustainability and efficacy of management strategies.

The intricacies of collaboration in the supply chain also merit deeper investigation. Understanding the specific mechanisms that drive successful collaboration could inform best practices and lead to improved coordination among supply chain partners. This exploration might involve qualitative methods to capture the nuances of collaborative relationships.

With rapid technological advancements reshaping industries, it is crucial to assess how new technologies are impacting fresh produce supply chains. Future studies could evaluate the adoption and effects of blockchain, IoT, artificial intelligence, and other innovations on efficiency, transparency, and competitiveness.

Sustainability and resilience are becoming increasingly important in supply chain strategy development. Research could focus on how to integrate these concepts effectively into supply chain operations, examining the balance between environmental stewardship, social responsibility, and economic viability.

Comparative analyses across different industries can shed light on unique supply chain challenges and opportunities. By studying how various industries approach supply chain management, researchers can identify transferable strategies that enhance performance and innovation.

Finally, consumer behaviour has a profound effect on supply chains. Future research should delve into how shifts in consumer preferences influence supply chain strategies, particularly as consumers become more environmentally conscious and demand greater transparency from producers.

Each of these areas not only extends the work of the current study but also opens new doors for discovery and advancement in the field of supply chain management. By pursuing these directions, researchers can contribute to a more resilient, efficient, and sustainable future for the fresh produce industry.

5.7 Conclusion

This research aims to delve into the intricate relationship between the performance of fresh produce supply chains and five pivotal determinants, namely, top management, supplier integration, internal management, customer integration, and risk management. Additionally, the study seeks to unravel the role of collaboration behaviour within this context. Through a meticulous analysis of data derived from Chinese fresh produce supply chains, this investigation culminates in the following conclusions:

The factors of top management, supplier integration, internal management, customer integration, and risk management positively influence the performance of fresh produce supply chains. These empirical findings substantiate the validity of hypotheses 1 through 5.

Collaboration behaviour emerges as a constructive moderator in the relationships among top management, supplier integration, customer integration, risk management, and the performance of fresh produce supply chains. This lends empirical credence to the propositions outlined in hypotheses 6, 7, 9, and 10.

In contrast, the moderating influence of collaboration behaviour on the nexus between internal management and the performance of fresh produce supply chains was not statistically significant. This outcome may fail to provide support for Hypothesis 8.

In aggregate, these empirical findings underscore the imperative of effective governance and harmonious orchestration across diverse facets of fresh produce supply chains to increase their overall performance. Notably, collaboration behaviour emerges as a pivotal mechanism that augments the positive correlations between most of the key determinants and performance metrics. Nevertheless, internal management might be subject

to a complex interplay of influences beyond the scope of collaboration behaviour. This study contributes valuable insights and pragmatic recommendations, thus enriching the theoretical understanding and practical implementation of strategies within the realm of fresh produce supply chains.

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APPENDICES

APPENDIX A: Questionnaire



Institute of Faculty of Economics and Business
University Malaysia Sarawak
94300 Kota Samarahan
Sarawak, Malaysia

Dear respondent:

We are conducting a study on fresh agricultural produce supply chain management., with an emphasis on management control, collaborative behaviour, etc. Your candid feedback is critical to the success of this study. Though several questions may appear identical, each one tackles a distinct issue. There are no correct or incorrect replies; we value your viewpoint.

If you have any questions or would want to learn more about the study's findings, please contact the individual mentioned below. Your participation is critical to the agriculture business.

Thank you for taking the time out of your busy schedule to take part in this research. Your kind cooperation and help are greatly appreciated.

Yours sincerely,

Yin Fengzhao (Email: yinfengzhao007@gmail.com; Phone: +86 15553661251)



经济管理学院
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尊敬的专家:

我们正在进行关于新鲜农产品供应链管理的研究，重点关注管理控制、协作行为等方面。您的诚实反馈对于本研究的成功至关重要。虽然有些问题可能看起来相似，但每个问题都涉及不同的议题。没有正确或错误的答案；我们非常重视您的观点。

如果您有任何问题或想了解更多关于这项研究的结果，请联系下面列出的人员。您的参与对农业行业至关重要。

感谢您在百忙之中抽出时间参与这项研究。我们非常感激您的合作和帮助。

殷凤朝 (邮件: yinfengzhao007@gmail.com; 电话: +86 15553661251)

Section 1: Background Information

The following questions are meant only for the purpose of analysis (Please answer by writing or marking a tick whichever is required):

1. Gender (please tick one) 性别（单选）

☐ Male	☐ 男
☐ Female	☐ 女

2. Your age: () 您的年龄 ()

☐ Below 35 years old	☐ 35 岁及以下
☐ 36-45 years old	☐ 36 岁-45 岁
☐ 46-54 years old	☐ 46 岁-54 岁
☐ 55 years old and above	☐ 55 岁及以上

3. Your Education Level [Single Choice]

您的教育水平（单选题）

☐ Diploma and Below	☐ 专科及以下
☐ Bachelor's Degree	☐ 本科
☐ Postgraduate and Above	☐ 硕士及以上

4. What type of company are you in? [Single Choice] *

您公司的类型？

☐ Vegetables and fruits	☐ 蔬菜和水果
☐ Fresh produce services	☐ 配套服务

5. How long has your current organization been established?

您所在的公司成立多久了？

○ Less than 5 years	不足 5 年
○ 5 to 10 years	5 到 10 年
○ 11 to 15 years	11 到 15 年
○ More than 15 years	15 年以上

Section 2

This is the second part of the questionnaire, focusing on the influencing factors during the development of the fresh agricultural produce (such as vegetables) supply chain. It is divided into five sections: top management, supplier integration, internal management, customer integration, and retail. 这是问卷的第二部分，重点关注新鲜农产品（如蔬菜）供应链发展过程中的影响因素。它分为五个部分：高层管理、供应商整合、内部管理、客户整合和零售管理。													
Responses are measured on a seven-point scale, with scores ranging from 1 (strongly disagree) to 7 (strongly agree). 回答以七分制进行测量，分数范围从 1（强烈不同意）到 7（强烈同意）。。													
Construct 1: Top management 维度 1：高层管理 The senior management of the company has made efforts in the following aspects. 公司的高级管理层，对以下方面做出了努力。							References: Siddh et al. (2021)						
TM1	Committed to enhancing customer satisfaction. 致力于客户满意度的提升						1	2	3	4	5	6	7
TM2	Committed to improving relationships with suppliers.						1	2	3	4	5	6	7

	致力于改善与供应商之间的关系							
TM3	Value the application of new ideas, technologies, and processes to the company's operations. 重视将新的想法、技术和流程应用到公司的运营中	1	2	3	4	5	6	7
TM4	Paying attention to human resource management, committed to improving employee work efficiency and employee satisfaction. 重视人力资源管理，致力于提升员工工作效率和员工满意度	1	2	3	4	5	6	7
Construct 2: Supplier integration 维度 2： 供应商整合 Company in terms of supplier management 公司在对供应商的整合方面		References Uddin & Akhter (2022)						
SI1	Regular communication with suppliers about the company's operations 经常与供应商沟通公司经营情况	1	2	3	4	5	6	7
SI2	Joint coordination of inventory with suppliers 与供应商之间的共同协调库存	1	2	3	4	5	6	7
SI3	Timely and prompt response to the needs or inquiries of suppliers 及时、快速回复供应商的需求或者问题	1	2	3	4	5	6	7
SI4	Committed to establishing a procurement network with suppliers 致力于与供应商之间形成采购网络	1	2	3	4	5	6	7
SI5	Stable receipt of goods and services from suppliers	1	2	3	4	5	6	7

	公司可以连续稳定的收到来自供应商的货物							
Construct 3: Internal Management 维度 3： 内部管理		References						
In terms of internal management, the company...		Siddh et al.						
公司在内部管理上		(2022)						
IM1	Continuously improve internal process management and enhance processing quality	1	2	3	4	5	6	7
	不断改进内部的工艺管理流程、提高加工质量							
IM2	Strict product quality standards have been established	1	2	3	4	5	6	7
	建立了严格的产品质量标准							
IM3	Standard conditions have been established for the transportation and storage of food products	1	2	3	4	5	6	7
	对食品产品的运输和存储设立了标准							
IM4	Effective inventory management has been implemented	1	2	3	4	5	6	7
	实施了有效地库存管理							
Construct 4: Customer Integration 维度 4： 客户整合		References						
In terms of customer integration, the company...		Bae et al. (2023)						
公司在客户整合方面								
CI1	Real-time sharing of our production process with customers makes consumers more aware of the manufacturing process of the product.	1	2	3	4	5	6	7
	及时与客户分享我们的生产过程，使消费者更了解产品的制造过程							

CI2	Real-time gathering of customer feedback on product demands, to better predict market needs. 及时获取客户对产品需求的反馈，以更好地预测市场需求。	1	2	3	4	5	6	7
CI3	Improve the payment collection process with customers to enhance payment efficiency and accuracy. 改进与客户之间的付款收取流程，以提高支付的效率和准确性。	1	2	3	4	5	6	7
CI4	Real-time gathering of market information and trends provided by consumers to help the company better understand market dynamics. 及时获取消费者提供的市场信息和趋势，以帮助公司更好地了解市场动态。	1	2	3	4	5	6	7
CI5	Optimize the product delivery process through real-time monitoring. 通过实时监控，优化产品交付过程	1	2	3	4	5	6	7
Construct 5: Risk Management 维度 5: 风险管理 The company needs to control the following risks. 公司需要对以下风险需要进行控制		References Nayal et al. (2023)						
RM1	Product delivery and pick-up delays (such as transportation issues, natural disasters or production delays) 产品交付和提货延迟（如运输问题、自然灾害或生产延迟导致）	1	2	3	4	5	6	7
RM2	Unable to meet market demand or deliver products on time (there may be insufficient storage and delivery capabilities in the supply chain)	1	2	3	4	5	6	7

	无法满足市场需求或及时交付产品（供应链中可能存在储存和交付能力不足的情况）							
RM3	The supply chain disruption or inventory backlog is caused by unstable market demand. 不稳定的市场需求导致的供应链中断或者库存积压	1	2	3	4	5	6	7
RM4	The inaccurate market forecasts and demand predictions can lead to either an excess of inventory or inadequate supply. 不准确的市场预测和需求预测可能导致的库存过剩或供应不足	1	2	3	4	5	6	7
RM5	Reduced logistics efficiency and delayed deliveries due to a shortage of labor or drivers. 由于劳动力或者驾驶员的短缺造成的物流效率降低和交付延迟	1	2	3	4	5	6	7
RM6	道路不通（例如因为天气条件或政治因素，可能导致货物无法运输或跨境贸易受阻） Road closures or cross-border trade disruptions due to weather or political factors.	1	2	3	4	5	6	7
RM7	The rising transportation costs caused by the unstable oil prices. 由于不稳定的油价造成的运输成本上升	1	2	3	4	5	6	7

Section 3 第三部分

The following is Part 3 of the questionnaire, which mainly focuses on the collaboration behavior in the development of the supply chain of fresh agricultural products, including cooperation among agricultural suppliers, customers and others.

以下是问卷的第三部分，主要关注新鲜农产品供应链发展中的合作行为，包括农产品供应商、客户以及其他相关方之间的合作。														
Responses are measured on a seven-point scale, with scores ranging from 1 (strongly disagree) to 7 (strongly agree).														
回应是通过七点量表进行测量的，分数范围从 1（强烈不同意）到 7（强烈同意）。														
Construct 6: Collaboration Behavior								References Baah et al. (2022)						
维度 6：协同行为														
Our company has achieved the following collaborations with our partners.														
我们的公司与合作伙伴之间实现了以下合作														
CB1	Shared costs and benefits (such as savings from shared inventory costs and losses from order changes).							1	2	3	4	5	6	7
	共享成本和利益（例如共享库存成本的节约和订单变更的损失）。													
CB2	Our firm and supply chain partners jointly search, acquire, assimilate and apply relevant knowledge							1	2	3	4	5	6	7
	共同搜索、获取、应用相关的知识（以不断提高供应链的知识水平和竞争力）													
CB3	Collaboratively propose measures to improve the supply and sales network.							1	2	3	4	5	6	7
	共同提出措施来改进供应和销售网络。													
CB4	Our firm and supply chain partners share accurate, timely, and helpful relevant information.							1	2	3	4	5	6	7

	我们的公司和供应链合作伙伴共享准确、及时和相关有用的信息。							
CB5	Our firm and supply chain partners collaboratively manage inventory and demand forecasts 公司与供应链伙伴共同进行库存管理、共同对市场需求进行预测	1	2	3	4	5	6	7

Section 4 第四部分

This is the fourth section of the questionnaire, focusing on the indicators for measuring the performance of the fresh supply chain. 这是问卷的第四部分，专注于测量新鲜供应链绩效的指标													
Responses are measured on a seven-point scale, with scores ranging from 1 (strongly disagree) to 7 (strongly agree). 回应是通过七点量表进行测量的，分数范围从 1（强烈不同意）到 7（强烈同意）。													
Construct 7: Fresh Produce Supply Chain Performance 维度 7：生鲜供应链表现 The following is a specific description of supply chain performance. 以下是对供应链表现的具体描述。						References Lusiantoro et al. (2022)							
FP1	Orders from customers are received on time almost every time. 每次都可以及时接收到来自客户的订单。						1	2	3	4	5	6	7
FP2	Able to accurately and promptly ship products ordered by customers.						1	2	3	4	5	6	7

	能够准确、及时地将客户订购的产品发出							
FP3	Able to accurately send the quantity of products ordered to customers. 能够准确的向客户发送订购的产品数量	1	2	3	4	5	6	7
FP4	Able to deliver orders to the correct address. 能够将订单配送到准确的地址	1	2	3	4	5	6	7
FP5	Able to provide convenient payment options for customers. 能够为客户提供便捷的支付条件	1	2	3	4	5	6	7
FP6	Able to provide high-quality products for the market. 能够为市场提供优质的产品	1	2	3	4	5	6	7
FP7	Able to deliver products to customers in a timely manner. 能够及时地交付产品给客户	1	2	3	4	5	6	7
FP8	Able to quickly resolve customer complaints. 可以快速解决客户的投诉	1	2	3	4	5	6	7
FP9	Able to respond to customer inquiries in a timely manner. 可以及时回复客户的询问	1	2	3	4	5	6	7

APPENDIX B: SPSS Output

Appendix B1: Demographic Profile of the Respondents

Statistics						
		Gender	Age	Education	Type	WorkExperience
N	Valid	173	173	173	173	173
	Missing	0	0	0	0	0

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	107	61.8	61.8	61.8
	Female	66	38.2	38.2	100.0
	Total	173	100.0	100.0	

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 35	37	21.4	21.4	21.4
	36-45	57	32.9	32.9	54.3
	46-54	46	26.6	26.6	80.9
	55 years and above	33	19.1	19.1	100.0
	Total	173	100.0	100.0	

Education					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Associate Degree	45	26.0	26.0	26.0
	Bachelor's Degree	82	47.4	47.4	73.4
	Master's Degree and Above	46	26.6	26.6	100.0
	Total	173	100.0	100.0	

Type					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Vegetables and Fruits	143	82.7	82.7	82.7
	Supporting Services	30	17.3	17.3	100.0
	Total	173	100.0	100.0	

WorkExperience					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 5 years	35	20.2	20.2	20.2

5-10 years	52	30.1	30.1	50.3
10-15 years	51	29.5	29.5	79.8
More than 15 years	35	20.2	20.2	100.0
Total	173	100.0	100.0	

Appendix B2: Mean and Standard Deviation for the Overview of the Variables

Descriptive Statistics			
	N	Mean	Std. Deviation
TM1	173	5.20	1.596
TM2	173	5.03	1.414
TM3	173	5.09	1.518
TM4	173	5.24	1.461
SI1	173	4.91	1.524
SI2	173	4.88	1.450
SI3	173	5.02	1.594
SI4	173	5.05	1.566
SI5	173	4.77	1.436
IM1	173	4.46	1.601
IM2	173	4.75	1.597
IM3	173	4.71	1.516
IM4	173	5.18	1.576
CI1	173	4.66	1.600
CI2	173	5.19	1.568
CI3	173	4.86	1.465
CI4	173	4.79	1.560
CI5	173	4.90	1.550
RM1	173	4.74	1.690
RM2	173	4.69	1.697
RM3	173	4.77	1.593
RM4	173	4.83	1.618
RM5	173	4.88	1.566
RM6	173	4.87	1.635
RM7	173	4.95	1.647
CB1	173	4.65	1.595
CB2	173	5.09	1.558
CB3	173	5.12	1.745
CB4	173	5.03	1.649

CB5	173	5.17	1.604
FP1	173	4.75	1.678
FP2	173	4.80	1.605
FP3	173	4.92	1.585
FP4	173	4.94	1.611
FP5	173	4.88	1.615
FP6	173	4.79	1.633
FP7	173	4.92	1.608
FP8	173	4.30	1.668
FP9	173	4.46	1.683
Valid N (listwise)	173		

Appendix B3: Harman's Single Factor Test

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.108	31.046	31.046	12.108	31.046	31.046
2	4.415	11.320	42.366	4.415	11.320	42.366
3	3.167	8.121	50.487	3.167	8.121	50.487
4	2.598	6.661	57.148	2.598	6.661	57.148
5	2.415	6.194	63.342	2.415	6.194	63.342
6	2.356	6.042	69.384	2.356	6.042	69.384
7	2.034	5.215	74.599	2.034	5.215	74.599
8	.677	1.737	76.336			
9	.672	1.722	78.058			
10	.636	1.632	79.690			
11	.590	1.512	81.201			
12	.550	1.411	82.612			
13	.503	1.291	83.903			
14	.440	1.128	85.031			
15	.425	1.091	86.122			
16	.395	1.013	87.135			
17	.382	.980	88.114			
18	.363	.930	89.045			
19	.352	.902	89.947			
20	.333	.853	90.801			
21	.328	.842	91.642			
22	.307	.787	92.430			

23	.278	.712	93.141			
24	.272	.698	93.840			
25	.255	.655	94.495			
26	.246	.632	95.127			
27	.236	.604	95.731			
28	.206	.529	96.259			
29	.189	.486	96.745			
30	.181	.463	97.208			
31	.171	.438	97.646			
32	.162	.415	98.062			
33	.145	.372	98.434			
34	.132	.338	98.772			
35	.124	.318	99.090			
36	.112	.287	99.377			
37	.094	.240	99.617			
38	.076	.194	99.812			
39	.073	.188	100.000			

Extraction Method: Principal Component Analysis.

APPENDIX C: SMARTPLS 4.0 Output

Appendix C1: Overview

Path coefficients-Mean, STDEV, T values, P values

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
CI -> FP	0.126	0.128	0.055	2.297	0.022
IM -> FP	0.269	0.278	0.056	4.817	0
RM -> FP	0.179	0.182	0.059	3.054	0.002
SI -> FP	0.168	0.161	0.064	2.62	0.009
TM -> FP	0.177	0.176	0.049	3.647	0
CB x TM -> FP	0.145	0.143	0.049	2.947	0.003
CB x SI -> FP	0.162	0.161	0.065	2.485	0.013
CB x IM -> FP	0.111	0.1	0.059	1.893	0.058
CB x CI -> FP	0.164	0.163	0.051	3.246	0.001
CB x RM -> FP	0.144	0.141	0.055	2.606	0.009

Appendix C2: Latent Variable Correlation

	CB	CI	FP	IM	RM	SI	TM
CB	1	0.2	0.196	0.126	-0.012	0.203	0.212
CI	0.2	1	0.399	0.283	0.32	0.332	0.245
FP	0.196	0.399	1	0.508	0.404	0.505	0.373
IM	0.126	0.283	0.508	1	0.287	0.397	0.257
RM	-0.012	0.32	0.404	0.287	1	0.365	0.133
SI	0.203	0.332	0.505	0.397	0.365	1	0.299
TM	0.212	0.245	0.373	0.257	0.133	0.299	1

Appendix C3: Cross Loadings

	CB	CI	FP	IM	RM	SI	TM
CB1	0.914	0.164	0.193	0.112	0.013	0.212	0.206
CB2	0.832	0.167	0.15	0.146	-0.073	0.18	0.143
CB3	0.868	0.237	0.182	0.139	0.043	0.171	0.277
CB4	0.879	0.138	0.121	0.09	0.001	0.168	0.135
CB5	0.872	0.156	0.188	0.065	-0.043	0.151	0.144
CI1	0.163	0.898	0.387	0.357	0.307	0.356	0.237
CI2	0.188	0.851	0.332	0.272	0.297	0.247	0.16
CI3	0.148	0.841	0.284	0.214	0.282	0.252	0.168
CI4	0.201	0.838	0.345	0.175	0.192	0.224	0.209
CI5	0.154	0.848	0.344	0.179	0.293	0.327	0.262
FP1	0.204	0.39	0.799	0.416	0.293	0.362	0.288
FP2	0.175	0.393	0.903	0.478	0.376	0.462	0.311
FP3	0.083	0.25	0.787	0.38	0.304	0.3	0.419
FP4	0.212	0.2	0.775	0.368	0.307	0.343	0.314
FP5	0.124	0.358	0.83	0.428	0.305	0.452	0.292
FP6	0.107	0.264	0.817	0.39	0.399	0.36	0.277
FP7	0.162	0.348	0.766	0.411	0.351	0.463	0.32
FP8	0.138	0.356	0.791	0.456	0.289	0.439	0.251
FP9	0.217	0.303	0.787	0.343	0.306	0.458	0.246
IM1	0.17	0.237	0.44	0.883	0.21	0.4	0.193
IM2	0.101	0.243	0.477	0.917	0.296	0.358	0.255
IM3	0.122	0.257	0.472	0.903	0.281	0.327	0.263
IM4	0.057	0.28	0.427	0.877	0.235	0.341	0.203
RM1	0.035	0.331	0.412	0.227	0.899	0.363	0.215
RM2	-0.117	0.196	0.293	0.246	0.806	0.264	0.111
RM3	0.019	0.284	0.402	0.284	0.836	0.274	0.125
RM4	0.04	0.229	0.268	0.198	0.832	0.304	0.09
RM5	-0.014	0.269	0.274	0.263	0.82	0.363	0.08
RM6	-0.029	0.259	0.235	0.115	0.789	0.253	0.089
RM7	-0.026	0.281	0.395	0.301	0.87	0.31	0.043
SI1	0.167	0.265	0.439	0.397	0.321	0.907	0.353
SI2	0.203	0.346	0.411	0.358	0.371	0.868	0.24
SI3	0.162	0.274	0.5	0.346	0.348	0.892	0.219
SI4	0.22	0.273	0.443	0.288	0.231	0.883	0.244

SI5	0.157	0.328	0.448	0.384	0.354	0.907	0.283
TM1	0.182	0.216	0.314	0.294	0.155	0.252	0.868
TM2	0.157	0.169	0.313	0.256	0.108	0.254	0.909
TM3	0.217	0.212	0.367	0.163	0.128	0.249	0.874
TM4	0.183	0.262	0.308	0.196	0.073	0.298	0.857

Appendix C4: Outer Loadings

	CB	CI	FP	IM	RM	SI	TM
CB1	0.914						
CB2	0.832						
CB3	0.868						
CB4	0.879						
CB5	0.872						
CI1		0.898					
CI2		0.851					
CI3		0.841					
CI4		0.838					
CI5		0.848					
FP1			0.799				
FP2			0.903				
FP3			0.787				
FP4			0.775				
FP5			0.83				
FP6			0.817				
FP7			0.766				
FP8			0.791				
FP9			0.787				
IM1				0.883			
IM2				0.917			
IM3				0.903			
IM4				0.877			
RM1					0.899		
RM2					0.806		
RM3					0.836		
RM4					0.832		
RM5					0.82		
RM6					0.789		
RM7					0.87		
SI1						0.907	
SI2						0.868	
SI3						0.892	
SI4						0.883	
SI5						0.907	

TM1							0.868
TM2							0.909
TM3							0.874
TM4							0.857

Appendix C5: Outer Loadings-Mean, STDEV, T values

	Original sample	Sample mean (M)	Standard deviation	T statistics
CB1 <- CB	0.914	0.908	0.044	20.86
CB2 <- CB	0.832	0.826	0.05	16.554
CB3 <- CB	0.868	0.864	0.042	20.552
CB4 <- CB	0.879	0.869	0.057	15.361
CB5 <- CB	0.872	0.869	0.044	19.814
CI1 <- CI	0.898	0.898	0.014	63.077
CI2 <- CI	0.851	0.85	0.026	33.105
CI3 <- CI	0.841	0.839	0.027	31.389
CI4 <- CI	0.838	0.837	0.03	27.895
CI5 <- CI	0.848	0.848	0.022	39.143
FP1 <- FP	0.799	0.798	0.029	27.572
FP2 <- FP	0.903	0.902	0.015	60.68
FP3 <- FP	0.787	0.787	0.03	26.26
FP4 <- FP	0.775	0.775	0.036	21.809
FP5 <- FP	0.83	0.829	0.024	34.447
FP6 <- FP	0.817	0.816	0.027	30.614
FP7 <- FP	0.766	0.765	0.03	25.408
FP8 <- FP	0.791	0.79	0.033	23.776
FP9 <- FP	0.787	0.788	0.03	25.846
IM1 <- IM	0.883	0.883	0.016	54.691
IM2 <- IM	0.917	0.916	0.013	68.987
IM3 <- IM	0.903	0.904	0.015	61.888
IM4 <- IM	0.877	0.877	0.018	49.422
RM1 <- RM	0.899	0.899	0.013	70.008
RM2 <- RM	0.806	0.805	0.031	25.894
RM3 <- RM	0.836	0.837	0.022	38.277
RM4 <- RM	0.832	0.83	0.03	28.022
RM5 <- RM	0.82	0.818	0.026	31.161
RM6 <- RM	0.789	0.787	0.033	23.753
RM7 <- RM	0.87	0.87	0.019	46.535
SI1 <- SI	0.907	0.907	0.014	65.457
SI2 <- SI	0.868	0.868	0.019	46.679
SI3 <- SI	0.892	0.892	0.014	62.715

SI4 <- SI	0.883	0.883	0.014	62.611
SI5 <- SI	0.907	0.907	0.013	70.614
TM1 <- TM	0.868	0.867	0.02	42.398
TM2 <- TM	0.909	0.908	0.013	69.194
TM3 <- TM	0.874	0.873	0.024	36.524
TM4 <- TM	0.857	0.855	0.027	31.516

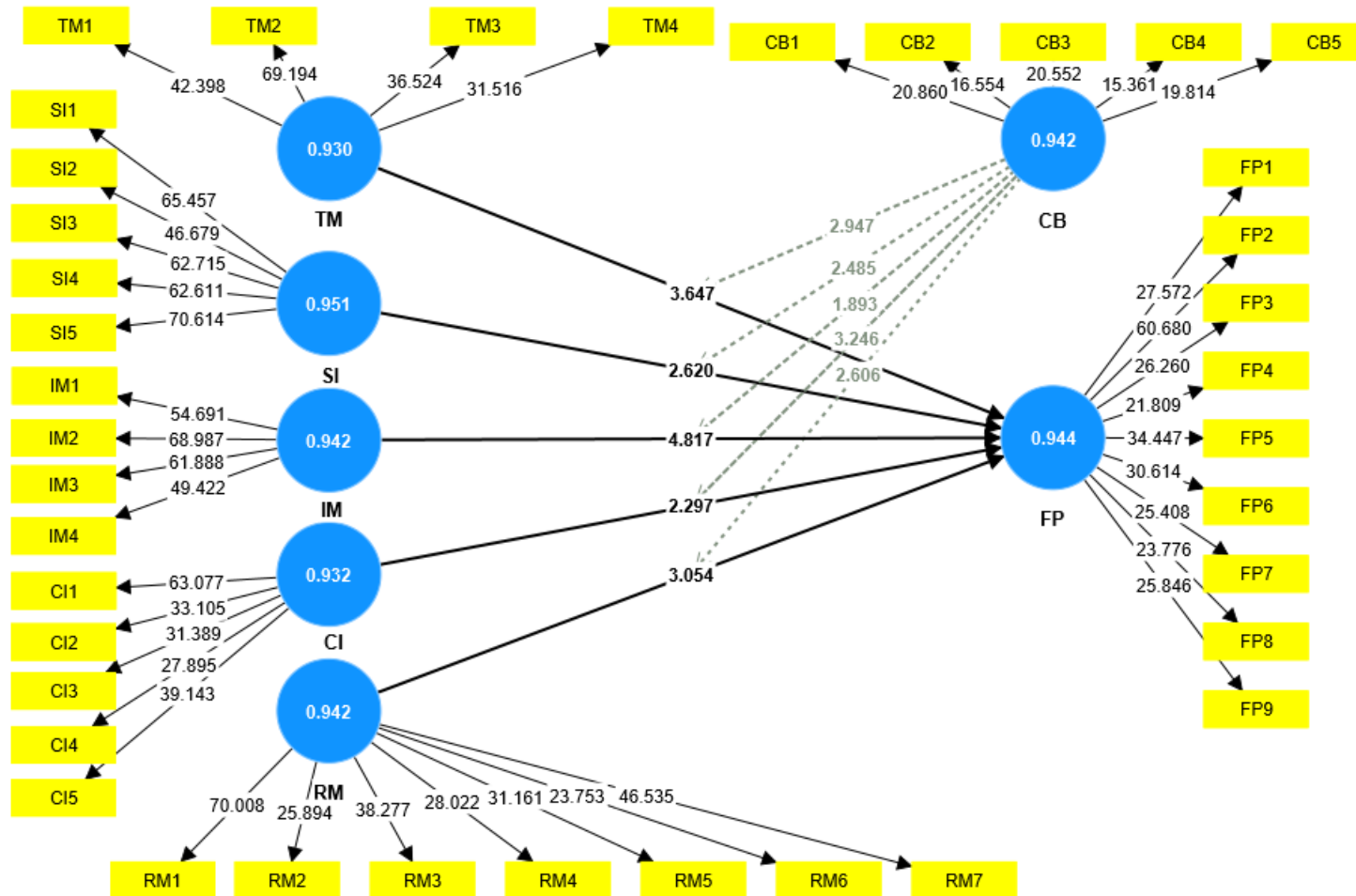
Appendix C6: Multicollinearity

	VIF		VIF
CB1	3.674	IM4	2.833
CB2	2.295	RM1	3.566
CB3	2.618	RM2	2.336
CB4	3.287	RM3	2.482
CB5	2.656	RM4	2.714
CI1	3.088	RM5	2.561
CI2	2.536	RM6	2.356
CI3	2.589	RM7	2.945
CI4	2.27	SI1	3.762
CI5	2.357	SI2	3.049
FP1	2.5	SI3	3.282
FP2	4.247	SI4	3.024
FP3	2.21	SI5	3.662
FP4	2.356	TM1	2.567
FP5	2.788	TM2	3.35
FP6	2.583	TM3	2.401
FP7	2.008	TM4	2.319
FP8	2.283	CB x SI	1
FP9	2.257	CB x CI	1
IM1	2.796	CB x TM	1
IM2	3.625	CB x RM	1
IM3	3.232	CB x IM	1

Appendix C7: Predictive Relevance (R^2)

	R-square	R-square adjusted
FP	0.683	0.661

Appendix C8: Research Model with Beta Values



Appendix C9: Research Model with P Values

