

Supply Chain Management and Business Performance of Agri-Farm Businesses in the Province of Rizal

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ABSTRACT

Agricultural enterprises in the Province of Rizal face persistent supply chain challenges, including fragmented supplier networks, inadequate post-harvest infrastructure, and limited coordination across production and distribution stages. This study assessed supply chain management (SCM) practices and their relationship with the non-financial business performance of agri-farm businesses in Rizal. Specifically, it examined SCM implementation using the Supply Chain Operations Reference (SCOR) Model dimensions of Plan, Source, Make, Deliver, and Return, alongside business performance indicators comprising cost efficiency, operational efficiency, and customer satisfaction. Employing a quantitative descriptive-correlational research design, the study involved 342 respondents,

consisting of 57 agri-farm owners, managers, and supervisors and 285 customers selected through stratified sampling. Data were collected using a validated five-point Likert scale questionnaire and analyzed through weighted means, analysis of variance (ANOVA), and Pearson's correlation coefficient. Findings revealed that SCM practices were implemented to a high extent, with Source receiving the highest assessment and Return the lowest. Business performance was likewise rated high, particularly in customer satisfaction. ANOVA indicated no significant differences in SCM assessments across demographic profiles, while significant differences emerged between respondent groups regarding business performance evaluations. Pearson correlation established a significant positive relationship between SCM practices and business performance, with Deliver and Return demonstrating the strongest associations with cost efficiency. The findings highlight the importance of delivery reliability and reverse logistics in improving agribusiness performance. The study provides a SCOR-based framework to guide agri-farm operators, cooperative managers, and policymakers in strengthening supply chain efficiency, operational competitiveness, and sustainable agricultural business development within the province.

Keywords: *supply chain management, SCOR model, agri-farm businesses, non-financial business performance, Rizal Province*

INTRODUCTION

Agricultural operations worldwide is undergoing a profound transformation, driven by rapidly growing emerging companies where rising incomes and shifting dietary patterns create vast market opportunities. The agricultural sector, which contributes approximately 4% of global GDP and exceeds \$5 trillion in values, is central to the world's economic and nutritional security. The industry's foundation rests on an estimated 570 million farms, the majority of which are small, family-run operations. While these small farms are crucial for local economies and employment, their successful integration into modern global supply chains remains a formidable challenge (Lavan, 2023).

Agri-farms, as operational units within the agricultural sector, refer to farm-level enterprises engaged in the production of crops, livestock, poultry, and aquaculture products. Unlike the broader agribusiness sector which encompasses processing, distribution, and retail, agri-farms focus specifically on primary production activities. In the Philippines, agri-farms range from small family-run operations to medium and large-scale commercial farms that serve as the foundation of the agricultural supply chain. These farms face unique challenges in managing their supply chains, including input sourcing, production management, product delivery, and the handling of returns and post-harvest losses. The complex structure of agribusiness-ranging from informal to local vendors to powerful multinational corporations such as Nestle underscores a critical operational need: the adoption of sophisticated Supply Chain Management (SCM) to ensure the consistent delivery of safe, quality agricultural products while maintaining ethical and environmental viability across the entire system (HL Agro, 2024).

The significance of supply chain management to organizational success has been well-established in management literature. In contemporary business environments, enterprise can no longer function as independent entities: they must operate as interconnected nodes within coordinated supply chain networks. This interdependence makes effective SCM a prerequisite for establishing and sustaining competitive advantage in both local and global market (Aitken, Christopher, & Towill, 2002). For agri-farms, this interconnectedness is particularly acute given the inherent complexity of agricultural supply chain, which involve multiple stakeholders, including input suppliers, farmers, processors, transporters, wholesalers, and retailers, each of whom must function in coordinated alignment to deliver value to the final customer.

Agriculture remains one of the most essential pillars of global development, providing the world's population with food, raw materials, and employment opportunities. As the global population is projected to approach 9.7 billion by 2050, the pressure on agricultural systems to meet growing food demand continues to intensify (United Nations, 2019). This increasing demand, driven by urbanization, rising incomes, and changing consumption patterns, has accelerated the transformation of the global agri-food system. Today, agribusiness-which contributes nearly 4% to global GDP and exceeds 5\$ trillion in annual value is a highly interconnected network in which production, processing, logistics, and distribution occur across multiple countries and regions (Lavan, 2023). However, this global interconnectedness also exposes agricultural supply chains to a variety of risks including climate-related disruptions, volatile markets, geopolitical tensions, and transportation bottlenecks. These vulnerabilities underscore the critical need for resilient and efficient Supply Chain Management (SCM) to ensure stability, sustainability, and competitiveness in agricultural production (Ivanov, 2020).

Supply chain management in agri-farms encompasses the coordination and optimization of all processes and activities required to ensure the smooth, efficient, and cost-effective flow of products, information, and finances across the entire agricultural supply chain. In crop production specifically, SCM involves the integration of input procurement, planting and cultivation management, harvesting, post-harvest handling, distribution, and post-delivery support into a coherent operational system that responds dynamically to market demand, seasonal cycles, and resource availability (Chopra & Meindl, 2019).

Crop production is a particularly complex operational context for SCM because of the inherent biological, environmental, and market uncertainties that govern farm-level operations. Unlike manufactured goods, agricultural crops are perishable, seasonal, and subject to weather biological risks. A delayed harvest, a broken cold chain, or an inefficient logistics arrangement can result in significant post-harvest losses, market disruptions, and diminished farm profitability. Effective SCM in crop production therefore requires that farm managers not only optimize individual operational activities but also ensure that all activities across the supply chain – from input sourcing to final product delivery – are tightly coordinated and aligned with broader market demands (Wirda et al., 2025).

In agricultural settings, supply chain management has evolved from a logistics-focused function to a strategic management discipline that addresses the full range of operational, relational, and informational dimensions of the farm enterprise. Aitken, Christopher, & Towill (2002) posited that businesses operating

within interconnected supply chains require effective SCM as a prerequisite for sustained competitive advantage. This perspective is particularly relevant for agri-farms, which operate within multi-tiered supply networks involving upstream input suppliers and downstream market channels. Effective agricultural SCM ensures that raw materials, production inputs, and final products move seamlessly across various stages from production to distribution while minimizing waste, reducing costs, and enhancing profitability (Chopra & Meindl, 2019).

Furthermore, supply chain resilience plays a critical role in mitigating risks associated with market instability, and external disruptions in agricultural operations (Ivanov, 2020). The coordinated planning, execution, and monitoring of every stage involved in the production, processing, and distribution of agricultural products from farms to final consumers is the defining function of agribusiness supply chain management. This encompasses the procurement of raw inputs, manufacturing and value-addition processes, inventory and transportation management, and adherence to food safety and sustainability standards. Building consumer confidence and stakeholder trust requires efficient resource utilization, waste reduction, and improved traceability, all outcomes of effective agricultural SCM (Tracextech, 2024).

In the Philippine context, the Province of Rizal presents a compelling case for investigating SCM in agri-farm production. According to the Rizal Provincial Government Official Website, Rizal Province is very affable for agricultural development in consideration of climatic condition, soil fertility and proximity to markets. There are about 6,019.58 hectares with diversified or high value crops like vegetables, fruits and root crops. There are 13,917 farms in the province of Rizal, according to the Philippine Statistics Authority's most current census. It displays how quickly the province has grown since 2002. Agriculture supply chain management produces and delivers fruits, vegetables, and animal-based products. It involves farmers, transporters, warehouses, retailers, suppliers, and consumers. It comprises new product development, distribution, finance, marketing, and customer service. Producers, traders, processors, and buyers have structured relationships in a coordinated supply chain (Abelardo, 2023). Farmers in the Philippines are now being encouraged to shift to high-value vegetable planting. This will bring opportunities to farmers because of the increasing demand for vegetables. Different vegetables are being sourced from Eastern Rizal to be able to aid in the expensive crops being sold in Manila markets (Estrella, 2020).

Rizal farms, operate within a dynamic supply chain ecosystem shaped by distinct geographic and market characteristics. Livestock and aquaculture likewise play substantial roles, with the province being a known hog-producing region and part of the productive zone of Laguna de Bay. Despite these resources, agri-farms in Rizal face pronounced challenges such as fragmented supplier networks, infrastructure constraints; especially in upland municipalities, proximity to major urban markets that demand high reliability, and freshness standards. These challenges make Rizal's agri-farms a relevant and timely context for examining how SCM practices are implemented at the farm level and how they relate to overall business performance.

Micro, Small, and Medium Enterprises (MSMEs) constitute a significant portion of agri-farm population by promoting value addition to farm products, raising smallholder farmers' incomes, and generating a range of economic possibilities in rural regions where poverty is still prevalent (GGGI, 2021). However, because restricted access to financing and vulnerability to natural disasters, and limited organizational capacity, MSMEs are often unable to fully realize the agricultural potential that their landholding and locations afford. Strengthening SCM competencies among these farm enterprises is therefore not only a business management imperative but also a development priority for Rizal province.

This study adopts the Supply Chain Operations Reference (SCOR) model as the primary analytical framework for evaluating SCM among agri-farms in Rizal. The SCOR model, originally developed in 1996 by the Supply Chain Council now part of the Association for Supply Chain Management (ASCM) is the internationally recognized, cross-industry standard tool for supply chain analysis, benchmarking, and performance improvement (APICS, 2017). The SCOR model describes the supply chain activities across

five core management processes: Plan, Source, Make, Deliver, and Return. Each process addresses a distinct operational domain of the supply chain, together spanning all customer interactions from order entry through paid invoice, and all product transactions from the supplier's supplier to the customer's customer (APICS, 2017). For agri-farms, the SCOR model offers significant advantages as an evaluative framework. Its standardized definitions and metrics allow for meaningful comparison across farms of different sizes and operational contexts. Its process-based structure captures the full sequence of operational activities in crop production. And its performance attributes align directly with the non-financial performance dimensions that are most operationally relevant to farm-level enterprises, where formal financial accounting may be limited but where process-level performance improvements can yield measurable competitive and economic advantages (Callado et al., 2015; Wirda et al., 2025).

Research Objectives and Key Questions

The study aims to examine and evaluate the Supply Chain Management and Business Performance of Agri-farm Businesses in the Province of Rizal.

Specific Objectives:

To identify and assess the supply chain management implemented by agri-farm businesses in the Province of Rizal.

To assess the level of business performance among agri-farm businesses in terms of cost efficiency, operational efficiency, and customer satisfaction.

Statement of the Problem

This study sought to address the Supply Chain Management and Business Performance of Agri-Farm Businesses in the Province of Rizal; it aimed to address the following questions:

1. What is the demographic profile of the respondents when grouped according to:
 - 1.1. farm owners/managers/supervisors
 - 1.1.1. location;
 - 1.1.2. years of operation;
 - 1.1.3. business size;
 - 1.1.4. initial capital;
 - 1.1.5. present capital;
 - 1.1.6. average monthly revenue;
 - 1.1.7. average monthly expenses;
 - 1.1.8. average customers per day;
 - 1.1.9. age;
 - 1.1.10. years of service in the business; and
 - 1.1.11. sex?
 - 1.2. customers
 - 1.2.1. location;
 - 1.2.3. how long have you been a customer;
 - 1.2.4. age; and
 - 1.2.5. sex?
2. How do the farm owner/manager/supervisor assess the supply chain management of agri-farms in terms of:
 - 2.1. plan;
 - 2.2. source;
 - 2.3. make;
 - 2.4. deliver; and

2.4. return?

3. Is there a significant difference in the assessment of farm owner/manager/supervisor of supply chain management of agri-farm businesses in terms of their demographic profile?
4. What is the level of business performance of agri-farms in Rizal in terms of:
 - 4.1. cost efficiency;
 - 4.2. operational efficiency; and
 - 4.3. customer satisfaction? (for agri-farm customers)
5. Is there a significant difference in the level of business performance of agri-farms as evaluated by the two groups of respondents?
6. Is there a significant relationship on the assessment of supply chain management and business performance of agri-farms?
7. Based on the findings of the study, what supply chain management framework can be proposed?

Justification of Research Significance in the field of Business Management

The study entitled “*Supply Chain Management and Business Performance of Agri-Farm Businesses in the Province of Rizal*” is highly significant to the field of Business Management as it addresses the growing need for strategic efficiency and competitiveness in agri-farm operations through the lens of Supply Chain Management (SCM) utilizing the SCOR Model.

In today’s dynamic and uncertain market environment, SCM is recognized as a vital component of organizational success, integrating procurement, production, logistics, and customer relations into a cohesive system that enhances value creation and business sustainability (Chopra & Meindl, 2019). For business managers and operators, understanding how effective supply chain management influences performance provides critical insights for improving operational processes, resource allocation, and market responsiveness.

In the context of agri-farms, the study contributes to the practical application of management theories in a sector that faces unique challenges-such as fluctuating demand, perishability of goods, and dependency on natural conditions (Ahumada & Villalobos, 2011). By focusing on non-financial performance indicators-specifically cost efficiency, operational efficiency, and customer satisfaction, this study aligns with modern performance management frameworks that emphasize process improvement and customer-centric strategies rather than purely financial outcomes (Kaplan & Norton et al., 1996). These measures are particularly relevant for agri-farms in emerging economies, where financial transparency and record-keeping may be limited but where operational improvements can still yield measurable competitive advantages.

Moreover, this research contributes to managerial decision-making by offering empirical evidence on which supply chain practices drive better performance outcomes. The findings of this study can help agri-farm businesses in Rizal to formulate policy, provide training, and innovation initiatives that can strengthen the province’s contribution to regional economic development.

Lastly, this study enriches the literature in business management by bridging SCM theory and agri-farm performance. Agriculture plays a vital role in the Philippine economy, particularly in rural areas such as Rizal. They contribute to food security, employment, and local economic resilience. Abrokwah (2018), found a positive correlation between SCM and performance in agri-farms, highlighting the strategic value of supply chain optimization. Understanding these linkages enables agri-farm stakeholders to make data-driven decisions that improve operational outcomes. It supports the idea that effective supply chain strategies are not limited to large corporations but are equally essential to the survival and competitiveness of micro, small and medium enterprises (MSMEs).

Brief Summary of Methodology

This study utilized a quantitative research approach employing a descriptive-correlational research design to examine the relationship between supply chain management (SCM) and business performance of agri-farms in Rizal. The descriptive aspect was used to determine and describe existing SCM and performance levels of agri-farms, while correlational aspects aimed to identify the degree of relationship between SCM and non-financial performance indicators such as cost efficiency, operational efficiency, and customer satisfaction.

Quantitative research techniques, data gathering and analysis was conducted with the use of statistics (Rashid et al., 2019). Quantitative data does not gather exhaustive information from participants but utilizes many of them to generalize the findings. The objective of data evaluation is to establish a relationship between variables and the acceptance or rejection of the study hypothesis. The quantitative technique gathers data objectively, enabling the data to be minimized (Khan et al., 2022).

Descriptive-Correlational research design was deemed appropriate as it allows the researcher to describe existing conditions and determine the degree of relationship between variables without manipulation (Calderon & Gonzales, 2020).

The study involved two groups of respondents: (1) agri-farm owners, managers, supervisors, who provided data on SCM and for the internal aspects of business performance, particularly cost efficiency and operational aspects of business performance, these individuals were considered the most knowledgeable about their respective organizations' operations, processes, and managerial decisions related to supply chain management and (2) customers of these agri-farms, who served as respondents for the customer satisfaction component of business performance. Since customer satisfaction reflects the external perception of performance, it was essential to gather responses directly from customers who had recent experience purchasing from or engaging with the agribusinesses.

Using stratified sampling, respondents were selected to ensure fair representation across agri-farms and customer segments. Data were collected through a structured and a validated questionnaire, which included sections on SCM practices and business performance indicators using a Five-point Likert scale.

Statistical tools such as frequency, percentage, weighted mean, ANOVA, and Pearson's correlation coefficient (r) were employed to analyze the data. The findings from these analyses aimed to determine the level of SCM implementation, assess business performance, and identify the significant relationship between these variables.

Literature Review

Supply Chain Operations Reference (SCOR) Model

The SCOR model is widely used in industry and has become the standard for supply chain management. According to Raj, Anita (2024) SCOR is a performance-based framework for managing supply chain activities. The components of the SCOR model are Plan, Source, Make, Deliver, and Return.

Plan this process involves demand and supply planning, which includes balancing resources with requirements and establishing plans for the supply chain. It also encompasses the management of business rules, data collection, inventory, capital assets, transportation, and regulatory requirements. Planning procedures primarily illustrate the tasks involved in devising strategies for supply chain management (Saleheen, Habib & Hanafi, 2018). The processes encompass the gathering of requirements, data on available resources, the alignment of requirements with resources to determine intended capabilities and deficiencies in demand or resources, and the identification of measures to rectify these deficiencies (Prasetyaningsih, Muhamad & Amolina, 2020).

Source category covers the sourcing of stocked, make-to-order, and engineer-to-order products. It includes scheduling deliveries, receiving and transferring products, authorizing supplier payments, and managing supplier performance and incoming inventory. Source procedures specify the order or schedule

of deliveries and the procurement of products and services (Lemghari, Okar & Sarsi, 2018). These procedures include the issuance of purchase orders, scheduling of deliveries, reception, validation, and storage of commodities, along with the acceptance of bills from suppliers (Nguyen, 2024).

Make focuses on production activities, including scheduling and managing production, testing, packaging, preparing for delivery, and releasing production orders. The phrase 'conversion of materials' is utilized in place of production or manufacturing because 'make' includes all types of material transformation. Assembly, chemical processing, maintenance, repair, overhaul, recycling, refurbishment, remanufacturing, and other common terms for material conversion processes (Ikatrinasari, Harianto & Yuslistyari, 2020).

Deliver involve order management, warehousing, transportation, and distribution activities. It includes everything from managing customer orders to transporting products to the destination. Delivery process encompasses the receipt, validation, and generation of client orders, the scheduling of order delivery, picking, packaging, shipment, and customer invoicing. The Deliver Retail process provides a condensed view of the Source and Deliver procedures employed only in a Make-to-Stock retail operation.

Return addresses the return of products, whether due to defects, excess, or obsolescence, and includes return receipt, scheduling, and disposition. Return processes specify the facts concerning the reverse flow of products (Putri, Huda & Sinulingga, 2019). The return process includes acknowledging the need for a return, deciding on the disposition, organizing the return, and managing the shipping and receipt of the returned items (Kusrini, Caneca, Helia & Miranda, 2019). Return process elements do not specify the operations of repair, recycling, refurbishing, and remanufacturing.

These hierarchical connections enable the categorization of processes. To improve performance and gain a competitive edge, supply chain processes must be evaluated and improved using the metrics of the Supply Chains Operations Reference (SCOR) model (Rodriguez, Manay, Guaita-Pradas & Marques-Perez, 2022). The SCOR model metrics support the goals of supply chain management and provide a reliable framework for evaluating and improving supply chain performance in enterprises (El-Garaihy, 2021).

Process of Supply Chain Management

According to Kerutagi, M. et al., (2024) the process of agri supply chain management involves the following: Procurement involves sourcing and acquiring the necessary inputs, such as seeds, fertilizers, and machinery from suppliers. Agribusinesses establish relationships with reliable suppliers and negotiate contracts to ensure a steady and quality supply of inputs. Procurement decisions consider factors such as cost, quality, reliability, and sustainability. Production Planning involves strategic decision-making to optimize production capacity, allocate resources, and meet market demands. It includes forecasting demand, crop rotation planning, determining optimal planning schedules, and managing labor and equipment requirements. Effective production planning ensures efficient resource utilization and minimizes production gaps or surpluses. Inventory Management is essential for balancing supply and demand and minimizing wastage. Agribusinesses must carefully manage their inventory of agricultural inputs, work-in-progress products, and finished goods. This involves tracking inventory levels, monitoring shelf life and quality, and employing techniques like just-in-time (JIT) inventory management to optimize stock levels. Transportation and Logistics are fundamental components of agribusiness supply chain management. The efficient and reliable movement of agricultural products from farms to processing facilities, distribution centers, and ultimately to consumers is crucial for maintaining product quality and minimizing waste (Rejeb et. Al., 2018) Effective transportation management involves selecting appropriate modes of transport (road, rail, sea, air), optimizing routes, consolidating shipments, and managing logistic networks. Efficient logistics reduce lead times, minimize costs, and ensure timely delivery. Distribution and Customer Service in agribusiness must ensure that products reach the intended customers efficiently and effectively. This involves selecting appropriate distribution channels, managing relationships with distributors and retailers,

and providing excellent customer service. Order processing, timely delivery and accurate product information contribute to customer satisfaction and loyalty. Information Management and Technology play a crucial role in supply chain management. Agribusinesses utilize technologies like Enterprise Resource Planning (ERP), Warehouse Management Systems (WMS), and Supply Chain Management software to capture and analyze data, monitor inventory, track shipments, and make informed decisions. Real-time data sharing among stakeholders enhances visibility and enables proactive problem-solving. Collaboration and Relationship Management building strong relationships among supply chain partners are key to successful supply chain management in agribusiness. Agribusiness works closely with farmers, processors, distributors, and retailers to ensure smooth coordination, information sharing, and joint decision-making. Collaborative practices like contract farming, where farmers and agribusinesses have long-term agreements, foster closer relationships and promote mutual benefits.

Evolution of SCM in the Agribusiness Context

Agribusiness plays a crucial function in the economic transformation through the development of agro-based industries and provision of employment and income (Katua 2014 et. al.) Agribusiness investments accelerate agricultural expansion through the establishment of new markets and development of a vibrant input supply sector. Tarafdar and Qrunfleh (2017) stated that adopting an integrated move towards supply chain management (SCM) relationship is a great path to conforming to the changing needs of the customer. For firms to remain focused and sustain competitive advantage and performance goals in both local and international markets, the most successful approach is through SCM (Li et al., 2006). Agribusiness firms adopt SCM strategies to minimize cost by leveraging production and contribution activities to the enterprise suppliers and to fulfil customer requests by delivering standardised products that meet customer's satisfaction (Ince et al. 2013).

A supply chain consists of manufacturers, suppliers, transporters, warehouses, wholesalers, retailers and finally the customers. The entire supply chain of each of the organisations within the network of companies contributes to delivering value to the customer. This also includes new product development, marketing, operations, distribution, finance and customer service (Chopra & Meindl, 2015); thus, the effective management of a supply chain is imperative to establish and withstand competitive advantage in products and services of the firms.

In addition, researchers Alfalla-Luque et al. (2013), and Prajogo and Olhager (2012) detailed that integrating and handling the main components of information was paramount to the successful performance of the supply chain and the firm. Similarly, Ince et al (2013) worked on the impact of enterprise resource planning systems and SCMP on firm performance, and their finding supports that effective SCM practices have an appreciable effect on the competitive advantage and firm performance. With the growing interest of scholars and experts over the past decades on SCM, Bechtel and Jayaram (1997), and Burgess, Singh and Koroglu (2006) regarded it as a vital constituent for operational success and the integration of numerous business procedures including demand scheduling and predicting, purchasing, engineering and assembly, delivery, resource management and customer management (Lummus et al. 1997; Mentzer et al. 2001). However, organisations must have blueprints to integrate and connect cross-functional activities internally and externally with the procedures of suppliers and customers to enhance a firm's performance in the supply chain.

In today's highly competitive and dynamic market environment, effective inventory management is crucial for the success and sustainability of businesses. Inventory management involves the supervision of non-capitalized assets, or inventory, and stock items. It plays a pivotal role in ensuring the right quantity of products is available at the right time to meet customer demand while minimizing costs associated with holding and ordering inventory. One of the most significant challenges in inventory management is currently predicting future demand. Demand forecasting is the process of making estimations about future customer demand using historical data, market analysis, and statistical tools. Accurate demand forecasting

enables businesses to optimize their inventory levels, reduce excess stock, avoid stockouts, and improve overall supply chain efficiency. Forecasting techniques have been an essential part of inventory management. This technique is commonly used in the planning of production and supply chain (Harahap et al., 2025).

Agriculture Supply Chain

The agricultural supply chain is vital to the Philippine economy because it guarantees food security and promotes rural development. However, there are several challenges that can obstruct its growth and sustainability.

Agriculture supply chains are distinct from industrial supply chains due to their high exposure to environmental risks, short product life cycles, varying production volumes, and dependence on smallholder producers. These characteristics require supply chain frameworks that can evaluate both operational efficiency and vulnerability to disruptions. Studies emphasize that integrating performance models with SCOR allows to better analyze bottlenecks, plan for variability, and design interventions that respond to the realities of agri-food production systems (Moazzam, 2018; Khandelwal, 2021).

According to Abelardo, N. 2023, agriculture supply chain management produces and delivers fruits, vegetables, and animal-based products. It involves farmers, transporters, warehouses, retailers, suppliers, and consumers. It comprises new product development, distribution, finance, marketing, and customer service. Producers, traders, processors, and buyers have structured relationships in a coordinated supply chain. People's purchasing power has risen globally, particularly in developing countries like India. This has increased consumption of high-value fruits, vegetables, and animal protein. Governments of these emerging economies want to encourage private investment in agricultural marketing infrastructure. They are making it easier for businesses to enter the market and promoting a coordinated supply chain.

Definition and Importance of Agribusiness

According to Goldberg (1957), Agribusiness is the sum of all operations involved in manufacture and distribution of farm supplies, production operations on the farm, and the storage, processing, and distribution of farm commodities. Another definition from Edwards & Schultz (2005), defines that agribusiness is a dynamic and systematic endeavor that serves consumers globally and locally through innovation and management of multiple value chains that deliver valued goods and services derived from the sustainable orchestration of food, fiber and natural resources.

Agribusiness is generally the commercial aspect related to agriculture or agricultural activities and its products. The Agribusiness sector is engaged in the production and operations of a farm, the manufacture and distribution of farm equipment and supplies, and the processing, storage, and distribution of farm commodities. The very core of the industry is agriculture, which is supported by the manufacturing sector and service sector. The Agribusiness sector is quite diverse as it encompasses input production, farm operations and management, equipment and supplies manufacturing, food/non-food processing, trading, and retailing.

The Philippine Agribusiness sector is roughly composed of five (5) subsectors; these are crop production, animal production (includes livestock and poultry), Forestry and Logging, Fishery (including aquaculture) and Agri-support services and manufacturing. Crop production subsector includes farms that mainly grow crops and fruits that are eventually processed for food and fiber. It remains the major activity of the industry with 49% of the overall production. Following crop production is the Fishery subsector occupying 25% of the overall production. Fishing activities include local and commercial fishing, fish cage/pen operations and seafood production. Animal production comes third, capturing 21% (11% livestock; 10% poultry), whose activities range from small farming to large ranches that raise animals for sale or for animal products. Lastly, Forestry, Logging, and Agri-support services share the remaining activities of the industry (Bugador, 2015).

If synthesized, agribusiness comprises all organizations in various sizes (micro, small, medium or large) that engage in the production, distribution, marketing, or utilization of food fiber, forest products, or biofuel, including those that supply water and collect waste from those organizations. Thus, agribusiness simply pertains to the application of theories and practices of business administration to organizations engaged in agriculture and agriculturally related products and services (Van Fleet, 2016).

The occupations in this industry vary widely as it contains the agriculture, manufacturing, and service sectors. Training, skills, and qualifications depend on the nature and scope of work some of the industry participants engage in.

Sustainable Agribusiness and Supply Chain

Sustainability is a critical consideration in agribusiness, aiming to meet present needs while preserving resources and ecosystems for future generations. Sustainable practices in agribusiness focus on minimizing negative environmental impacts, ensuring social responsibility, and maintaining economic viability. This holistic approach encompasses various aspects, including resource management, biodiversity conservation, climate change mitigation, and responsible business practices. The concept of sustainability in agribusiness supply chains encompasses various dimensions. Environmentally sustainable practices include reducing greenhouse gas emissions, conserving water resources, minimizing chemical inputs, and protecting biodiversity. Social sustainability involves fair trade, ethical sourcing, respect for human rights, and ensuring the well-being of workers and local communities. Economic sustainability focuses on the long-term profitability and viability of agribusinesses, enabling them to invest in sustainable practices and adapt to market dynamics (Seuring et. al., 2008).

Agriculture in Rizal Province

According to Balita, C. (2025), the Philippines is primarily an agricultural country with a large portion of Filipinos living in rural areas and supporting themselves through agricultural activities. Preliminary figures for 2022 reported about a quarter of employed Filipinos work in the agricultural sector which is made up of four sub-sectors: farming, fisheries, livestock and forestry. In the same year, the sector generated a gross value added (GVA) of about 1.78 trillion Philippine pesos, equivalent to about 8.9 percent of the country's gross domestic product (GDP).

CALABARZON registered reductions in the value production in agriculture and fisheries at constant 2018 prices in 2021. By province, Rizal posted the highest annual decline in the value of production at -41.9 percent. Decreases were also noted for Laguna at -25.3 percent, Cavite at -8.5 percent, Batangas at -6.1 percent and Quezon at -3.4 percent. Batangas had the largest share of the total value of production in agriculture and fisheries in CALABARZON at 42.4 percent in 2021. The province also had the highest contribution in livestock at 58.4 percent and poultry at 52.8 percent. Meanwhile, Quezon accounted for the largest share in cops at 52.4 percent and fisheries at 38.8 percent. At current prices, Batangas has the highest value of production in agriculture and fisheries among the provinces in CALABARZON amounting to PhP 67.74 billion in 2021. This was followed by Quezon at PhP 44.75 billion, Laguna at PhP 14.09 billion, and Cavite at PhP 13.26 billion. Rizal recorded the lowest value of production of PhP 11.97 billion. The Provincial Value of Production in Agriculture and Fisheries serves as a primary input in the estimation of the Provincial Product Accounts (Del Prado, 2022).

According to the Binangonan Municipal Agriculture Office (MAO), bangus stockings/fingerlings were priced at P2.00 per piece. Meanwhile, feeds were priced at P1,500.00 per 1 cavan. The Farm Plan and Budget for bangus production requires a total of P538,200.00 capital requirement to be able to put up one hectare of fish cage. Problems encountered in this industry include variable climates, lake pollution and siltation, and establishing a strong relationship with suppliers. Considering that the bangus fishing industry in the municipality is already at its maturity stage, these problems are inevitable.

Challenges in the Agriculture Sector

The agribusiness sector grapples with distinct challenges. While these challenges largely hinge on the geographical areas where an agribusiness organization functions, there are a few universally common issues (Fiona, L., 2023). Climate Change in the earth's thermostat continues its relentless climb, the world of agricultural production and global food security are set to face an unprecedented test of resilience. Businesses in the sun-soaked regions of North Africa will find themselves wrestling with dwindling yields, while farmers will grapple with capricious revenues and the looming specter of crop failure. Regions currently teetering on the brink of food insecurity, like Sub-Saharan Africa, and areas parched by water security, like India, will bear the brunt of this challenge. Sustainability Pressures in agribusiness is set to shake the very foundations of conventional practices. Those in the eye of the storm will be existing businesses whose strategies are out of sync with global climate goals, sectors with colossal carbon footprints such as beef livestock, and markets vulnerable to the rising tide of consumer climate consciousness-palm oil springs to mind. Slowing Productivity or the deceleration of agricultural productivity growth is casting ominous shadows over global food security. Those facing the firing line are agribusiness sectors heavily reliant on carbon-intensive inputs, regions witnessing explosive population growth like Sub-Saharan Africa, areas scarred by rapid soil erosion or severe degradation, and sectors thriving on deforestation and land degradation for increased output. Labor Shortages is the ticking time bomb of aging populations and waning interest in agricultural vocations is set to trigger labor shortages in the sector. This will push farmers into a corner, compelling them to dangle the carrot of higher wages to lure workers. Paradoxically, labor shortages will also lead to a surge in crop wastage, nudging prices northward. Rising Input Costs is dramatically reshaping the face of modern farming. Fertilizers, pesticides, machinery, and labor costs-everything's skyrocketing. Case in point, fertilizer prices leaped by 30% in 2022, hot on the heels of an 80% jump in 2021, a consequence of supply disruptions due to sanctions, export restrictions, and curtailed European ammonia production. Feed prices followed suit in 2022, propelled by increasing fertilizer costs and feed shortages triggered by the Ukraine-Russia crisis.

Agribusiness and the Sustainability Challenge

Agriculture, like many other activities in the contemporary world, has been substantially transformed by the application of intensification technologies, the globalization of agri-food markets and the financialization of production and consumption. As denounced by Vandana Shiva, "we are facing a deep and growing crisis rooted in how we produce, process, and distribute our food. An inefficient, wasteful, and unsustainable model of food production is pushing the planet, its ecosystems, and its diverse species to the brink of destruction". The image of an intense, globalized and money-making agriculture is commonly captured in everyday language by the expression of agribusiness. While agribusiness has no rigid or consensual definitions, it is directly associated with hyper-modern farming and the insertion into the cross-scale features of capitalist agriculture. The origin of the term agribusiness is historically attributed to Davis and Goldberg, who defines agribusiness as multiple operations involving the manufacture and distribution of farm supplies and the storage, processing and distribution of agricultural commodities. Agribusiness became ever since associated with a large agro-industrial complex under concentrated forms of corporate ownership and management. Progress towards higher levels of agricultural sustainability and better environmental governance are directly impacted by the controversial nature of sustainable development and by the acceptability of sustainability notions.

The Concept of Sustainability

Environmental awareness began in the 70's with the United Nations Conference on the Human Environment claiming that adequate measures should be implemented to face these problems (United Nations, 1972). Still, only in the 80's sustainability emerged as a clearer concept, when the World Commission on Environment and Development brought it into mainstream and defined sustainable

development as “development that meets the needs of the present without compromising the ability of future generations to meet their needs” (Harlem, 1987, p.41). Since then, the term sustainability has been defined in numerous ways. According to Charter and colleagues 92002, p.10), sustainability means “to maintain or prolong both environmental and human health and simply good management”. Van de Kerk and Manuel (2008) suggest that it comprises the depletion of resources, the conservation of nature and other ecological aspects, and the human well-being and quality of life. In fact, sustainability has been given approximately three hundred alternative definitions (Santillo, 2007; Hult, 2011; Borowy, 2013). According to (Farsi, H., et al., 2017), understanding the sustainability concept is a major matter as it is the basis for sustainability assessment.

In the last decade, building sustainable supply chains has gathered tremendous attention from environmentalists, NGOs, and businesses. This society-wide sustainability initiative has influenced many firms’ supply chain strategies. For instance, Wal-mart in 2005 launched three overarching sustainability goals: (1) use 100% renewable energy; (2) produce zero waste; (3) sell products that sustain our resources and environment (Denend and Plambeck, 2007). To achieve these goals, the company examined various aspects of its supply chains to identify areas that offered the most potential for sustainability. And it used various incentives to motivate its suppliers to contribute to its sustainability goals.

Sustainability as a Priority in SCM

Supply chains are at the heart of global commerce, connecting raw materials to finished products. However, they’re also responsible for a significant portion of greenhouse gas emissions, deforestation, and resource depletion. Integrating sustainability into supply chains isn’t just about corporate social responsibility—it’s about future-proofing businesses. Companies that adopt sustainable practices can reduce environmental harm, build resilience, and meet the growing demand for ethical products. The growing number of agri-tourism businesses acknowledges implementing sustainable practice because it helps their businesses survive while attracting nature-focused visitors. The subsequent part of the literature review explores actual sustainable practices used in the agri-tourism sector while analyzing their implementation and resulting effects. According to Luther, D. (2020), supply chain sustainability benefits not only companies’ own interests and those of their stakeholders but also society and the planet at large. For many companies, sustainability is no longer just something to monitor, but integral to the foundation of their supply chain.

Business Sustainability

The agricultural sector is concerned with improving its performance. This concern is evident in the financial and production statistics already widely collected. However, production efficiency and financial performance are not the only goals of individual farmers, agricultural industries, or policymakers. The vision of what it means to be a good farmer or a healthy sector is much broader. Sustainable development itself is a politically defined term and was defined by the Brundtland Commission as development that ‘seeks to meet the needs and aspirations of the present without compromising ability to meet those of the future’ (WCED, 1987). Various disciplines have addressed the interpretation of sustainability, cultural sustainability, environmental sustainability and economic sustainability. Social sustainability includes services of education and health. Cultural sustainability includes language, values and cultural aspirations. Of relevance here is economic sustainability. Agribusiness is a special case when considering sustainability indicators. Agricultural production depends on natural capital to a much larger extent than industrial production, so that measures of natural capital, such as soil fertility and rainfall, are also economic capital measures.

According to Zvavahera, P. et al. (2023), agri-tourism has emerged as a potential tool for socio-economic development in developing countries that can lead to income generation, employment creations, diversification of livelihood, and poverty reduction in rural areas. Additionally, with agricultural holdings

expressing positive attitudes on the development of agritourism' and anticipating positive impacts on the economy, society, and the environment (Ciric et al., 2021). However, mere implication of farm to table concept does not automatically lead to a sustainable development of agri-tourism (Gajic, T., et al., 2024), and some developing countries faces several challenges including inadequate infrastructure, potential negative environmental and socio-cultural impacts if not properly planned and implemented (Lak, A. et al., 2022).

In Agri-tourism sustainability emphasizes the importance of community well-being and cultural integrity. Cavalleri, Sofia Anna Enrica et al., (2022) underscores the positive social transformation that may arise from community-based tourism. Their framework emphasizes that when local populations are actively involved in the planning and execution of agritourism initiatives, it fosters more resilient rural livelihoods. The study suggests that agritourism, when developed, can be a powerful tool for social enrichment. Additionally, in the study of Hollas, C. et al., n.d., the profitability of agritourism ventures in the United States carries significant social implications. While their focus was on economic viability, the success of these operations contributed to the overall well-being of rural communities by generating employment opportunities and supporting the continuation of agricultural traditions. However, according to Vu, A. 2023, the integration of tourism into remote communities can inadvertently lead to the erosion of local cultures and create social disruptions. Similarly, Larcher, M. et al., 2024 research findings suggest that the demands of tourism can sometimes alter traditional farming practices and potentially strain established social dynamics within the community.

Environmental sustainability is essential for preserving natural resources and promoting biodiversity. Ndhlovu, E. et al., (2024) analysis on agritourism and sustainability indicates that a significant theme in the research is the potential for agritourism to contribute positively to sustainability through the implementation of responsible environmental practices. This suggests a recognized capacity within the sector to align tourism with ecological preservation. According to Shen, C. et al., (2020) organic agritourism can contribute positively to environmental sustainability essentially, the study views organic agritourism as a promising approach for developing rural tourism in a way that is also environmentally friendly and sustainable in the long run. A study on the effects of agritourism development reveals potential negative environmental consequences for local communities.

Demographic Profile

Demographic characteristics of the participants are crucial for the success of agribusinesses. Age and sex are fundamental demographic variables that are widely used to segment populations for analytical and practical purposes. Age categorization allows insights into life stage-specific trends, while age groups reflect generational distinctions and evolving societal roles. Sex provides a binary classification that aids in understanding differentials in behaviors, access to resources, or policy impacts (Hayes, A., 2024). According to Santoso et al., (2020) Age played a significant role in one's capacity for business operations and performance enhancement. Enhanced performance was closely linked to physical, mental, and decision-making readiness, shaping one's approach to activities.

Firm Size and Age of the Business

Schiffer and Weder (2001) investigated how markets, governmental variables, and the economic growth of SMEs were affected by firm size. They conducted a global survey of 10,000 businesses across 80 countries and demonstrated that firm size was a significant factor in determining the success of a business. In terms of taxes and regulations, financing, inflation, corruption, street crimes, and anti-competitive behaviors, smaller businesses showed more issues than medium-sized and larger businesses. Watts et al. (1998) examined the growth and development requirements of SMEs in order to analyze the relationship between common management issues and organizational characteristics. Following a thorough analysis of the experience-based learning process and its effects on business growth, the growth process

disparities between large enterprises and SMEs were revealed. They claimed that the term "crisis" is notably problematic and that it is crucial to analyze internal crises independently from external crises. The Firm Foundations report found the age of a business was a useful indicator of business success. A longer-running company is probably more experienced and knowledgeable about the different production processes and the market, which might have an impact on a business plan. In addition to having larger reserves, a more established company may be better equipped to handle unforeseen circumstances or market downturns. A new company entering the market must think about how to best position their goods and services. The new company may be able to make more strategic decisions, such as differentiating its goods or services based on factors like quality, price, or innovation.

Non-Financial Indicators and the Balance Scorecard

In performance measurement, scholars recognize that non-financial indicators provide a more holistic view of organizational outcomes, especially in contexts where financial data may be limited or unstable. The Balanced Scorecard framework is widely used for this purpose because it integrates customer perspectives, internal processes, and learning dimensions alongside financial metrics. Recent analyses confirm that non-financial indicators such as efficiency, customer satisfaction, and process performance often serve as early predictors of operational improvements, making them highly relevant in agriculture-based enterprises (Madsen, 2025; Akinrinola, 2020).

Cost Efficiency

Cost efficiency is widely regarded as one of the key indicators of organizational performance, particularly in supply chain-driven industries such as agribusiness. In its broadest sense, cost efficiency refers to an organization's ability to minimize costs while maintaining or improving the level of output and quality (Heizer, Render, & Munson, 2017). It reflects how effectively a business utilizes its resources-such as labor, materials, equipment, and capital-to generate value.

In supply chain management (SCM), cost efficiency is shaped by how well different processes-procurement, production, logistics, and distribution-are integrated. Efficient planning practices help reduce forecasting errors, prevent overproduction, and optimize resource allocation, all of which reduce unnecessary expenditures (Chopra & Meindl, 2019). Effective sourcing strategies further contribute to cost efficiency by enabling firms to secure high-quality inputs at competitive prices while maintaining strong supplier relationships (Monczka et al., 2020).

Meanwhile, production efficiency-achieved through process standardization, quality control, and technology adoption-reduces operational disruptions, rework, and material waste (Slack, Brandon-Jones, & Burgess, 2018). Logistics and distribution are also major contributors to cost efficiency. Streamlined delivery systems reduce transportation costs, avoid delays, minimize fuel consumption, and prevent product spoilage-an essential concern for agribusinesses dealing with perishable goods (Rushton, Croucher, & Baker, 2017). Even post-sales activities, such as return processes and waste management, can improve cost efficiency by recovering value from defective or excess products (Lambert, Garcia-Dastugue, & Croxton, 2005).

From a managerial perspective, cost efficiency is considered a non-financial performance indicator, because it reflects internal operational strengths rather than direct financial results. It is argued that cost efficiency strengthens competitiveness by enabling firms to offer lower prices, reinvest in innovation, or buffer themselves against market shocks (Porter, 1985; Kaplan & Norton, 1996). In agribusiness, where profit margins are often narrow and input prices fluctuate, improving cost efficiency is crucial for long term survival and growth (Van der Vorst, 2009).

Operational Efficiency

Operational efficiency minimizes waste and maximizes resource utilization; it is a crucial component of sustainable business operations. According to Patra and Hota's (2024) analysis of the literature on eco-efficiency, businesses that implement eco-friendly practices frequently see an increase in their company value. ESG practices, like better governance and environmental management, can result in increased production and resource use, according to Xu and Wan (2024). According to Bello et al. (2020), operational excellence and cost savings are facilitated by sustainable practices including waste reduction and energy efficiency. When taken as a whole, these studies support the idea that efficiency is a means of achieving both sustainability and competitive advantage.

Operational efficiency may involve improved post-harvest handling, optimized storage processes, enhanced scheduling, and better coordination between suppliers and distributors, especially because agricultural products are often perishable and time-sensitive (Van der Vorst, 2009). It is also considered a non-financial indicator because it reflects internal strengths rather than direct financial outcomes. Organizations with high operational efficiency often experience improved service reliability, shorter cycle times, fewer production disruptions, and greater responsiveness to customers (Kaplan & Norton, 2006).

Customer Satisfaction

Customer satisfaction is a post-purchase evaluation where the chosen alternative at least gives the same result or exceeds consumer expectations. At the same time, dissatisfaction would arise if the results obtained were not in accordance with or were below consumer expectations. In other words, the overall attitude of customers after consumption can show their satisfaction with a product or service. Customer satisfaction is achieved when a product meets or exceeds consumer expectations (Cheema, 2013). It ensures repurchase and customer loyalty (Usta, Berezina & Cobanoglu, 2014). Customer satisfaction significantly impacts a company's future income and profitability (Forozia, Zadeh & Gilani, 2013). Retaining satisfied customers is more cost-effective than attracting new ones, making customer satisfaction a critical business priority (Dominici & Guzzo, 2010).

Customer satisfaction plays a crucial role in business success, as organizations need to analyze customer demands effectively (Escrow, 2001). Previous research suggests that satisfaction is influenced by perceived quality and value, which are determined by customer expectations (Oh, 2000). To remain competitive, businesses must adopt customer-focused strategies (Senguo & Kilango, 2015). Lendel and Varmus (2011) highlight the importance of innovation strategies in enhancing a firm's innovative potential, while Wang, Zhao, and Voss (2016) argue that innovation is a key factor in a company's success in competitive markets.

Identification of Research Gaps and How the Study Addresses Them

The review of related literature shows that while supply chain management (SCM) has been widely studied, there are still important areas that need further exploration, especially in the context of local agribusinesses. Most existing studies focus on manufacturing companies or large industries in developed countries, leaving a gap in understanding how SCM practices affect smaller agribusiness enterprises in local settings like Rizal (Kumar et al., 2023). This study aims to fill that gap by focusing specifically on the SCM of agri-farms in the Province of Rizal and examining how these practices contribute to their business performance.

Another gap found in the literature is that many studies measure business performance using financial indicators such as profit or sales growth. While financial indicators are important, they may not fully capture the operational realities and daily challenges faced by agribusinesses, many of which lack formal accounting systems or are hesitant to disclose financial information. To address this limitation, the present study focuses on non-financial indicators namely, cost efficiency, operational efficiency, and customer satisfaction which better reflect how these businesses manage their operations and serve their

customers. These indicators are considered more practical, measurable, and reflective of the outcomes that directly result from effective SCM. They highlight how businesses manage resources, optimize operations, and meet customer expectations-key aspects that define long-term competitiveness. It was also noted that there are only a few empirical studies that test the direct relationship between SCM and non-financial performance outcomes (Israel, et al., 2023). This research helps close that gap by providing actual data on how specific supply chains influence efficiency and customer satisfaction in agri-farm.

Lastly, limited research provides region-specific insights that could guide local decision-making in areas like logistics, supplier coordination, and infrastructure. By focusing on Rizal, this study not only contributes to academic knowledge but also offers practical recommendations that local agribusiness managers and policymakers can use to improve supply chain operations. This study helps fill the gaps by localizing SCM research, using non-financial performance indicators, and generating practical insights that can support the growth and competitiveness of agri-farms in Rizal.

Theoretical Framework Underpinning the Study

This study is anchored on the Supply Chain Operations Reference (SCOR) Model, which provides a comprehensive framework for analyzing and improving supply chain management (SCM). Developed by the Supply Chain Council (SCC, 2012), the SCOR Model identifies five core processes-Plan, Source, Make, Deliver, and Return, that collectively define how supply chains operate to achieve efficiency and effectiveness. The model emphasizes integration, coordination, and performance measurement across all supply chain activities, ensuring that firms can optimize their operations and respond effectively to customer demands.

Another framework that will be utilized to evaluate the business performance using non-financial indicators is derived from the Balanced Scorecard (BSC) by Kaplan and Norton (1996). These indicators include cost efficiency, operational efficiency, and customer satisfaction, which reflect the internal process and customer perspectives of performance measurement. Cost efficiency measures the ability of the business to manage resources and reduce operational expenses; operational efficiency evaluates the effectiveness of internal processes and production systems; and customer satisfaction assesses how well the business meets customer expectations and builds loyalty.

The SCOR model offers a process-based lens to evaluate operational aspects such as planning, sourcing, making, delivering, and returning. Together, these models enable a comprehensive assessment of cost efficiency, operational efficiency, and customer satisfaction-key indicators of business performance in sustainable enterprises using non-financial indicators in Kaplan & Norton's logic.

To operationalize business performance in this study, the researcher adopts a Key Performance Indicator (KPI) based approach that aligns with both SCOR and TBL. Business performance is conceptualized as the dependent variable, measured through three core dimensions: (1) Cost Efficiency, (2) Operational Efficiency, and (3) Customer Satisfaction. A non-financial performance measure will be used for this study. These three (3) factors are linked in a cause-and-effect chain. Operational improvement leads to better customer outcomes, which secures future profits (Kaplan, R.S., & Norton, D.P. 1992). Cost Efficiency not as the actual monetary savings, but as the potential for savings driven by the non-financial improvements, it is the leading indicator for cost reduction. Operational Efficiency is drawn from the BSC's Internal Process Perspective. It measures how well the organization executes the processes that create and deliver value. The SCOR model will be utilized to define and measure this efficiency, which is a non-financial metric of speed and quality (Lockamy, A., & McCormack, K., 2004). It uses non-financial measures to gauge how customers perceive the value created by efficient operations (Parasuraman, A., et al., 1988).

By integrating the SCOR Model and non-financial performance measures, the theoretical framework posits that effective SCM practices directly contribute to improved cost efficiency, operational

efficiency, and customer satisfaction among agri-farms in Rizal. This linkage highlights the critical role of SCM as a strategic capability that enhances organizational performance beyond financial outcomes.

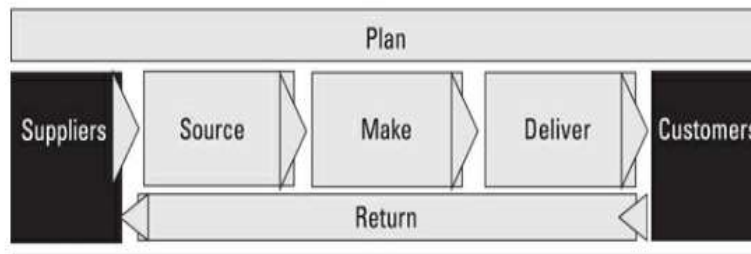


Figure 1. *Supply Chain Operations Reference Model*

Conceptual Framework

The conceptual framework of this study is anchored on the Supply Chain Operations Reference (SCOR) Model, which identifies the core supply chain processes of Plan, Source, Make, Deliver, and Return as the essential drivers of organizational performance (Supply Chain Council, 2012). In this study, these five SCOR components constitute the independent variable, representing the supply chain management practices implemented by agribusinesses. The SCOR model suggests that organizations that systematically plan their supply chain, manage sourcing activities, optimize production, and ensure efficient delivery and return processes are more likely to achieve higher performance outcomes (Chopra & Meindl, 2019).

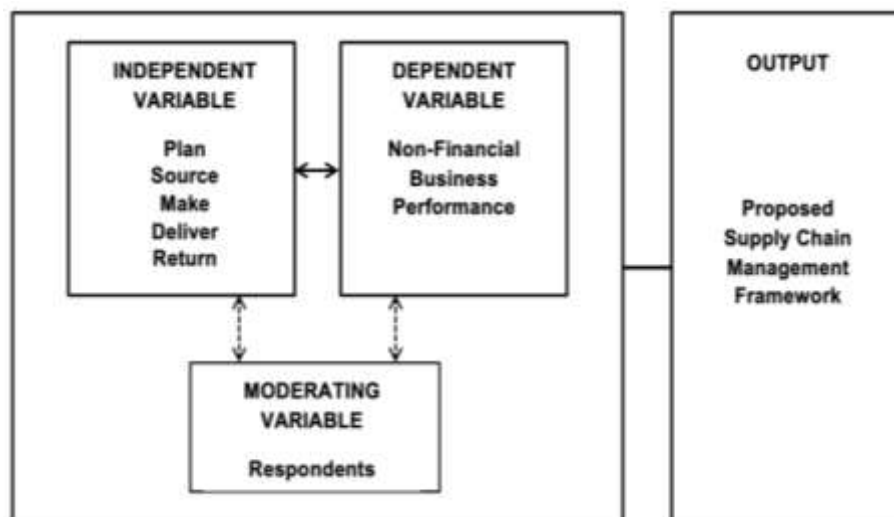


Figure 2. *Conceptual Framework of Supply Chain Management and Business Performance of Agri-Farm Businesses in the Province of Rizal*

The independent variable represents the five core process dimensions of the SCOR Model – Plan, Source, Make, Deliver, and Return which collectively operationalize the concept of supply chain management. These dimensions are grounded in the premise that organizations that strategically manage their supply chain activities are better positioned to achieve superior performance outcomes.

The dependent variable, business performance, is examined through three non-financial dimensions: Cost Efficiency, Operational Efficiency, and Customer Satisfaction. These dimensions reflect elements of the Balanced Scorecard framework, which highlights internal processes and customer

perspectives as key indicators of organizational effectiveness (Kaplan & Norton, 1996). This conceptual framework assumes a direct and positive influence on SCM on business performance. When supply chain processes are well designed and consistently executed, agri-farms are expected to achieve lower operating costs, improved workflow performance, and higher satisfaction among customers.

The respondents serve as the moderating variable, as their demographic and business-related characteristics influence the strength and direction of the relationship between Supply Chain Management (SCM) practices and business performance.

The proposed Supply Chain Management Framework is the output of the study, derived from the empirical findings on SCM, business performance, and the moderating role of respondents' characteristics. It integrates the most effective SCM dimensions identified in the study and aligns them with the operational realities of agri-farm businesses. The framework serves as a practical guide for improving supply chain performance based on the contextual conditions revealed by the respondents.

METHODS

Research Design and Approach

This study adopted a quantitative method to examine the Supply Chain Management (SCM) and business performance of Agri-farm businesses in the Province of Rizal. Quantitative research involves the collection and analysis of numerical data to describe, explain, and determine relationships among variables through statistical methods (Creswell & Creswell, 2018). This approach allows for objective measurement and the generalization of results across a defined target population, making it well-suited for studies that seek empirically grounded and replicable findings within an organizational and agricultural context.

Specifically, this study employed a descriptive-correlational research design, which integrates two complementary methodological approaches to address the research objectives comprehensively. This design was deemed appropriate as it does not involve the manipulation of variables but instead seeks to observe, measure, and determine the degree of association between them as they naturally occur (Calderon & Gonzales, 2020; Fraenkel, Wallen, & Hyun, 2019).

The first method utilized in this study was the descriptive method, which was employed to systematically gather, organize, and present data that accurately characterize the current state of the variables under investigation. In the context of this study, the descriptive method was used to determine and describe the extent to which Supply Chain Management are implemented among agri-farm businesses in the Province of Rizal, as well as to assess the level of non-financial business performance achieved across three key dimensions: cost efficiency, operational efficiency, and customer satisfaction. Using descriptive statistical tools such as frequency counts, percentage distribution, and weighted means applied to a five-point Likert scale, the study was able to present a clear and structured profile of both the respondents and their perceptions of SCM implementation and business performance. This method provided the foundational layer of analysis upon which further relational inquiry was built, ensuring that the variables were adequately understood before their associations were examined.

The second method employed is the correlational method, which was used to identify and analyze the nature and strength of the relationship between SCM and the non-financial business performance indicators of agri-farm businesses, namely cost efficiency, operational efficiency, and customer satisfaction. Unlike experimental designs, the correlational method does not seek to establish causation but rather to determine the degree to which two or more variables are associated with one another (Fraenkel, Wallen, & Hyun, 2019). In this study, the Pearson Correlation Coefficient (r) served as the primary inferential statistical tool for measuring the linear relationship between the identified variables. The numerical results gathered through this correlational analysis provided an empirical basis for drawing conclusions and formulation of recommendations grounded in statistical evidence.

Settings of the Study

This study is conducted in the Province of Rizal, located in the CALABARZON Region (Region IV-A) of the Philippines. Rizal is composed of one component city, Antipolo City, and thirteen municipalities, namely Angono, Baras, Binangonan, Cainta, Cardona, Jala-Jala, Morong, Pililla, Rodriguez (Montalban), San Mateo, Tanay, Taytay, and Teresa. The Province of Rizal is a particularly instructive locale for studying the operational realities of agri-farm businesses as it describes as a peri-urban agro industrial interface: a transitional zone where agricultural production persists alongside, and increasingly in tension with, the expanding pressures of metropolitan growth. According to Malaque and Yokohari (2007) agricultural lands in the peripheral provinces of Metro Manila, including Rizal, have been subjected to sustained urban pressures resulting in landscape fragmentation and land use conversion, a process that challenges the continuity and viability of farm-based enterprises. As urbanization intensifies the demand for efficient and market-responsive agricultural supply chain, Rizal emerges as a province where the stakes of SCM are not merely operational, but structurally determinative of whether businesses can survive and grow.

Furthermore, many agri-farm businesses in the Province of Rizal are classified as micro, small, and medium enterprises (MSMEs), a sector that plays a foundational role in the Philippine economy and constitutes the predominant form of agricultural business organization at the provincial level. MSMEs in developing regional economies face distinctive challenges in managing supply chains effectively, particularly given constraints in capital, technology, logistics, and market access (Abalos et al., 2021).



Figure 3. *Location Map of the Province of Rizal*

Data Collection Method

The data collection strategy of this study was specifically structured to address the research questions comprehensively, ensuring that all aspects of the study's objectives were thoroughly investigated.

The study utilized a survey questionnaire as the primary data collection tool to gather quantitative data on Supply Chain Management (SCM) and business performance among agri-farms in the Province of Rizal. The questionnaire was designed to obtain measurable responses from both agri-farm representatives (Owners, Managers, and Supervisors,) and customers of these agri-farms. This method was chosen because

it allows the researcher to collect standardized data efficiently from a relatively large number of respondents, ensuring reliability and comparability of responses (Creswell & Creswell, 2018).

Two sets of respondents were involved in the study:

- **Members of the Agri-farm**, including owners, managers, and supervisors, who provided data on the extent of implementation of SCM and internal business performance indicators such as cost efficiency and operational efficiency.
- **Customers of the Agri-farm**, who served as respondents for the customer satisfaction variable of non-financial business performance. Their responses provided an external perspective on how SCM and operational performance influence overall customer experience and satisfaction.

Two slightly modified versions of the survey questionnaire were prepared—one tailored for agri-farm representatives and another for customers. Both instruments contained structured statements rated using a five-point Likert scale, ranging from 1 (To a Very Low Extent) to 5 (To a Very High Extent), to measure the degree to which each statement applied to the respondents' organization or experience. The questionnaire for agribusiness members consisted of three main parts: (1) respondent profile; (2) SCM based on the Supply Chain Operations Reference (SCOR) Model—Plan, Source, Make, Deliver, and Return (Supply Chain Council, 2012); and (3) internal business performance indicators, namely cost efficiency and operational efficiency. The customer questionnaires focused on (1) respondent profile and (2) customer satisfaction indicators derived from the Balanced Scorecard framework (Kaplan & Norton, 1996).

Data gathering was carried out after obtaining approval from the academic panel and consent from the participating businesses. The researcher ensured that participation was voluntary, and all responses were treated with strict confidentiality and used only for academic purposes. Collected data were then encoded, tabulated, and analyzed using statistical tools such as frequency, weighted mean, and Pearson's correlation coefficient (r) to determine the strength of the relationship between SCM practices and business performance.

Sampling Strategy

This study employed a stratified sampling primarily because of the heterogeneous nature of the agri-farm sector across Rizal Province. Stratified sampling is a probability sampling method that involves dividing the population into relatively homogeneous sub-populations or strata based on specific characteristics, then selecting samples for each stratum to ensure adequate representation of all subgroups within the population (Calderon & Gonzales, 2020). Since agri-farm businesses differ considerably in terms of location, size, years of operation, and daily customer, a uniform sampling approach would have been insufficient to capture the full breadth of this diversity. By dividing the population into distinct subgroups prior to sample selection, stratified sampling ensured every relevant segment of the agri-farm sector was adequately represented in the dataset, thereby reducing the risk of sampling bias and enhancing the overall representativeness of the study.

Furthermore, the proportional allocation of respondents within each stratum ensured that the composition of the sample reflected the actual distribution of agri-farm businesses across the province. This was particularly important given that the research questions required meaningful comparisons across different business classifications and municipal locations. The dual-respondent structure of the study covering both agri-farm members and their corresponding customers was likewise accommodated by the stratified design, as it allowed the two groups to be sampled in a manner that maintained direct correspondence between organizational units and their respective customer bases, preserving the internal coherence of the research.

The sample size was determined through the application of Slovin's formula at a five percent margin of error, yielding 57 agri-farm representatives as organizational respondents. A ratio of 5 customers per establishment was subsequently applied, producing 285 customer respondents and bringing the total

sample to 342 participants. This sampling design is therefore justified not only by its statistical soundness but also by its contextual appropriateness, as it directly addressed the demands of the research objectives while ensuring that the findings remain credible, comparable, and generalizable across the diverse agri-farm landscape of Rizal Province.

Data Analysis Techniques

To ensure a rigorous and systematic interpretation of the collected data, the responses obtained from the survey questionnaires administered to both agri-farm members and customers of agri-farm businesses in the Province of Rizal were carefully encoded, tabulated, and subjected to appropriate statistical analyses. The selection of statistical tools was guided by the nature of the research objectives, the type of data gathered, and the level of measurement of the variables under investigation. The analysis was organized around four primary purposes: describing the profile of respondents, determining the extent of Supply Chain Management (SCM) implementation and the level of non-financial business performance, and determining the relationship between these two central variables.

The first layer of analysis employed descriptive statistics to organize and summarize the data in a meaningful and interpretable manner. Frequency counts and percentage distributions were used to present the demographic profile of the respondents, providing a structured picture of the sample composition across both agri-farm members and customers. These tools allowed for the systematic categorization of background characteristics such as location, age, sex, years of operation, and business size and facilitated a thorough understanding of who the respondents were in relation to the agri-farm businesses operating across Rizal Province.

The weighted mean served as the primary descriptive measure for analyzing respondents' ratings on the survey items pertaining to SCM practices and non-financial business performance. This measure was particularly appropriate given the ordinal nature of the data obtained through the five-point Likert scale instrument, which ranged from 1 (*To a Very Low Extent*) to 5 (*To a Very High Extent*).

The weighted mean enabled the researcher to determine the overall level of extent to which each SCM component – Plan, Source, Make, Deliver, and Return as well as each dimension of non-financial business performance, namely cost efficiency, operational efficiency, and customer satisfaction was perceived to be implemented or achieved among the agri-farm businesses in the Province of Rizal.

To address the research questions concerning significant differences in the assessment of SCM practices and business performance across respondent groupings defined by demographic characteristics such as location, years of operation, business size, and average monthly revenue, a one-way Analysis of Variance (ANOVA) was utilized. ANOVA is a parametric inferential test that examines whether statistically significant differences exist among the means of three or more independent groups simultaneously, without inflating the Type I error rate associated with conducting multiple pairwise comparisons (Pallant, 2020). This tool was appropriate given that several demographic variables in the study involved more than two categories. Where the results of ANOVA indicated a statistically significant F-value at the 0.05 level of significance, post-hoc analysis was conducted to determine which specific group pairing contributed to the observed difference.

For demographic variables that yielded only two categories - such as sex – an independent sample t-test was employed to determine whether a statistically significant difference existed between the two groups in their assessment of SCM and business performance. The t-test is a parametric test of mean differences between two independent groups and was deemed appropriate for normally distributed continuous or interval-level data (Creswell & Creswell, 2018).

Finally, to address the central inferential objective of the study – examining the nature and strength of the relationship between SCM and the non-financial business performance of agri-farm businesses the Pearson Product-Moment Correlation Coefficient (r) was employed.

Ethical Considerations

This study adhered to the following ethical principles: (1) Informed Consent. The agribusiness owners, operators, employees, customers, who took part in answering the survey questionnaire were fully informed of the purpose of the study and their part in it.

They were provided with an option to participate voluntarily and were aware that they could withdraw at any moment without any consequence. An informed consent form was provided to each respondent, ensuring that they were fully aware of the nature of the study, the expected duration of participation, and how their responses would be used. (2) Confidentiality and Privacy. The confidentiality of all the participants was maintained, and care was taken so that any personal or sensitive data gathered during the study was anonymized and kept safe. Aggregated data alone was employed in the study to safeguard the identity of the participants, (3) Avoiding Harm and Bias. The researcher ensured that due care was exercised and not to cause any unjust harm or prejudice to the business owner/manager/supervisor. Positive and negative feedback were examined in a balanced manner, and the aim was to give constructive basis for supply chain management in agri-farm businesses.

Lastly, honesty, transparency, and objectivity were observed in all phases of the study-from data gathering to analysis and reporting-to uphold academic integrity and credibility. The researcher also ensured that all sources of information were properly cited and acknowledged to avoid plagiarism and intellectual dishonesty.

RESULTS AND DISCUSSION

Profile of Respondents from Agri-Farm Businesses in the Province of Rizal in Terms of Different Aspects

Table 1 presents the frequency and percentage of the profile of agri-farm respondents, particularly agri-farm owner, manager, and supervisor, in terms of location.

Table 1. *Frequency and Percentage Distribution of Respondents in Terms of Location*

Profile	Agri-Farm Owner/Manager/Supervisor	
	f	%
Angono	2	3.5%
Antipolo	6	10.5%
Baras	4	7.0%
Binangonan	2	3.5%
Cainta	2	3.5%
Cardona	2	3.5%
Jalajala	3	5.3%
Morong	6	10.5%
Pililla	4	7.0%
Rodriguez	3	5.3%
San Mateo	3	5.3%
Tanay	16	28.1%
Taytay	2	3.5%
Teresa	2	3.5%
Total	57	100%

The table reveals a notably uneven geographic distribution of agri-farm businesses across the 14 municipalities of Rizal Province. The distribution spans from a dominant concentration in Tanay (28.1%) to minimal representation in several municipalities namely Angono, Binangonan, Cainta, Cardona, Taytay, and Teresa, each contributing only (3.5%). Morong and Antipolo follow as secondary hubs (10.5%) each, with Baras and Pililla forming a mid-tier cluster (7.0%) each.

The findings suggest that respondents were distributed across different municipalities in Rizal, allowing the study to capture perspectives from various agricultural areas in the province. Among the municipalities in Rizal, Tanay has one of the largest agricultural land areas, which may explain why more agri-farm businesses and farm operators, managers, and supervisors, were available for participation in the study.

Buela et al. (2023) affirmed that agricultural areas in the CALABARZON region dominate the flat zones of the region's terrain, while hilly and mountainous areas present distinct land use challenges, a geographic reality that explains why respondent concentration follows topographical and land-use patterns rather than administrative boundaries alone. These results align with Ilagan (2020) and De Vera & Rosete (2019), which similarly found that agribusiness establishments tend to cluster in municipalities with fertile land and supportive local agricultural policies. The prominence of Tanay in the current findings supports this pattern. These findings reinforce the implications of the data in Table 1.

Table 2 presents the respondents' years of operation and business size of agri-farm in the Province of Rizal.

These variables are important in agri-farm businesses because they influence stability, capability, and overall performance. Agri-farm businesses that have been operating for a longer period are more likely to have developed strong customer relationships, supplier networks, management skills, and experience in dealing with challenges such as weather changes, fluctuating prices, and market competition. Business size on the other hand affects the agri-farm's workforce, production capacity, financial resources, and ability to invest in technology and infrastructure.

Table 2. *Frequency and Percentage Distribution of Respondents According to their Demographic Profile Variables (Years of Operation and Business Size)*

Profile		Agri-Farm Owner/Manager/Supervisor	
		f	%
Years of Operation	5 years and below	15	26.3%
	5 - 7 years	5	8.8%
	8-10 years	22	38.6%
	10 years or more	15	26.3%
	Total	57	100%
Business Size	Micro (9 or less employees)	17	29.8%
	Small (10-99) employees	19	33.3%
	Medium (100-99 employees)	21	36.8%
	Total	57	100%

The data shows that most of the agri-farm respondents have been operating their businesses for 8 to 10 years, with 22 respondents (38.6%) with the most significant share of any bracket. This is followed by those who have been operating for 5 years and below and those operating for 10 years or more, with 15 respondents each (26.3%). Only 5 respondents (8.8%) have been operating for 5 to 7 years. This distribution shows that most agri-farm businesses included in the study are already established and have been operating for several years. In terms of business size, most respondents were classified as medium enterprises, with 21 respondents (36.8%). This was followed by small enterprises with 19 respondents (33.3%), and micro

enterprises with 17 respondents (29.8%). This distribution show that the respondents were fairly distributed across different business sizes, although medium-sized farms had the highest representation.

These findings indicate that agri-farm businesses respondents in Rizal have already gained experience in managing operations, dealing with market conditions, and implementing supply chain practices. Businesses with longer years of operation are more likely to develop stronger management systems, wider networks, and more stable customer bases compared to newly established farms. The relatively high number of respondents with 10 years or more of operation further suggests that the agri-farm sector in Rizal is composed of experienced business operators. The dominance of medium-sized agri-farms in Rizal indicate that they have expanded their workforce operations over time. Medium-sized farms are often more capable of investing in equipment, facilities, marketing, and supply chain improvements compared to micro and small enterprises.

These finding aligns with the literature about business survival in the Philippine MSME landscape. According to Bautista and Manzano (2018), only six in every ten exporting Philippine MSMEs survive after their first year of operation, and that this figure drops to fewer than four in every ten by the end of their fourth year. Related studies also show that many agri businesses in the Philippines begin as micro enterprises and later expand into small or medium-sized operations as demand increases. Micro enterprises are often family-owned and rely on limited resources, while medium enterprises are generally better positioned to adopt innovation, improve productivity, and strengthen business performance (Tugade, 2020). These findings reinforce the implications of the data in Table 2.

Table 3 on the next page presents the agri-farm respondents' initial capital and present capital in the Province of Rizal.

The initial capital and present capital of agri-farm businesses are important variables to help explain the financial growth, sustainability, and overall business performance of the business. It provides evidence whether agri-farm businesses are progressing and becoming more financially stable.

Table 3. *Frequency and Percentage Distribution of Respondents According to their Demographic Profile Variables (Initial Capital and Present Capital)*

Profile		Agri-Farm Owner/Manager/Supervisor	
		f	%
Initial Capital	16,000 - 30,000	17	29.8%
	30,001 - 60,000	19	33.3%
	60,001 - 90,000	21	36.8%
	Total	57	100%
Present Capital	100,000 - 250,000	17	29.8%
	250,001 - 400,000	19	33.3%
	400,001 - 600,000	21	36.8%
	Total	57	100%

The data shows that most of the respondents started their agri-farm businesses with an initial capital ranging from ₱60,001 to ₱90,000, with 21 respondents (36.8%). This was followed by those with an initial capital of ₱30,001 to ₱60,000, with 19 respondents (33.3%), while 17 respondents (29.8%) reported an initial capital of ₱16,000 to ₱30,000. In terms of present capital, most respondents reported having current capital ranging from ₱400,001 to ₱600,000, with 21 respondents (36.8%). This was followed by those with ₱250,001 to ₱400,000, with 19 respondents (33.3%), while 17 respondents (29.8%) had present capital ranging from ₱100,000 to ₱250,000. The findings indicates that many agri-farm businesses in Rizal have experienced financial growth and expansion over time. The increase in capital may be attributed to higher sales, reinvestment of profits, improved business performance, and access to financing.

The findings suggest that capital plays a significant role in the establishment and sustainability of agri-farm businesses. Initial capital is important because it provides the resources needed for land preparation, equipment, labor, livestock, and other farm inputs. Meanwhile, present capital reflects the current financial strength of the business and its ability to expand operations, adopt new technology, and improve productivity.

According to the Food and Agriculture Organization (2023), businesses with larger financial resources are generally more capable of sustaining operations and remaining competitive in the market. Recent study also suggests that many agri-farm businesses have been able to improve their financial condition through time. Similarly, the Asian Development Bank (2023), emphasizes that access to financial resources and investment opportunities contributes positively to business growth and long-term success, particularly among micro, small, and medium enterprises.

Table 4 on the next page presents the agri-farm respondents' average monthly revenue and average monthly expenses in the Province of Rizal.

Understanding the average monthly revenue and average monthly expenses of agri-farm businesses is essential because they directly reflect the earning capacity and overall business performance. Efficient supply chain operations often lead to higher revenue through better product availability and market reach, while also reducing expenses through optimized sourcing, production efficiency, and logistics management.

Table 4. *Frequency and Percentage Distribution of Respondents According to their Demographic Profile Variables (Average Monthly Revenue and Average Monthly Expenses)*

Profile		Agri-Farm Owner/Manager/Supervisor	
		f	%
Average Monthly Revenue	21,000 - 150,000	17	29.8%
	150,001 - 250,000	19	33.3%
	250,001 - 350,000	21	36.8%
	Total	57	100%
Average Monthly Expenses	16,000 - 35,000	17	29.8%
	35,001 - 50,000	19	33.3%
	50,001 - 75,000	21	36.8%
	Total	57	100%

The table reveals that agri-farm respondents reported average monthly revenue ranging from ₱250,001 to ₱350,000, with 21 respondents (36.8%). This was followed by ₱150,001 to ₱250,000 with 19 respondents (33.3%), while 17 respondents (29.8%) reported ₱21,000 to ₱150,000. In terms of average monthly expenses, most respondents reported expenses ranging from ₱50,001 to ₱75,000, with 21 respondents (36.8%). This was followed by ₱35,001 to ₱50,000 with 19 respondents (33.3%), while 17 respondents (29.8%) had expenses ranging from ₱16,000 to ₱35,000.

The result on average monthly revenue indicates that a considerable number of agri-farm businesses in Rizal are already generating relatively higher monthly income levels, suggesting stable market demand and improved production capacity. This also indicates that higher revenue levels are also associated with higher operational costs, which is expected in growing agribusiness operations.

According to the Food and Agriculture Organization of the United Nations, revenue is a major indicator of agribusiness success because it reflects how efficiently a farm convert its products and services into financial returns. Agri-Farms with stable and increasing revenue are more likely to survive in competitive markets and sustain their long-term operations. Similarly, Martin (2010) emphasizes that efficient supply chain management improves both cost efficiency and revenue generation because it allows businesses to use their resources more effectively and provide greater value to customers.

Table 5 on the next page presents the demographic characteristics of respondents from agri-farm businesses in the Province of Rizal in terms of average customer per day, age, years of service, and sex.

Understanding these demographic characteristics provide a clearer background and profile of the individuals involved in the agri-farm businesses. These variables help explain differences in business practices, management style, decision-making, and operational performance among respondents. Differences in business performance, supply chain activities, and customer satisfaction levels can also be explained by the fact that companies with more everyday customers may have higher revenue, strong market presence, and more experience managing client needs. The respondent's expertise, leadership style, capacity for making decisions, and receptivity to new ideas may all be impacted by their age. Years of service are important since they show how experienced and knowledgeable the person is with the business. The study's ability to determine the proportion of male and female respondents in agri-farm businesses makes it crucial.

Table 5. *Frequency and Percentage Distribution of Respondents According to their Demographic Profile Variables (Average Customer per Day, Age, Years of Service, and Sex)*

Profile		Agri-Farm Owner/Manager/Supervisor	
		f	%
Average Customers per Day	10 and below	17	29.8%
	11 - 15 customers	19	33.3%
	16 - 20 customers	20	35.1%
	21 and above	1	1.8%
	Total	57	100%
Age	26-35 years old	5	8.8%
	36-45 years old	17	29.8%
	46-55 years old	21	36.8%
	56 years old and above	14	24.6%
	Total	57	100%
Years of Service	2 years and below	7	12.3%
	3-5 years	27	47.4%
	6-10 years	23	40.4%
	Total	57	100%
Sex	Male	23	40.4%
	Female	34	59.6%
	Total	57	100%

The table reveals that agri-farm businesses serve an average of 16 to 20 customers per day, with 20 respondents (35.1%). Followed by 11 to 15 customers per day with 19 respondents (33.3%), while 17 respondents (29.8%) reported serving 10 customers and below. Only 1 respondent (1.8%) reported serving 21 customers and above. This indicates stable demand for farm products, or farm related activities.

In terms of age, the distribution reveals a mature workforce with limited youth participation, most respondents were between 46 to 55 years old, with 21 respondents (36.8%). Followed by those aged 36 to 45 years old with 17 respondents (29.8%), while 14 respondents (24.6%) were 56 years old and above. Only 5 respondents (8.8%) were between 26 to 35 years old. This suggests that the agri-farm sector in Rizal is largely managed by mature and experienced individuals.

Regarding years of service, most respondents have been serving in their roles for 3 to 5 years, with 27 respondents (47.4%), followed by 6 to 10 years with 23 respondents (40.4%). Only 7 respondents (12.3%) have been in service for 2 years and below. The findings imply that many respondents have already

gained enough experience in managing farm operations, dealing with customers, and overseeing business activities.

Additionally, in terms of sex, most respondents were female, with 34 respondents (59.6%), while 23 respondents (40.4%) were male. This finding suggests that women play a significant role in the management and operation of agri-farm businesses in the Province of Rizal. This finding supports the observation that women have become increasingly visible in the agricultural sector, particularly in agribusiness and farm management.

According to the SCOR Model (2012), higher transaction volumes require superior reliability, responsiveness, and agility. Conversely, farms serving fewer customers may operate with simple supply chains but potentially achieve comparable revenues through premium positioning or value-added services (Hollas et al., 2021). The mature workforce brings accumulated knowledge, established supplier relationships, and proven management capabilities essential for navigating complex supply chain challenges in Philippine agriculture (Cruz, 2022). According to Haryati et al. (2024), demographics significantly impact farming retention, and the aging workforce suggests urgent need for strategies to attract and develop the next generation of entrepreneurs. The findings for years of service is also supported by Chopra and Meindl (2019), which implicates that employee experience and organizational knowledge are intangible assets that enhance supply chain capabilities. Long-tenured employees develop deep understanding of supplier relationships, customer preferences, seasonal patterns, and effective problem-solving approaches. According to the Department of Agriculture, women farmers participate in various segments of the agricultural value chain, including production, processing, marketing, and food preparation. Similarly, the study of Lu (2010), found that women farmers in the Philippines are highly involved in activities such as seeding, weeding, harvesting, pesticide application, and crop marketing.

Profile of Agri-Farm Customer Respondents in the Province of Rizal

Table 6 on the next page presents the geographic distribution of customer respondents across 14 municipalities in Rizal Province. A total of 285 customers participated in the study, representing the demand-side perspective of the agri-farm businesses supply chain management and business performance.

Table 6. *Frequency and Percentage Distribution of Customer Respondents in Terms of Location*

Profile	Customers	
	f	%
Angono	10	3.5%
Antipolo	30	10.5%
Baras	20	7.0%
Binangonan	10	3.5%
Cainta	10	3.5%
Cardona	10	3.5%
Jalajala	15	5.3%
Morong	30	10.5%
Pililla	20	7.0%
Rodriguez	15	5.3%
San Mateo	15	5.3%
Tanay	80	28.1%
Taytay	10	3.5%
Teresa	10	3.5%

Total	285	100%
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The data reveals customer distribution shows strong concentration in specific municipalities. The table shows that the highest number of customer respondents came from Tanay, with 80 respondents (28.1%) of the total sample. Followed by Antipolo and Morong, with 30 respondents each (10.5%). Baras and Pililla had 20 respondents each (7.0%), while Jalajala, Rodrigues, and San Mateo had 15 respondents each (5.3%). The remaining municipalities, namely Angono, Binangonan, Cainta, Cardona, Taytay, and Teresa, each contributed 10 respondents (3.5%).

The findings indicate that most customers of agri-farm businesses are concentrated in Tanay. The high number of customer respondents from Tanay suggests that agri-farm businesses in the area have stronger market demand and wider customer reach compared to other municipalities. The notable representation from Antipolo and Morong also contributed a significant number of respondents, and likewise reflects the agricultural and semi-rural characteristics, which indicate that these municipalities have growing demand for agri-farm products and services. Meanwhile, municipalities with lower customer counts may have fewer agri-farm establishments or smaller populations reflect the more urbanized and commercially developed characteristics of these areas, where residents may have less direct engagement with agri-farm businesses where fewer such businesses are located. This finding is consistent with Cruz and Layaoen's (2019), observation that urbanizing areas shift away from agricultural identities toward commercial and residential functions.

According to Teves (2018), Tanay's role as an agricultural center have strengthened through government programs. This reflects the municipality's role as a site for agricultural innovation and demonstration projects.

Table 7 on the next page presents the demographic characteristics of customer respondents from agri-farm businesses in the Province of Rizal in terms of duration as a customer, age, and sex.

Understanding these demographic variables help explain the characteristics, preferences, and buying behavior of the customers. This helps agri-farm businesses understand who their customers are, what they want, and how they behave and can help improve supply chain decisions, product offerings, customer satisfaction, and overall business performance.

Table 7. *Frequency and Percentage Distribution of Customer Respondents Demographic Profile Variables (Duration as a Customer, Age, and Sex)*

Profile		Customers	
		f	%
Duration as a Customer	Less than 6 Months	46	16.1%
	6 months to 1 year	144	50.5%
	1-3 years	65	22.8%
	More than 3 years	30	10.5%
	Total	285	100%
Age	26-35 years old	72	25.3%
	36-45 years old	68	23.9%
	46-55 years old	85	29.8%
	56 years old and above	60	21.1%
	Total	285	100%
Sex	Male	127	44.6%
	Female	158	55.4%
	Total	285	100%

The findings show that most respondents have been customers of agri-farm businesses for 6 months to 1 year, with 144 respondents (50.5%). Followed by customers who have been with the business for 1 to 3 years, with 65 respondents (22.8%). Meanwhile, 46 respondents (16.1%) have been customers for less than 6 months, while only 30 respondents (10.5%) have remained customers for more than 3 years. These findings suggest that many agri-farm businesses are continuously attractive new and relatively recent customers.

In terms of age, most customer respondents were between 46 to 55 years old, with 85 respondents (29.8%). Followed by those aged 26 to 35 years old with 72 respondents (25.3%), respondents aged 36 to 35 years old with 68 respondents (23.9%), and those aged 56 years old and above with 60 respondents (21.1%).

In terms of sex, the results show that female customers accounted for 158 respondents (55.4%), while male customers comprised of 127 respondents (44.6%). This indicates that female customers slightly outnumber male customers among the clientele of agri-farm businesses in Rizal.

The large number of customers within the 6 months to 1 year category may indicate growing interest in agri-farm products, their presence implies that some businesses are able to maintain customer loyalty and satisfaction. Research from Li (2021), implicates that customer satisfaction in agri-farm businesses significantly influence revisit intention, word-of-mouth promotion, and customer loyalty. Customers who enjoy meaningful and continuous agri-farm experiences are more likely to return and recommend business to others. For the age distribution the findings indicate that agri-farm businesses attract customers from a wide range of age groups, although middle-aged adults represent the largest segment. This finding is supported by the research of Philipps (2019), that agri-farm businesses in Rizal have successfully cultivated appeal across generational lines, potentially by offering a combination of experiential, education, and wellness-oriented activities.

Similarly, the study of Hsiang-Yung et al., (2026), indicates that the sector has the potential to sustain customer growth while also building loyalty among repeat customers.

Assessment of Supply Chain Management of Agri-Farm Businesses in the Province of Rizal

Table 8 presents the extent of supply chain management of agri-farm businesses in the Province of Rizal in terms of Plan component of the SCOR Model.

Table 8. *Computed Weighted Mean and Verbal Interpretation on the Extent of Supply Chain Management of Agri-Farm Businesses as Assessed by the Respondents in Terms of Plan*

Plan	$\bar{Wx}$	Verbal Interpretation
1. The business takes steps to analyze all costs associated with a product or service, not just the initial price, to make more informed decisions.	3.58	High Extent
2. The business regularly conducts a Sales and Operations Planning (S&OP) process.	3.58	High Extent
3. The business uses metrics to analyze and improve performance in areas like reliability, responsiveness, and agility.	3.75	High Extent
4. The business develops contingency plans for supply disruptions (e.g., seed shortages, disease outbreaks, port delays).	3.60	High Extent
5. The business' inventory policies for inputs (seeds, fertilizers) and finished goods are clearly defined and data driven.	4.30	Very High Extent
6. The business balances resources with requirements and establishes/communicates plans for the whole supply chain.	3.93	High Extent
7. The business takes steps to build resilience in the supply chain to better withstand disruptions.	3.98	High Extent
8. Operational plans are routinely coordinated with key suppliers and distributors to ensure synchronized resource flow.	4.19	High Extent

9. The business supply chain strategy is clearly defined and fully aligned with the organization's business strategy.	4.44	Very High Extent
10. The business' financial budgeting is clearly aligned with the supply chain operational plans of the business.	3.68	High Extent
Average	3.90	High Extent

The Plan dimension with an overall weighted mean of 3.90, verbally interpreted as High Extent indicates that agri-farm businesses in the area have substantially integrated planning processes into their supply chain operations, though there remains room for further optimization toward very high-performance levels. The highest weighted means were recorded for the supply chain strategy is clearly defined and fully aligned with the organization's business strategy ($\bar{x} = 4.44$, Very High Extent) and inventory policies for inputs and finished goods ($\bar{x} = 4.30$, Very High Extent). These results suggest that agri-farm respondents recognize critical importance of strategic alignment between supply chain activities and overarching business objectives, as well as the critical role that precise inventory management plays in agricultural production cycles. Operational coordination with suppliers and distributors also received a high weighted mean ($\bar{x} = 4.19$, High Extent). This indicates that agri-farm businesses maintain functional coordination mechanisms with their supply chain partners.

However, the lowest weighted mean was observed in the indicator business take steps to analyze all costs associated with a product or service and business regularly conduct a sales and operations planning process ($\bar{x} = 3.58$) both interpreted as high extent. These are the lowest scored indicators in the Plan dimension. Although still interpreted as high extent, these lower scores may imply that some agri-farm businesses have limited use of advanced cost analysis and formal planning systems.

The findings imply that agri-farm businesses in Rizal province demonstrate a generally strong foundation in supply chain planning, as reflected in the overall average weighted mean. According to Huan, Sheoran, and Wang (2004), effective supply chain planning requires that businesses first establish clear strategic intent before operationalizing it through measurable inventory and resource management policies.

Furthermore, the high rating on operational coordination with suppliers and distributors aligns with the SCOR Model's concept of Plan Supply Chain – the process of developing a course of action over time that represents a projected appropriation of supply chain resources to meet supply chain requirements (Bolstorff & Rosenbaum, 2011). In the context of agri-farm businesses, regular coordination with input suppliers such as seed companies and fertilizer distributors, as well as with downstream distributors and traders, is essential for maintaining uninterrupted production flows and minimizing post-harvest losses. This finding is further supported by Chopra and Meindl (2016), who argued that inter-organizational planning synchronization significantly reduces supply chain uncertainty and improves both responsiveness and reliability – two key performance attributes of the SCOR Model.

Table 9 on the next page presents the extent of supply chain management of agri-farm businesses in the Province of Rizal in terms of Source component of the SCOR Model.

Table 9. *Computed Weighted Mean and Verbal Interpretation on the Extent of Supply Chain Management of Agri-Farm Businesses as Assessed by the Respondents in Terms of Source*

Source	$W\bar{x}$	Verbal Interpretation
1. The business' sourcing strategy focuses on choosing sustainable materials essential for reducing environmental impact.	3.75	High Extent
2. The business has a formal process for selecting and certifying suppliers (e.g., input providers, farmers, cooperatives).	4.28	Very High Extent
3. Accurate inventory tracking for the agribusiness operations is successful and enables effective management of resources and finances.	4.30	Very High Extent
4. The business' payment terms with suppliers are fair and prompt, supporting	3.96	High Extent

their financial stability.		
5. Suppliers are selected based on quality, reliability, and sustainability.	3.98	High Extent
6. Contracts with suppliers explicitly define quality standards, delivery schedules, and pricing.	4.19	High Extent
7. The business conducts regular performance evaluations for key suppliers.	4.67	Very High Extent
8. Digital tools are used to manage procurement activities and to monitor sourcing activities.	4.49	Very High Extent
9. Accurate records of suppliers are maintained to track transactions.	4.14	High Extent
10. The business has a multi-sourcing strategy for critical inputs to avoid dependency on a single supplier.	3.89	High Extent
Average	4.17	High Extent

The Source dimension with an overall weighted mean of 4.17, verbally interpreted as High Extent indicates that agri-farm businesses in the Province of Rizal generally practice effective sourcing activities and supplier management. The findings suggest that respondents recognize the importance of maintaining reliable suppliers, monitoring procurement processes, and ensuring the availability of farm inputs necessary for business operations. Among the indicators, the highest rate item was the regular performance evaluation of key suppliers ($\bar{x} = 4.67$, Very High Extent). This finding implies that agri-farm businesses place strong emphasis on assessing the performance of their suppliers to ensure quality, reliability, and consistency in the delivery of products and services. The use of digital tools to manage procurement and monitor sourcing activities also received a very high rating ($\bar{x} = 4.49$, Very High Extent). The indicator with the lowest weighted mean was the sourcing strategy focusing on sustainable materials essential for reducing environmental impact ($\bar{x} = 3.75$), although it was still interpreted as High Extent. This suggests that while respondents are practicing sustainable sourcing to some degree, environmental considerations may not yet be their top priority compared to supplier quality, cost, and reliability.

This suggests that many agri-farm businesses are adopting technology to improve procurement efficiency, maintain records, and monitor inventory. Gunasekaran et al., (2017) emphasized that the integration of digital technologies into supply chain sourcing processes significantly reduces transaction costs, improves information symmetry between buyers and suppliers, and enhances the overall efficiency of procurement cycles. The findings on the Source dimension of the SCOR Model reveal the agri-farm businesses in Rizal exhibit a generally strong and technologically progressive approach to procurement and supplier management, as evidenced by the high to very high ratings obtained across the indicators. The Source process in the SCOR Model encompasses all activities related to procuring goods and services to meet planned or actual demand, including supplier identification and evaluation, procurement execution, and supplier relationship management (APICS, 2017).

Table 10 presents the extent of supply chain management of agri-farm businesses in the Province of Rizal in terms of Make component of the SCOR Model.

Table 10. *Computed Weighted Mean and Verbal Interpretation on the Extent of Supply Chain Management of Agri-Farm Businesses as Assessed by the Respondents in Terms of Make*

Make	$\bar{Wx}$	Verbal Interpretation
1. The business production and harvesting schedules are highly efficient and minimize waste (e.g., spoilage, field losses).	3.84	High Extent
2. The business adheres to strict quality control and food safety standards (e.g., GAP, HACCP) during production.	3.81	High Extent
3. The business' operations are flexible enough to adjust to changes in yield, quality, or urgent customer orders.	3.54	High Extent
4. The business' proactive maintenance programs are used for production and	3.56	High Extent

processing machinery/equipment.		
5. The business continuously measures and seeks to improve production costs, yield, and productivity.	4.00	High Extent
6. The business' workforce is highly skilled and trained in modern agricultural and processing techniques.	4.16	High Extent
7. The business effectively manages by-products and waste from production/processing (e.g., converting to compost, biofuel).	4.21	Very High Extent
8. The business' processing activity is designed to maximize output and value from raw agricultural materials.	4.14	High Extent
9. The business has excellent traceability systems from the farm/field through the processing stage.	3.86	High Extent
10. Robust quality control processes are in place to minimize defects and rework.	3.77	High Extent
Average	3.89	High Extent

The Make dimension with an overall weighted mean of 3.89, verbally interpreted as High Extent indicates that agri-farm businesses in Rizal are substantially engaged in production and processing activities that are aligned with the operational expectation of the SCOR Model's Make process. However, the overall average falls just below the Very High Extent threshold, suggesting that while core manufacturing and production capabilities are well-established, certain areas particularly operational flexibility, equipment maintenance, and quality control require further development and formalization.

The highest rated indicator in the Make dimension is the business effectively manages by-products and waste from production and processing ($\bar{x} = 4.21$, Very High Extent). This finding is particularly noteworthy as it reflects a strong environmental and economic consciousness among agri-farm businesses in Rizal. The workforce being highly skilled and trained in modern agricultural and processing techniques ranked second ($\bar{x} = 4.16$, High Extent). Human capital is widely recognized in supply chain as a foundational enabler of Make process performance. Processing activities designed to maximize output and value from raw agricultural materials ($\bar{x} = 4.14$, High Extent). This finding reflects the respondents' orientation toward value maximization in the Make process, a principle that is central to the SCOR Model's concept.

The two lowest—rated indicators in the Make dimension are operations flexible enough to adjust to changes in yield, quality, or urgent customer orders ($\bar{x} = 3.54$) and proactive maintenance programs for production and processing machinery and equipment ($\bar{x} = 3.56$), both interpreted as High Extent.

Under the SCOR Model, the highest rated indicator in the Make dimension is directly associated with the asset management efficiency performance attribute, which evaluates how effectively a business utilizes its production resources to generate value (Supply Chain Council, 2012).

Similarly, Swink et al., (2017) emphasized that investment in workforce training yield compounding returns in agricultural supply chains by improving both the technical quality of production outputs and the adaptive capacity of the organization to respond to changing market and environmental conditions.

Furthermore, operational flexibility is directly associated with the SCOR Model's agility performance attribute, which measures the ability of the supply chain to respond to external influences and changes in the marketplace (APICS, 2017).

Table 11 on the next page presents the extent of supply chain management of agri-farm businesses in the Province of Rizal in terms of Deliver component of the SCOR (Supply Chain Operations Reference) Model.

Table 11. *Computed Weighted Mean and Verbal Interpretation on the Extent of Supply Chain Management of Agri-Farm Businesses as Assessed by the Respondents in Terms of Deliver*

Deliver	$\bar{Wx}$	Verbal Interpretation
1. The business can fulfill and deliver customer orders with a very high degree of on-time and in-full performance.	3.56	High Extent
2. The business uses specialized logistics (e.g., refrigerated trucks) to maintain the cold chain for perishable products.	3.91	High Extent
3. The business' transportation network (own fleet or 3PL partners) is reliable and cost-effective, even to remote areas.	3.88	High Extent
4. Efficient order management process from receipt to delivery is evident to the business.	3.93	High Extent
5. The business' warehouse/storage facilities are well-managed to preserve product quality and minimize losses.	3.77	High Extent
6. The business provides customers with accurate and timely information on their order status and delivery times.	3.54	High Extent
7. Distribution strategy (e.g., direct, via wholesalers) effectively reaches out the target market.	3.98	High Extent
8. The business receives status reporting on outsourced services at least monthly.	3.95	High Extent
9. The delivery process encompasses the receipt, validation, and generation of client orders.	4.05	High Extent
10. The delivery process encompasses the receipt, validation, and generation of client orders.	3.84	High Extent
Average	3.84	High Extent

The Deliver dimension with an overall weighted mean of 3.84, verbally interpreted as High Extent indicates that agri-farm businesses in Rizal are substantially engaged in delivery and logistics activities consistent with the operational standards of the SCOR Model's Deliver process.

The highest-rated indicator in the Deliver dimension is the delivery process encompasses the receipt, validation, and generation of client orders ($\bar{x} = 4.05$, High Extent). This finding reflects that agri-farm businesses in Rizal have established functional order management systems that cover the critical initial stages of the delivery process, order receipt, validation, and generation. Distribution strategy effectively reaching the target market ($\bar{x} = 3.98$, High Extent) ranked as the second highest indicator, reflecting that agri-farm businesses in Rizal have developed reasonably effective channel strategies for bringing their products to market.

The two lowest-rated indicators in the Deliver dimension are the business provide customers with accurate and timely information on order status and delivery times ($\bar{x} = 3.54$, High Extent) and the business can fulfill and deliver customer orders with a very high degree of on-time and in-full performance ($\bar{x} = 3.56$, High Extent). These findings are particularly significant as both indicators are directly associated with the SCOR Model's Reliability performance attribute specifically the perfect order fulfillment metric, which measures the percentage of orders delivered on time, in full, without damage, and with accurate documentation (APICS, 2017).

According to the SCOR Model, order management is one of the foundational sub-processes of Deliver, as it governs the accuracy and speed with which customer requirements are translated into actionable fulfillment instructions across the supply chain (Bolstorff & Rosenbaum, 2011). Similarly, Lambert and Cooper (2000) emphasized that order management excellence is a critical determinant of customer loyalty in agricultural supply chains, where buyers place high value on consistency, accuracy, and timeliness in the fulfillment of their procurement requirements. Chopra and Meindl (2016) argued that distribution network design is one of the most consequential strategic decisions in supply chain

management, as it determines the speed, cost, and reliability with which products reach end customers. According to Gunasekaran (2001), on-time delivery is one of the most crucial customer-facing supply chain performance metrics, arguing that consistent failure to meet delivery commitment erodes customer trust, increases order cancellation rates, and ultimately weakens the competitive position of the business in the market.

Table 12 on the next page presents the extent of supply chain management of agri-farm businesses in the Province of Rizal in terms of Return component of the SCOR (Supply Chain Operations Reference) Model.

Table 12. *Computed Weighted Mean and Verbal Interpretation on the Extent of Supply Chain Management of Agri-Farm Businesses as Assessed by the Respondents in Terms of Return*

Return	$\bar{Wx}$	Verbal Interpretation
1. The business improves handling equipment quality and returns goods handling.	3.70	High Extent
2. The business has a clear, well-defined process for handling and receiving returned products from customers.	3.91	High Extent
3. The return process helps the business improve product quality and customer service.	3.86	High Extent
4. The business effectively manages the return of rejected or defective materials to their input suppliers.	3.95	High Extent
5. The business has an effective system for sorting returned goods for potential reuse, recycling, or disposal.	3.77	High Extent
6. The business actively recovers value from unsold or excess products (e.g., converting to other products, discount channels).	3.63	High Extent
7. The business analyzes the reasons for product returns to identify and address root causes in their processes.	3.82	High Extent
8. The business has initiatives for recycling or reusing water and other resources in their operations.	3.74	High Extent
9. The business is engaged in programs that promote circular economy (e.g., using biodegradable packaging).	3.93	High Extent
10. The business handles customer complaints related to product quality upon delivery and are resolved quickly and satisfactorily.	3.65	High Extent
Average	3.80	High Extent

The Return dimension with an overall weighted mean of 3.80, verbally interpreted as High Extent indicates that agri-farm business in Rizal have established functional reverse logistics and return management practices that are broadly aligned with the operational expectations of the SCOR Model's Return process. However, the overall average is the lowest among all five SCOR dimensions examined in this study, suggesting that return management remains the least developed and most inconsistently practiced supply chain function among the respondents a finding that warrants careful analysis and targeted intervention.

The highest-rated indicator in the Return dimension is the business effectively manages the return of rejected or defective materials to their input suppliers ($\bar{x} = 3.95$, High Extent). This finding reflects that agri-farm businesses in Rizal maintain reasonably effective upstream return management practice, ensuring that substandard or defective inputs such as low germination seed, contaminated fertilizers, or malfunctioning equipment are returned to suppliers in a timely and organized manner.

Engagement in circular economy programs such as biodegradable packaging ($\bar{x} = 3.93$, High Extent) ranked as the second highest indicator, reflecting a meaningful level of environmental stewardship among the respondents. The high rating on this indicator suggests that agri-farm businesses in Rizal are

increasingly aware of and responsive to the environmental imperatives shaping modern agricultural supply chain management.

The two lowest-rated indicators in the Return dimension are the business actively recovers value from unsold excess products ($\bar{x} = 3.63$, High Extent) and the business handles customer complaints related to product quality upon delivery and resolves them quickly and satisfactorily ($\bar{x} = 3.65$, High Extent). These findings represent the most critical performance gaps within the Return dimension.

Under the SCOR Model, the highest rated indicator falls under the Return Source sub-process, which is evaluated primarily through the Reliability attribute specifically measuring whether defective materials are identified, processed, and returned accurately and within agreed timeframes (APICS, 2017). Similarly, Rogers and Tibben-Lembke (1999) emphasized that effective supplier return management is a critical mechanism for enforcing input quality standards and holding suppliers accountable for the quality of materials they provide, thereby reducing the frequency and economic impact of quality failures in the production process. The Waste and Resource Action Programme (WRAP, 2015) estimated that surplus food and unsold agricultural products represent one of the largest and most economically avoidable sources of supply chain cost in the food and agriculture sector, underscoring the strategic importance of developing robust value recovery mechanisms. The lower score on customer complaints resolution is equally significant, as customer complain management is directly associated with the SCOR Model's responsiveness and reliability performance attributes (Supply Chain Council, 2012).

Table 13 on the next page presents the composite table on the computed weighted mean and its verbal interpretation on the assessment for agri-farm respondents in the extent of supply chain management in terms of the SCOR dimensions.

Table 13. *Composite Table on the Computed Weighted Mean and Its Verbal Interpretation on the Assessment of Extent of Supply Chain Management of Agri-Farms in terms of the SCOR Dimension*

SCOR Dimension	Average	Verbal Interpretation
Plan	3.90	High Extent
Source	4.17	High Extent
Make	3.89	High Extent
Deliver	3.84	High Extent
Return	3.80	High Extent
Grand Mean 2	3.92	High Extent

The composite table reveals the extent of supply chain management of agri-farms with an overall grand mean of 3.92 with a standard deviation of 0.327 indicates that the respondents, composed of farm owners, managers, and supervisors, perceive the implementation of supply chain management to a high extent. Among the SCOR dimensions, Source obtained the highest mean of 4.17, followed by Plan (3.90), Make (3.89), Deliver (3.84), and Return (3.80). The results indicate that sourcing activities are the strongest area of supply chain management among agri-farms.

The grand mean of 3.92 affirms that all five SCOR processes – Plan, Source, Make, Deliver, and Return – are being practiced effectively, with Source as the clear strength and Return as the relative are requiring further development. These results exceed the average performance category typically reported in comparable SCOR studies (Wirda et al., 2025), suggesting that the direct management involvement of farm owners, managers, and supervisors as respondents contributes meaningfully to stronger SCM outcomes.

Significant Difference in the Assessment of Supply Chain Management of Agri-Farm Businesses in the Province of Rizal as Evaluated by Respondent' Demographic Profiles

Table 14 presents the results of the one-way Analysis of Variance (ANOVA) and independent samples t-test conducted to determine whether significant difference exist in the supply chain management (SCM) assessment of agri-farm businesses in the Province of Rizal when grouped according to the demographic profile of the respondents.

Table 14. *Summary of Significant Difference of Supply Chain Management of Agri-Farm Businesses as Assessed by Respondents' Demographic Profile*

Demographic Variable	SCM Assessment (SCOR Dimension)	F	p-value	Ho	VI
Years of Operation	Plan	F = 0.781	0.5099	NR	NS
	Source	F = 0.781	0.5099	NR	N
	Make	F = 0.781	0.5099	NR	NS
	Deliver	F = 0.781	0.5099	NR	NS
	Return	F = 0.781	0.5099	NR	NS
	Overall	F = 0.781	0.5099	NR	NS
Business Size	Plan	F = 0.134	0.8750	NR	NS
	Source	F = 0.134	0.8750	NR	NS
	Make	F = 0.134	0.8750	NR	NS
	Deliver	F = 0.134	0.8750	NR	NS
	Return	F = 0.134	0.8750	NR	NS
	Overall	F = 0.134	0.8750	NR	NS
Initial Capital	Plan	F = 0.134	0.8750	NR	NS
	Source	F = 0.134	0.8750	NR	NS
	Make	F = 0.134	0.8750	NR	NS
	Deliver	F = 0.134	0.8750	NR	NS
	Return	F = 0.134	0.8750	NR	NS
	Overall	F = 0.134	0.8750	NR	NS
Present Capital	Plan	F = 0.134	0.8750	NR	NS
	Source	F = 0.134	0.8750	NR	NS
	Make	F = 0.134	0.8750	NR	NS
	Deliver	F = 0.134	0.8750	NR	NS
	Return	F = 0.134	0.8750	NR	NS
	Overall	F = 0.134	0.8750	NR	NS
Avg. Monthly Revenue	Plan	F = 0.134	0.8750	NR	NS
	Source	F = 0.134	0.8750	NR	NS
	Make	F = 0.134	0.8750	NR	NS
	Deliver	F = 0.134	0.8750	NR	NS
	Return	F = 0.134	0.8750	NR	NS
	Overall	F = 0.134	0.8750	NR	NS
Avg. Monthly Expenses	Plan	F = 0.134	0.8750	NR	NS
	Source	F = 0.134	0.8750	NR	NS
	Make	F = 0.134	0.8750	NR	NS
	Deliver	F = 0.134	0.8750	NR	NS
	Return	F = 0.134	0.8750	NR	NS
	Overall	F = 0.134	0.8750	NR	NS
Avg. Customers per day	Plan	F = 0.246	0.8636	NR	NS
	Source	F = 0.246	0.8636	NR	NS
	Make	F = 0.246	0.8636	NR	NS
	Deliver	F = 0.246	0.8636	NR	NS

	Return	F = 0.246	0.8636	NR	NS
	Overall	F = 0.246	0.8636	NR	NS
Age	Plan	F = 0.928	0.4339	NR	NS
	Source	F = 0.928	0.4339	NR	NS
	Make	F = 0.928	0.4339	NR	NS
	Deliver	F = 0.928	0.4339	NR	NS
	Return	F = 0.928	0.4339	NR	NS
	Overall	F = 0.928	0.4339	NR	NS
Years of Service	Plan	F = 2.585	0.0847	NR	NS
	Source	F = 2.585	0.0847	NR	NS
	Make	F = 2.585	0.0847	NR	NS
	Deliver	F = 2.585	0.0847	NR	NS
	Return	F = 2.585	0.0847	NR	NS
	Overall	F = 2.585	0.0847	NR	NS
Sex	Plan	t = 0.593	0.5553	NR	NS
	Source	t = 0.593	0.5553	NR	NS
	Make	t = 0.593	0.5553	NR	NS
	Deliver	t = 0.593	0.5553	NR	NS
	Return	t = 0.593	0.5553	NR	NS
	Overall	t = 0.593	0.5553	NR	NS

The ANOVA results revealed that years of operation did not produce a significant difference in the SCM assessment across all dimensions ($F = 0.781$, $p = 0.5099$, $df = 3,53$). This finding holds true for Plan, Source, Make, Deliver, Return and the Overall SCM assessment. This implies that regardless of whether agri-farm businesses have been operating for five years or less, between five to seven years, eight to ten years, or more than ten years, the respondents' evaluation of their supply chain management remained statistically comparable. In terms of business size, no significant difference was found across all SCM dimensions ($F = 0.134$, $p = 0.8750$, $df = 2,54$). The null hypotheses was not rejected. This finding suggests that the scale of operations, in terms of workforce size, does not meaningfully differentiate how agri-farm businesses manage their supply chains.

The analysis of respondents grouped by initial capital likewise yielded no significant difference in SCM assessment across all SCOR dimensions ($F = 0.134$, $p = 0.8750$, $df = 2,54$). The null hypothesis was not rejected. This result indicates that the amount of startup capital invested in the business did not influence how respondents rated their supply chain management. No significant difference was observed when respondents were group by present capital. The null hypothesis was not rejected. The consistency of this result with the initial capital findings reinforces the conclusion that financial capitalization whether at the start or at the present stage of the business does not serve as differentiating factor in SCM assessment. The grouping of respondents by average monthly revenue produced no significant difference across all SCM dimensions ($F = 0.134$, $p = 0.8750$, $df = 2,54$). The null hypothesis was not rejected. This finding implies that revenue performance does not significantly influence the respondents' assessment of their supply chain management. Similarly, grouping respondents by average monthly expenses revealed no significant difference in SCM assessment across all dimensions ($F = 0.134$, $p = 0.8750$, $df = 2,54$). The null hypothesis was not rejected. This result indicates that the level of operational expenditure does not differentiate how agri-farm businesses evaluate their supply chain. Average number of customers per day showed no significant difference in SCM assessment ($F = 0.246$, $p = 0.8636$, $df = 3,53$). The null hypothesis was not rejected. The results for age groupings showed no significant difference in SCM assessment across all dimensions ($F = 0.928$, $p = 0.4339$, $df = 3,53$). The null hypothesis was not rejected. Years of service yielded the highest F statistic and the lowest p-value in the table ($F = 2.585$, $p = 0.0847$, $df = 2,54$), though stil

falling short of the 0.05 significance threshold. Sex shows no significant difference across all SCOR dimensions ($t = 0.593$, $p = 0.5553$, $df = 55$). The null hypothesis was not rejected.

There is no significant difference in the assessment of Supply Chain Management (SCM) across all SCOR dimensions (Plan, Source, Make, Deliver, Return) when grouped by any of the demographic variables examines.

Tables 15, 16, and 17 present the findings on the influence of Supply Chain Management (SCM) on the Business Performance of Agri-Farm Businesses in the Province of Rizal. Specifically, these tables examine the extent to which SCOR dimension affect business performance along three non-financial dimensions: Cost Efficiency, Operational Efficiency, and Customer Satisfaction.

Supply Chain Management's Influence on the Business Performance of Agri-Farm Businesses

The finding in Table 15 presents the overall extent of SCM influence on business performance in terms of cost efficiency.

Table 15. *Computed Weighted Mean and Verbal Interpretation on the extent of SCM influence on the Business Performance of Agri-Farm in Terms of Cost Efficiency*

Cost Efficiency	$\bar{Wx}$	Verbal Interpretation
1. To what extent does the business use locally available resources to reduce input expenses.	3.54	High Extent
2. To what extent does the staff are trained to perform multiple roles to reduce labor costs.	3.98	High Extent
3. To what extent does the pricing strategy is adjusted based on cost and market demand.	3.95	High Extent
4. To what extent optimal inventory levels are used to avoid overstocking or shortages	4.05	High Extent
5. To what extent does the business track cost per unit to improve profitability.	3.84	High Extent
6. To what extent does the business reduce production costs over the past year.	3.70	High Extent
7. To what extent does the business regularly review the allocated budget to identify-cost saving opportunities.	3.91	High Extent
8. To what extent does the business invest in cost-effective technologies or equipment.	3.86	High Extent
9. To what extent does the business achieve economies of scale through bulk purchasing or shared resources.	3.95	High Extent
10. To what extent does the business negotiate with suppliers to reduce input costs and analyze cost trends over time.	3.77	High Extent
Average	3.86	High Extent

The business performance of agri-farm businesses in terms of cost efficiency with an average weighted mean of 3.86 verbally interpreted as high extent suggests that agri-farm businesses in Rizal generally implement supply chain management that help minimize costs, optimize resources, and improve profitability.

Among the indicators, the highest rated item was the use of optimal inventory levels to avoid overstocking or shortages ($\bar{x} = 4.05$, High Extent). This finding reflects a strong awareness among agri-farm businesses of the critical relationship between inventory management and cost efficiency.

Staffed trained to perform multiple roles to reduce labor costs ($\bar{x} = 3.98$, High Extent) and pricing strategy adjusted based on cost and market demand ($\bar{x} = 3.95$, High Extent) and achieving economies of scale through bulk purchasing or shared resources ($\bar{x} = 3.95$, High Extent) all received equally high ratings, reflecting the respondents multi-dimensional approach to cost management. Cross trained and multi skilled workforces reduce the need for specialized labor redundancy and enable more flexible labor deployment in

response to seasonal fluctuations in agricultural production, a significant source of labor cost savings in agri-farm operations.

The indicator with the lowest weighted mean was the use of locally available resources to reduce input expenses ($\bar{x} = 3.54$), although it still received a verbal interpretation of High Extent.

In the SCOR Model, the highest indicator under cost efficiency is strongly associated with the Source and Deliver dimensions because effective inventory control reduces holding costs, prevents waste, and improves the flow of products and materials (Supply Chain Council, 2012). Silver, Pyke, and Thomas (2017) affirmed that inventory optimization through demand forecasting, safety stock calibration, and reorder point management yields significant reductions in total supply chain cost while simultaneously improving service levels, making it one of the highest-return investments in supply chain management. According to SCOR literature, the Source process emphasizes supplier selection, procurement efficiency, and cost reduction through better sourcing decisions. Seuring and Muller (2008) argued that local sourcing strategies not only lower procurement and logistics costs but also reduce supply chain vulnerability to external shocks.

Table 16 on the next page presents the overall extent of SCM influence on business performance in terms of operational efficiency.

The business performance of agri-farm businesses in terms of operational efficiency with an average weighted mean of 4.01 verbally interpreted as high extent indicates that agri-farm businesses generally maintain effective operations through efficient production, skilled labor, reliable supply chain, and organized work processes.

The highest rated indicator was the skill and productivity of the workforce, including management ($\bar{x} = 4.67$, Very High Extent). This suggests that respondents believe their employees and managers possess the necessary competencies to perform tasks effectively and contribute to the smooth operation of the business. The two lowest-rated indicators in the Operational Efficiency dimension are data recording and tracking systems are accurate and up to date ($\bar{x} = 3.54$, High Extent) and the process for getting products to market through transport and logistics is timely and cost effective ($\bar{x} = 3.56$, High Extent). These findings highlight two critical operational infrastructure gaps that overall operational efficiency of agri-farm businesses in Rizal.

Table 16. *Computed Weighted Mean and Verbal Interpretation on the extent of SCM influence on the Business Performance of Agri-Farm in Terms of Operational Efficiency*

Operational Efficiency	$\bar{Wx}$	Verbal Interpretation
1. To what extent does the business production outputs (yield, volume) meet or exceed the planned target.	4.19	High Extent
2. To what extent is the business workforce (including management) skilled and productive.	4.67	Very High Extent
3. To what extent is our supply chain (from sourcing to delivery) smooth and uninterrupted.	4.49	Very High Extent
4. To what extent does the business minimize post-harvest losses through effective handling and storage.	4.14	High Extent
5. To what extent does the business follow standardized operating procedures (SOPs) for key tasks.	3.89	High Extent
6. To what extent does the business operation quickly adapt to unexpected disruptions (e.g., weather, pest outbreaks, market shifts).	3.84	High Extent
7. To what extent does the business workforce possess the skills and training to solve problems independently.	3.81	High Extent
8. To what extent does the business data recording and tracking systems accurate and up to date.	3.54	High Extent
9. To what extent is the business process for getting products to market	3.56	High Extent

(transport, logistics) timely and cost-effective.		
10. To what extent is the business production cycle time optimized for maximum output.	4.00	High Extent
Average	4.01	High Extent

Swink et al. (2017) argued that workforce skill and productivity are the single most important determinants of operational performance in agricultural enterprises, as they directly govern the quality, speed, and consistency of every production and supply chain activity from planting and harvesting to processing, packaging, and distribution. Furthermore, the high-rating in-workforce productivity reflects the critical role of management capability in driving operational efficiency. Drucker (1999) emphasized that management effectiveness defined as the ability to set clear performance expectations, allocate resources optimally, and create an organizational environment conducive to high performance is the primary lever through which agricultural enterprises can improve their operational outcomes.

Gunasekaran and Ngai (2004) demonstrated that businesses with robust supply chain information systems consistently outperform those with manual or fragmented data recording across all key supply chain performance metrics. Similarly, Rodrigue et al. (2017) argued that logistics infrastructure quality is one of the primary structural determinants of agricultural supply chain competitiveness, and that businesses operating in areas with inadequate transportation infrastructure face a persistent and systematic cost disadvantage relative to those with access to efficient logistics networks.

The finding in Table 17 on the next page presents the overall extent of SCM influence on business performance in terms of customer satisfaction.

Table 17. *Computed Weighted Mean and Verbal Interpretation on the extent of SCM influence on the Business Performance of Agri-Farm in Terms of Customer Satisfaction*

Customer Satisfaction	$\bar{Wx}$	Verbal Interpretation
1. To what extent does the product quality of the agribusiness (e.g., freshness, appearance, lack of defects) consistently meet your expectations.	3.97	High Extent
2. To what extent does the agribusiness provide you with good overall value.	4.09	High Extent
3. To what extent do you find the pricing of the agribusiness to be fair and competitive for the quality provided.	4.36	Very High Extent
4. To what extent does the business handle customer feedback and suggestions.	4.25	Very High Extent
5. To what extent does the agribusiness provide accurate order quantities (no significant shortages or overages).	3.63	High Extent
6. To what extent does the business track customer satisfaction metrics to improve service.	3.85	High Extent
7. To what extent does personalization of services help to meet customer preferences.	4.25	Very High Extent
8. To what extent do the business maintain a high level of service consistency to ensure repeat customers.	4.31	Very High Extent
9. To what extent do the business communicate about order confirmations, pricing changes, and other updates.	3.94	High Extent
10. To what extent do you see yourself continuing to do business with the organization in the future.	4.08	High Extent
Average	4.07	High Extent

The average weighted mean of 4.07, indicates that SCM substantially influence the customer satisfaction outcomes of agri-farm businesses in Rizal. The highest-rated indicator was the fairness and competitiveness of pricing for the quality provided ($\bar{x} = 4.36$), which received a verbal interpretation of

Very High Extent. The lowest-rated indicator was accurate order quantities with no significant shortages or overages ($\bar{x} = 3.63$, High Extent). This finding highlights a meaningful gap in order fulfillment accuracy, a dimension of supply chain performance that directly impacts customer operational planning, inventory management, and financial budgeting.

The findings suggests that customers believe the prices charged by agri-farm businesses are reasonable and appropriate for the value they receive. Nagle et al. (2016) argued that value-based pricing where prices are set in accordance with the customers perceived value of the product rather than solely on cost-plus calculations is the most effective pricing strategy for maximizing both customer satisfaction and business profitability, as it aligns with the business's revenue model with the customer's value expectations. This finding is supported by the Supply Chain Council (2012), which states that order quantity accuracy is captured in the SCOR Model's Perfect Order Fulfillment metric, which requires that orders be delivered not only on time and in good condition but also in the exact quantities requested by the customer.

Table 18 presents the significant difference in Business Performance of Agri-Farms as Evaluated by Respondent Groups.

Table 18. *Significant Difference in Business Performance of Agri-Farms as Evaluated by the Respondent Groups*

SCOR Model	Business Performance	p	r	Ho	VI
Plan	Cost Efficiency	0.449	0.102	FR	NS
	Operational Efficiency	0.602	0.071	FR	NS
Source	Cost Efficiency	0.338	-0.129	FR	NS
	Operational Efficiency	0.005	0.367	R	S
Make	Cost Efficiency	0.370	0.121	FR	NS
	Operational Efficiency	0.074	0.239	FR	NS
Deliver	Cost Efficiency	<.001	0.887	R	S
	Operational Efficiency	0.434	-0.106	FR	NS
Return	Cost Efficiency	<.001	0.889	R	S
	Operational Efficiency	0.022	0.302	R	S

The analysis of the Plan component revealed that both cost efficiency ($p = 0.449$, $r = 0.102$) and operational efficiency ($p = 0.602$, $r = 0.701$) yielded p-values well above the 0.05 significance level, with near zero positive correlation coefficients in both cases. These results led to the failure to reject the null hypothesis for both dimensions, indicating that differences in planning practices among agri-farm respondent groups do not produce statistically meaningful variation in either cost or operational outcomes. The weak correlations suggest that while a slight positive directional tendency exists, it carries no practical weight in distinguishing business performance across the groups studied.

The Source component produced contrasting outcomes between the two performance dimensions. Cost efficiency returned a non-significant result ($p = 0.338$, $r = -0.129$), with a negligible negative correlation implying that sourcing practices bear no meaningful relationship with cost outcomes across the respondent groups. Operational efficiency, however, yielded a statistically significant result ($p = 0.005$, $r = 0.367$), prompting rejection of the null hypothesis. The moderate positive correlation indicates that how agri-farms manage their sourcing activities including input procurement, supplier selection, and material quality is meaningfully associated with differences in operational output.

Under the Make component, neither cost efficiency ($p = 0.370$, $r = 0.121$) nor operational efficiency ($p = 0.074$, $r = 0.239$) reached the 0.05 threshold for statistical significance, and the null hypothesis was retained for both. The cost efficiency correlation was weak and positive, while operational efficiency produced a low to moderate positive correlation that narrowly fell short of significance. Production and processing activities within the studied agri-farms do not appear to generate observable performance differences among respondent groups, possibly because farm level production methods remain relatively homogenous and are heavily influenced by external constraints.

The Deliver component produced the most pronounced finding in the study. Cost efficiency returned a very strong positive correlation ($r = 0.887$) with a highly significant p-value ($p < .001$), leading to rejection of the null hypothesis. This near perfect correlation indicates that variations in delivery related activities encompassing logistics management, distribution practices, and order fulfillment processes are strongly associated with cost performance differences among agri-farms. Operational efficiency, by contrast, returned no significant result ($p = 0.434$, $r = 0.106$), with a negligible negative correlation suggesting that delivery activities are disconnected from output volume or productivity outcomes.

The Return component was the only SCOR dimension to yield statistically significant results across both business performance measures. Cost efficiency produced a very strong positive correlation ($r = 0.889$, $p < .001$), nearly identical in magnitude to the Deliver component result, while operational efficiency also reached significance with a moderate positive correlation ($r = 0.302$, $p = 0.022$). The null hypothesis was rejected for both dimensions.

Across all five SCOR components, statistically significant differences in business performance were concentrated in the downstream stages of the supply chain. Cost efficiency was significantly associated with the Deliver and Return components, while operational efficiency showed significant relationships with Source and Return. The upstream components Plan and Make did not yield significant results in either performance dimension, suggesting that performance differentiation among agri-farms is driven more by how products are delivered and returns are handled than by how operations are planned or executed internally. Wirda et al. (2025) noted that supply chain complexity in agribusiness spanning multiple actors from farmers to retailers directly hampers coordination and operational efficiency, particularly at the sourcing and distribution stages. The consistent significance of the Return component across both dimensions is supported by Adegosa et al. (2024), who established that well managed reverse logistics generates measurable cost savings through waste reduction and resource optimization, with direct benefits to operational efficiency. Taken together, these findings suggest that agri-farm managers should prioritize downstream supply chain activities particularly delivery and return management as primary levers for improving business performance.

Significant Relationship of Supply Chain Management and Business Performance of Agri-Farm Businesses

Table 19 on the next page presents the result of the Pearson correlational analysis conducted to determine the significant relationship between the supply chain management assessment using the SCOR Model dimensions and the Business Performance of Agri-Farm Businesses in the Province of Rizal.

Table 19. Significant Relationship between SCM and Business Performance of Agri-Farm Businesses

SCM (SCOR Dimension)	Cost Efficiency (N = 57)				Operational Efficiency (N = 57)				Overall Business Performance (N = 57)				Customer Satisfaction (N = 285)			
	p	r	Ho	VI	p	r	Ho	VI	p	r	Ho	VI	p	r	Ho	VI
Plan	0.449	0.102	FR	NS	0.602	0.071	FR	NS	0.346	0.127	FR	NS	-	-	-	-
Source	0.338	- 0.129	FR	NS	0.005	0.367	R	S	0.978	0.004	FR	NS	-	-	-	-
Make	0.370		FR	NS	0.074	0.239	FR	NS	0.124	0.206	FR	NS	-	-	-	-

SCM (SCOR Dimension)	Cost Efficiency (N = 57)				Operational Efficiency (N = 57)				Overall Business Performance (N = 57)				Customer Satisfaction (N = 285)			
	p	r	Ho	VI	p	r	Ho	VI	p	r	Ho	VI	p	r	Ho	VI
		0.121														
Deliver	< .001	0.887	R	S	0.434	-0.106	FR	NS	< .001	0.844	R	S	-	-	-	-
Return	< .001	0.889	R	S	0.022	0.302	R	S	< .001	0.785	R	S	-	-	-	-
Overall SCM	< .001	0.862	R	S	0.694	-0.053	FR	NS	< .001	0.838	R	S	-	-	-	-
Overall Customer Satisfaction													.16	-2.453	R	S

The Plan dimension showed no significant relationship with any of the business performance dimensions — Cost Efficiency ($r = .102$, $p = .449$), Operational Efficiency ($r = .071$, $p = .602$), and Overall Business Performance ($r = .127$, $p = .346$). All three pairs yielded negligible correlation coefficients with p-values well above the .05 threshold, leading to a failure to reject the null hypothesis across all comparisons. This finding suggests that planning activities — such as inventory policy setting, supply chain strategy alignment, and financial budgeting — do not directly translate into measurable cost or operational performance outcomes at the individual respondent level.

The Source dimension yielded one statistically significant relationship: a weak positive correlation with Operational Efficiency ($r = .367$, $p = .005$, $p < .01$). This indicates that as sourcing practices improve — particularly in supplier evaluation, procurement digital tools, and multi-sourcing strategies — operational efficiency also tends to increase. However, no significant relationship was found between Source and Cost Efficiency ($r = -.129$, $p = .338$) or Overall Business Performance ($r = .004$, $p = .978$). The significant relationship with Operational Efficiency is logically consistent, as reliable and well-managed sourcing directly supports uninterrupted production cycles and workforce productivity — the two highest-rated indicators of Operational Efficiency in this study ($\bar{x} = 4.49$ and $\bar{x} = 4.67$, Very High Extent).

The Make dimension showed no significant relationship with any business performance dimension — Cost Efficiency ($r = .121$, $p = .370$), Operational Efficiency ($r = .239$, $p = .074$), and Overall BP ($r = .206$, $p = .124$). All p-values exceeded the .05 threshold, though the correlation with Operational Efficiency ($r = .239$) approached borderline significance. The near-significant relationship between Make and Operational Efficiency ($p = .074$) warrants attention. Within the SCOR Model, the Make process encompasses production scheduling, quality control, waste management, and workforce management — all of which directly influence operational throughput and efficiency. The borderline result may reflect the relatively small sample size ($N = 57$), which limits statistical power, and suggests that the practical relationship between production activities and operational efficiency may be stronger than the p-value indicates.

The Deliver dimension yielded two highly significant relationships: a strong positive correlation with Cost Efficiency ($r = .887$, $p < .001$) and a strong positive correlation with Overall Business Performance ($r = .844$, $p < .001$). No significant relationship was found with Operational Efficiency ($r =$

-.106, $p = .434$). These findings indicate that delivery and logistics practices are the strongest drivers of cost efficiency in agri-farm businesses. The strong correlation ($r = .887$) confirms that businesses with superior delivery processes — characterized by on-time fulfillment, cold chain management, and effective order management — simultaneously achieve greater cost efficiency through reduced waste, fewer returns, and optimized logistics expenditures.

The Return dimension produced the most varied pattern of significant relationships among all SCOR dimensions. A strong positive correlation was found with Cost Efficiency ($r = .899$, $p < .001$) — the highest r -value in the entire matrix — along with a strong positive correlation with Overall Business Performance ($r = .785$, $p < .001$). Additionally, a statistically significant but weak negative correlation was found with Operational Efficiency ($r = -.302$, $p = .022$).

The exceptionally strong correlation between Return and Cost Efficiency ($r = .899$) suggests that reverse logistics and return management practices are closely tied to cost outcomes in agri-farm businesses. This finding is consistent with the SCOR Model's Return process, which encompasses the recovery, recycling, and disposal of products and materials (APICS, 2017). The significant negative correlation between Return and Operational Efficiency ($r = -.302$, $p = .022$) warrants careful interpretation. A negative relationship implies that as return management activities increase, operational efficiency scores tend to decrease slightly. This counter-intuitive finding may reflect the operational burden that return processes impose on agri-farm businesses — handling returned products, managing defective materials, and processing customer complaints require additional labor, storage space, and administrative effort that can disrupt the flow of core production and delivery activities. Rogers and Tibben-Lembke (1999) warned that poorly integrated reverse logistics systems can create operational friction and divert resources from forward supply chain activities, leading to measurable reductions in overall operational efficiency.

According to the SCOR Model, the Plan process involves high-level strategic alignment and does not directly govern the execution of cost-saving or efficiency-generating activities (APICS Supply Chain Council, 2017). Kaplan and Norton (1992) similarly noted that strategic planning effectiveness is reflected more in long-term financial returns than in short-term operational metrics, which may explain why no correlation was detected within this sample. Within the SCOR Model, the Source process encompasses supplier selection, procurement execution, and supplier relationship management (APICS, 2017). Chopra and Meindl (2016) affirmed that procurement excellence reduces supply chain variability, which in turn stabilizes the Make and Deliver processes and contributes to overall operational performance. For the Make dimension Swink et al. (2017) noted that production process excellence is a foundational operational efficiency driver in agribusiness supply chains. The SCOR Model identifies the Deliver process as governing order management, transportation, and distribution — processes that carry some of the highest direct costs in agricultural supply chains (APICS Supply Chain Council, 2017). Lambert and Cooper (2000) similarly found that distribution network efficiency is the single largest determinant of supply chain cost in agribusiness enterprises.

Proposed Supply Chain Management Framework Based on Study Findings

Table 20 presents the proposed supply chain management framework for agri-farm businesses in the Province of Rizal.

The proposed framework is grounded from the Supply Chain Operations Reference (SCOR) Model, as its theoretical foundation, which structures supply chain activities across five interrelated dimensions: Plan, Source, Make, Deliver, and Return. Empirical data were gathered through weighted mean scores obtained from 57 agri-farm respondents in owner, manager, or supervisor roles, along with 285 customer respondents distributed across 14 municipalities in Rizal Province.

Table 20. Proposed Supply Chain Management Framework for Agri-Farm Businesses

SCOR Dimension	Strategic Priority	Proposed Strategy / Recommendation	Business Performance Impact
PLAN	Inventory & Budget Alignment	Maintain clearly defined, data-driven inventory policies for farm inputs and align financial budgets with supply chain operational plans.	Cost Efficiency
	Strategic Alignment	Ensure the supply chain strategy is fully integrated with the overall business strategy and communicated across all farm operations.	Operational Efficiency
	Resilience Planning	Develop and regularly update contingency plans for supply disruptions (e.g., seed shortages, pest outbreaks, weather events).	Operational Efficiency
SOURCE	Supplier Evaluation	Conduct regular formal performance evaluations of key suppliers to ensure quality, reliability, and timely delivery of farm inputs.	Operational Efficiency
	Digital Procurement	Adopt and expand use of digital tools for procurement management, inventory tracking, and sourcing activity monitoring.	Cost & Operational Efficiency
	Multi-Sourcing Strategy	Develop alternative supplier networks for critical farm inputs to reduce dependency and enhance supply chain resilience.	Cost Efficiency
MAKE	Waste & By-Product Management	Implement systems to recover value from agricultural by-products and waste through composting, biofuel conversion, or recycling.	Cost Efficiency
	Workforce Upskilling	Continuously train and develop the workforce in modern agricultural techniques, equipment operation, and quality control practices.	Operational Efficiency
	Operational Flexibility	Improve the farm's capacity to adapt quickly to changes in yield, quality fluctuations, or urgent customer orders.	Operational Efficiency
DELIVER	Order Fulfillment Accuracy	Strengthen order management systems to ensure products are delivered on time, in full, and with complete documentation.	Cost Efficiency
	Cold Chain & Logistics	Invest in reliable and cost-effective transportation infrastructure including refrigerated logistics for perishable products.	Customer Satisfaction
	Customer Communication	Provide customers with timely and accurate information on order status, delivery timelines, and pricing changes.	Customer Satisfaction
RETURN	Complaint Resolution	Establish a fast, transparent, and standardized customer complaint resolution process tied to root-cause analysis.	Customer Satisfaction
	Value Recovery from Surplus	Develop mechanisms to convert unsold or excess farm products into alternative revenue streams (e.g., processed goods, discount channels).	Cost Efficiency
	Circular Economy Practices	Scale up adoption of circular economy initiatives such as biodegradable packaging, water recycling, and resource reuse programs.	Operational Efficiency

Within the Plan dimension, the recommended strategies address three key areas: aligning inventory with financial budgets, embedding supply chain goals within the overall business direction, and building resilience against unforeseen disruptions. These interventions aim to bridge the existing gap between strategic intent and operational execution, which is particularly critical in agricultural settings where supply chain volatility is an inherent challenge.

The Source dimension addresses procurement activities and supplier relationship management. While the dimension generally scored well, the comparatively lower performance in sustainable sourcing reveals an area requiring attention. To address this, the framework encourages agri-farm businesses to diversify their supplier base through multi-sourcing arrangements and to incorporate environmental sustainability as a criterion in procurement decisions. Such measures are expected to strengthen supply

chain resilience while responding to the growing consumer and market preference for responsible agricultural practices.

The Make dimension demonstrates that agri-farm businesses are making meaningful progress in environmental stewardship and workforce development. However, the indicators that received the lowest scores within this dimension point to notable vulnerabilities in production operations. Accordingly, the framework highlights waste reduction and by-product utilization, employee skills development, and adaptive production capacity as the most critical areas for intervention and improvement.

Among all five dimensions, Deliver exhibits one of the most pronounced associations with business outcomes, particularly in terms of Cost Efficiency. Nonetheless, the indicators that scored lowest within this dimension correspond directly to the Perfect Order Fulfillment metric of the SCOR Model, indicating room for significant improvement. The framework therefore prescribes focused strategies in the areas of order accuracy, cold chain and logistics infrastructure, and transparent communication with customers, with the intent of closing critical performance gaps and further capitalizing on the Deliver dimension's demonstrated influence on business outcomes.

The Return dimension indicates that agri-farm businesses are increasingly incorporating resource recovery into their operations, though this area remains the least developed among all SCOR dimensions. Evidence from this study suggests that inadequately embedded return processes can generate operational friction, pulling labor and resources away from core forward supply chain functions. This finding highlights the importance of treating return management not as an afterthought, but as a structured and fully integrated component of the overall supply chain system.

Taken as a whole, the framework encourages agri-farm businesses in Rizal Province to transition from a reactive, operationally driven approach toward a proactive, technology-supported, and customer-oriented supply chain model. This shift involves building on the relative strengths already observed in the Source and Plan dimensions, while directing deliberate efforts toward addressing the identified weaknesses in the Return and Deliver dimensions, ultimately working toward a more balanced and high-performing supply chain system.

In-depth Discussion of Findings in Relation to Research Objectives and Literature

1. Profile of Agri-Farm Businesses and Their Respondents

The geographic distribution of agri-farm businesses across the Province of Rizal reveals a strong concentration in Tanay, which accounted for 28.1% of all respondents. This spatial clustering is consistent with Malaque and Yokohari's (2007) observation that peri-urban municipalities in Rizal Province with larger agricultural land endowments tend to sustain denser farm communities, even as urbanization exerts pressure on surrounding areas. The prominence of Tanay as the dominant agricultural hub aligns with the findings of Ilagan (2020) and De Vera and Rosete (2019), who similarly identified that agri-farm business clusters in Philippine provinces form where local government actively supports agriculture alongside favorable land and topographic conditions. From a business management perspective, this concentration has direct implications for supply chain infrastructure planning, as logistic networks, input supply chains, and market access routes serving Rizal Province are disproportionately anchored around a single municipality, creating potential vulnerabilities if service disruptions occur in that area.

Most of the respondent agri-farms have been operating for 8 to 10 years (38.6%) and are classified as medium-sized enterprises (36.8%), reflecting a sector that has matured past the high-mortality early years common among Philippine MSMEs. This finding aligns with Bautista and Manzano's (2018) study, which found that surviving Philippine MSMEs consolidate into small and medium-scale operations after navigating early establishment challenges, while Tugade (2020) observed that agricultural MSMEs that successfully transition to medium size demonstrate greater capacity for supply chain investment, technology adoption, and market diversification. The capital trajectory for a median initial bracket of ₱60,001 to ₱90,000 to a present capital range of ₱400,001 to ₱600,000 further affirms that the agri-farms

in this study have achieved meaningful financial growth, consistent with the Food and Agriculture Organization's (2023) assertion that accumulated financial resources are a primary determinant of long-term agricultural business longevity and competitive resilience.

The demographic profile of respondents highlights two structurally important characteristics of agri-farm management in Rizal Province. The predominance of female respondents at 59.6% validates the Department of Agriculture's recognition of women as integral participants across all segments of the Philippine agricultural value chain, from production and processing to marketing and customer service. Conversely, the concentration of respondents in the 46 to 55 age bracket raises concerns about generational succession, as Haryati et al. (2024) cautioned that an aging agricultural workforce without deliberate youth engagement strategies poses long-term risks to farm operational continuity and the transfer of accumulated supply chain knowledge across generations. Taken together, these demographic findings suggest that while current management is experienced and capable, strategic investment in succession planning and youth development is urgently necessary to sustain the sector's long-term performance.

2. Extent of SCM Implementation Across SCOR Dimensions

The overall grand mean of 3.92 across all five SCOR dimensions — Plan, Source, Make, Deliver, and Return — confirms that agri-farm businesses in Rizal Province are implementing supply chain management practices to a high extent, with the Source dimension emerging as the strongest area ($\bar{x} = 4.17$) and Return as the least developed ($\bar{x} = 3.80$). The high performance in the Source dimension, driven by very high scores in regular supplier evaluation ($\bar{x} = 4.67$) and adoption of digital procurement tools ($\bar{x} = 4.49$), is consistent with Gunasekaran et al.'s (2017) finding that integrating digital technologies into procurement processes reduces transaction costs, improves information symmetry between buyers and suppliers, and enhances overall procurement cycle efficiency. These results confirm that agri-farm businesses in Rizal have made meaningful progress in formalizing and digitizing their sourcing activities, an advancement that directly strengthens supply chain reliability as defined by the SCOR Model's supplier relationship management expectations (APICS, 2017).

Despite the Plan dimension's generally strong overall average ($\bar{x} = 3.90$), the relatively lower scores on formal cost analysis and Sales and Operations Planning (S&OP) at $\bar{x} = 3.58$ each suggest that a significant share of respondents continue to rely on informal or experience-based planning rather than data-driven demand forecasting systems. Huan et al. (2004) argued that effective supply chain planning requires that strategic alignment be operationalized through measurable inventory and resource management policies, while Chopra and Meindl (2016) demonstrated that inter-organizational planning synchronization significantly reduces supply chain uncertainty. The gap between high-level strategic alignment and structured operational planning systems represents one of the most actionable improvement opportunities within the Plan dimension for agri-farm businesses in Rizal.

The Make dimension's findings reveal an asymmetric capability profile: agri-farm businesses perform strongly in by-product and waste management ($\bar{x} = 4.21$) and workforce training ($\bar{x} = 4.16$) but score comparatively lower on operational flexibility ($\bar{x} = 3.54$) and proactive equipment maintenance ($\bar{x} = 3.56$). Swink et al. (2017) noted that this pattern is common in agricultural supply chains, where environmental management practices tend to advance ahead of operational agility because the former are driven by regulatory compliance and immediate cost-saving imperatives, while the latter require capital investment in flexible production systems that many SMEs defer. Addressing the flexibility and maintenance gaps within the Make dimension is therefore essential for improving the agility performance attribute of the SCOR Model, particularly as agri-farm businesses face increasingly volatile weather patterns and market conditions.

The Deliver dimension's performance is constrained by its two weakest indicators: on-time in-full delivery ($\bar{x} = 3.56$) and customer order status communication ($\bar{x} = 3.54$), both of which are directly tied to the SCOR Model's Perfect Order Fulfillment metric. Gunasekaran (2001) argued that consistent failure to meet delivery commitments erodes customer trust and weakens competitive positioning in agricultural

markets, while Lambert and Cooper (2000) identified order management excellence as a primary determinant of customer loyalty in agricultural supply chains. These findings make the Deliver dimension's performance gaps particularly consequential for agri-farm businesses' ability to sustain and grow their customer relationships, underscoring the need for targeted investments in logistics infrastructure, order verification protocols, and real-time communication systems.

The Return dimension's position as the lowest-performing SCOR area ($\bar{x} = 3.80$) is consistent with broader literature on reverse logistics in agricultural SMEs. Rogers and Tibben-Lembke (1999) found that reverse logistics is chronically underprioritized in agricultural SMEs because its financial returns are less immediately visible than those of forward supply chain investments, while the Waste and Resource Action Programme (WRAP, 2015) estimated that surplus and unsold agricultural products represent one of the largest avoidable sources of supply chain cost in the food and agriculture sector. The low scores on value recovery from excess products ($\bar{x} = 3.63$) and customer complaint resolution ($\bar{x} = 3.65$) collectively indicate that return management continues to operate as a reactive function rather than a strategically integrated component of the supply chain system, limiting its potential to contribute to both cost efficiency and customer satisfaction outcomes.

3. SCM Influence on Non-Financial Business Performance

The findings confirm that supply chain management exerts a uniformly high influence across all three non-financial performance dimensions, with customer satisfaction recording the highest overall weighted mean (4.07), followed by operational efficiency (4.01) and cost efficiency (3.86). Within cost efficiency, the highest-rated indicator was the use of optimal inventory levels to avoid overstocking or shortages ($\bar{x} = 4.05$), a finding that aligns with Silver et al.'s (2017) affirmation that inventory optimization through demand forecasting, safety stock calibration, and reorder-point management yields significant reductions in total supply chain cost while simultaneously improving service levels. The relatively lower score on local resource utilization ($\bar{x} = 3.54$) is consistent with Seuring and Muller's (2008) finding that local sourcing strategies remain underutilized in emerging market agricultural supply chains despite their demonstrated potential to reduce procurement costs and insulate businesses from external supply disruptions.

The SCM-operational efficiency relationship is dominated by the exceptional performance of workforce skill and productivity ($\bar{x} = 4.67$, Very High Extent) and supply chain continuity ($\bar{x} = 4.49$, Very High Extent), consistent with Swink et al.'s (2017) contention that workforce competence is the single most important determinant of operational performance in agricultural enterprises. Drucker's (1999) emphasis on management effectiveness as the primary organizational lever for improving operational outcomes is similarly supported by the strong management capability scores reflected in the operational efficiency results. The identified gaps in data recording accuracy ($\bar{x} = 3.54$) and logistics timeliness ($\bar{x} = 3.56$) echo Gunasekaran and Ngai's (2004) demonstration that supply chain information system quality consistently differentiates high-performing from low-performing agricultural enterprises, highlighting these areas as priority targets for operational investment among Rizal agri-farms.

The highest customer satisfaction scores were recorded for price fairness and competitiveness ($\bar{x} = 4.36$, Very High Extent), service consistency ($\bar{x} = 4.31$, Very High Extent), and personalization of services ($\bar{x} = 4.25$, Very High Extent), reflecting a strong customer-perceived value proposition among Rizal agri-farm businesses. These results align with Nagle et al.'s (2016) value-based pricing framework, which posits that customer price satisfaction is maximized when pricing is aligned with perceived value rather than set purely on cost-plus calculations, and with Li's (2021) finding that satisfaction in agri-farm contexts significantly influences revisit intention and word-of-mouth promotion. However, the lowest-rated customer satisfaction indicator was order accuracy, with no significant shortages or overages ($\bar{x} = 3.63$, High Extent), a gap directly captured in the SCOR Model's Perfect Order Fulfillment metric (Supply Chain Council, 2012). This relatively low score suggests that fulfillment accuracy represents a structural

vulnerability that, if unaddressed, could gradually erode the currently strong customer satisfaction outcomes.

4. Significant Relationships Between SCM and Business Performance

The Pearson correlation analysis revealed that the relationship between SCM dimensions and non-financial business performance is not uniform across the supply chain but is instead concentrated in the downstream stages. The Plan and Make dimensions showed no statistically significant correlations with any of the three performance dimensions, suggesting that upstream planning and production activities, while important as operational foundations, do not directly differentiate business performance outcomes among agri-farm businesses at the scale and within the timeframe captured by this study. As Kaplan and Norton (1992) noted, strategic planning effectiveness tends to manifest more in long-term financial outcomes than in short-term operational metrics, which may explain the absence of significant correlations for the Plan dimension despite its strong weighted mean scores.

The Deliver dimension yielded the most operationally significant finding: a near-perfect positive correlation with cost efficiency ($r = 0.887$, $p < .001$) and a strong positive correlation with overall business performance ($r = 0.844$, $p < .001$). These results confirm that delivery and logistics practices are the strongest driver of cost efficiency among agri-farm businesses in Rizal, consistent with Lambert and Cooper's (2000) finding that distribution network efficiency is the single largest determinant of supply chain cost in agribusiness. The implication is direct: agri-farms that invest in improving on-time delivery performance, cold chain logistics, and order fulfillment accuracy stand to achieve the greatest gains in cost efficiency relative to investment in any other SCOR dimension.

The Return dimension produced the most comprehensive pattern of significant results across both measured performance dimensions, with a very strong positive correlation with cost efficiency ($r = 0.889$, $p < .001$) and a moderate positive correlation with operational efficiency ($r = 0.302$, $p = .022$). The exceptionally high correlation between return management and cost efficiency suggests that reverse logistics practices — including value recovery from surplus products, management of defective supplier inputs, and resolution of customer complaints — generate substantial cost savings that are directly reflected in overall business performance. Adegosa et al. (2024) similarly established that well-managed reverse logistics generates measurable cost savings through waste reduction and resource optimization, while Rogers and Tibben-Lembke (1999) warned that poorly integrated return processes create operational friction that can divert resources from forward supply chain activities, partially explaining the moderate negative correlation between Return and operational efficiency observed in this study.

CONCLUSIONS

Based on the findings of the study, the following conclusions are drawn regarding the supply chain management and business performance of agri-farm businesses in the Province of Rizal.

The Source dimension is the strongest area of SCM implementation, driven by robust supplier evaluation and digital procurement practices, while the Return dimension is the least developed, constrained by limited value recovery mechanisms and reactive complaint resolution. These results confirm that agri-farm businesses in Rizal have built a generally competent supply chain system, but have not yet achieved the consistent, integrated performance required for Very High Extent ratings across all dimensions.

There is no significant difference in the assessment of SCM across any demographic variable examined — including years of operation, business size, initial capital, revenue, and sex — indicating that supply chain management practices among Rizal agri-farms are relatively homogenous and are not meaningfully shaped by the structural or demographic characteristics of the businesses studied. The null hypothesis for this research question was therefore not rejected.

SCM exerts a high and positive influence on all three non-financial business performance dimensions, with customer satisfaction. Across all performance dimensions, the downstream SCOR

components — Deliver and Return — demonstrated the strongest and most statistically significant associations with business performance outcomes, while upstream components — Plan and Make — showed no direct significant relationships. This finding confirms that for agri-farm businesses in Rizal, performance differentiation is driven more by how products are delivered and how returns are managed than by how operations are planned or executed internally.

The correlation analysis confirmed a significant relationship between overall SCM and overall business performance, affirming the central hypothesis of this study. The null hypothesis was rejected. Supply chain management, particularly the Deliver and Return dimensions, serves as a critical strategic lever for improving cost efficiency and overall business outcomes in agri-farm enterprises in Rizal Province.

The proposed framework translates these conclusions into action. It reinforces the sector's sourcing strengths while addressing the identified gaps in planning formalization, production flexibility, delivery reliability, and return management. Each SCOR dimension is paired with targeted strategies from structured S&OP cycles and multi-sourcing arrangements to cold chain investments and value recovery programs forming a practical, evidence-based improvement pathway that agri-farm businesses in Rizal can adopt to achieve more consistent and balanced supply chain performance across all operational levels.

Practical Implications and Recommendations for Business Management

The results of this study offer several actionable insights for agri-farm operators, managers, and support institutions in the Province of Rizal.

1. Formalize Planning and Demand Forecasting.

The below average on cost analysis and S&OP ($\bar{x} = 3.58$ each) under the Plan dimension suggest that many agri-farm businesses still depend on intuition rather than structured data when making supply chain decisions. Managers are encouraged to adopt regular planning cycles that draw on actual inventory levels, customer demand patterns, and production capacity. Basic tools including free mobile applications or simple spreadsheet templates are sufficient to start this transition without requiring significant financial outlay.

2. Embed Sustainability in Procurement.

The relatively modest performance on sustainable sourcing ($\bar{x} = 3.75$) presents a differentiation opportunity that most agri-farms have yet to fully capture. Including environmental criteria such as biodegradable packaging, organic input sourcing, and supplier carbon footprint within formal procurement evaluations would not only align businesses with growing consumer expectations in nearby Metro Manila markets but also contribute to long-term supply chain resilience.

3. Invest in Delivery Infrastructure and Communication.

Low scores on operational flexibility, equipment maintenance, on-time delivery, and customer order communication all clustering around $\bar{x} = 3.54$ to 3.56 point to a consistent gap between upstream practices and weak downstream execution. Addressing this requires deliberate investment in transport arrangement, preventive maintenance schedules, and simple customer notification systems. Given the near-perfect correlation between Deliver performance and cost efficiency ($r = 0.887$), this area offers the highest return on any SCM investment the business can make.

4. Build Structured Return and Value Recovery Systems.

Every unsold or spoiled unit of agricultural produce presents a layered financial loss covering input costs, labor, and foregone revenue. The Return dimension's position as the lowest-performing SCOR area ($\bar{x} = 3.80$) signals that most agri-farms are absorbing these losses without systematic recovery efforts. Managers should establish programs that redirect surplus or rejected produce into secondary revenue

streams such as compost, processed goods, or animal feeds. Equally, customer complaint resolution ($\bar{x} = 3.65$) should be standardized into a defined, time bound process rather than handled on a case-by-case basis.

5. Strengthen Order Fulfillment Accuracy.

The order accuracy gap ($\bar{x} = 3.63$) is the most pressing customer satisfaction concern revealed by this study. Standardizing verification steps at every stage from order entry through picking, packing, and dispatch and using even a basic customer tracking log to monitor and resolve recurring errors would substantially protect the high customer satisfaction levels that agri-farms have built.

6. Develop a Succession and Youth Engagement Strategy.

With most respondents aged 46 to 55 and very few managers below 35, the sector faces a near-term leadership continuity risk. Agri-farm businesses should begin formalizing mentorship arrangements, establishing linkages with nearby agricultural schools and universities, and creating a clear succession pathway that ensure accumulated operational and supply chain knowledge is transferred before experienced managers exit the workforce.

7. For Policymakers and Support Agencies.

The concentration of agri-farm activity in Tanay, Antipolo, and Morong calls for geographically targeted interventions from the Provincial Government of Rizal, the Department of Agriculture, and the Department of Trade and Industry. Effective support measures include SCM capacity-building workshops grounded in SCOR best practices, incentive programs for digital procurement and farm management technology adoption, improvements to rural and road and cold-chain infrastructure in isolated municipalities, and financing programs calibrated to the capitalization needs of medium-sized farm enterprises. Promoting inter-municipal cooperative networks would further enable collective procurement, shared logistics arrangement, and coordinated market access among neighboring farms.

Limitations of the Study

This study was conducted with rigor and adherence to established research methodologies; however, several limitations must be acknowledged to accurately contextualize the findings and conclusions drawn from the data.

The cross-sectional design captures supply chain practices and business performance at a single point in time, which limits the ability to draw conclusions about causality or temporal dynamics. While the findings demonstrate significant associations between SCM and business performance, longitudinal research would be needed to determine definitively whether SCM improvements cause performance gains, or whether better performing firms simply have the resources to invest more heavily in supply chain systems.

The geographic focus on agri-farms in Rizal Province may limit the generalizability of findings to other regions with different agricultural ecosystems, market conditions, or infrastructure levels. Rizal's proximity to Metro Manila and relatively developed road network may produce supply chain performance patterns not representative of Philippine agriculture in more remote or rural provinces.

The study relies on self-reported data for both SCM assessment and business performance measurement, which introduces the potential for response bias. Respondents may overestimate their capabilities or performance due to social desirability effects or the absence of objective external benchmarks. While the significant perceptual differences between owners and managers versus customers provide partial validation that customers perceive actual service quality, objective third-party performance measures would further strengthen confidence in the findings.

The study's exclusive focus on the five SCOR Model dimensions means that other potentially important aspects of supply chain management — such as supply chain integration depth, information sharing quality, relationship governance mechanisms, and inter-organizational trust — are not captured in

the analysis. A more comprehensive assessment framework incorporating these dimensions might reveal different or additional patterns in the SCM-performance relationship.

Finally, the study examines business performance exclusively through non-financial indicators — cost efficiency, operational efficiency, and customer satisfaction — without including objective financial performance metrics such as profitability, return on investment, or revenue growth rates. While non-financial indicators are appropriate and practically relevant in the agri-farm MSME context, the inclusion of objective financial data in future studies would provide a more complete picture of the business performance consequences of SCM investment.

REFERENCES

- Abelardo, N. (2023, May 2). *Agriculture supply chain: Challenges and opportunities in the Philippines*. Transportify. <https://www.transportify.com.ph/delivery/business/agriculture-supply-chain-challenges-and-opportunities-in-the-philippines>
- Adegosa, A., Oladele, T., & Adeyemi, S. (2024). Reverse logistics and cost efficiency in agricultural supply chains. *Journal of Supply Chain and Operations Management*, 22(1), 45–62.
- Ahumada, O., & Villalobos, J. R. (2011). Operational model for planning the harvest and distribution of perishable agricultural products. *International Journal of Production Economics*, 133(2), 677–687. <https://doi.org/10.1016/j.ijpe.2011.05.015>
- Aitken, J., Christopher, M., & Towill, D. (2002). Understanding, implementing and exploiting agility and leanness. *International Journal of Logistics: Research and Applications*, 5(1), 59–74. <https://doi.org/10.1080/13675560110090>
- Akinrinola, O. (2020). Non-financial performance indicators and organizational effectiveness: A balanced scorecard approach. *African Journal of Business Management*, 14(4), 112–121.
- Alfalla-Luque, R., Medina-Lopez, C., & Dey, P. K. (2013). Supply chain integration framework using literature review. *Production Planning & Control*, 24(8–9), 800–817. <https://doi.org/10.1080/09537287.2012.666870>
- APICS Supply Chain Council. (2017). *SCOR: Supply chain operations reference model, version 12.0*. Association for Supply Chain Management.
- Asian Development Bank. (2023). *Financing agriculture value chains in developing Asia*. <https://www.adb.org>
- Balita, C. (2025). *Agriculture in the Philippines*. Statista. <https://www.statista.com/topics/5744/agriculture-industry-in-the-philippines/>
- Bautista, M., & Manzano, G. (2018). MSME survival rates in the Philippines: An analysis of early-stage enterprise mortality. *Philippine Management Review*, 25(1), 34–49.
- Bechtel, C., & Jayaram, J. (1997). Supply chain management: A strategic perspective. *The International Journal of Logistics Management*, 8(1), 15–34. <https://doi.org/10.1108/09574099710805565>
- Bello, A., Adekunle, A., & Osei, K. (2020). Sustainable operations and cost reduction in emerging market supply chains. *Sustainability*, 12(8), Article 3150. <https://doi.org/10.3390/su12083150>
- Bolstorff, P., & Rosenbaum, R. (2011). *Supply chain excellence: A handbook for dramatic improvement using the SCOR model* (3rd ed.). AMACOM.
- Buela, R., Santos, M., & Reyes, F. (2023). Land use patterns and agricultural concentration in CALABARZON: A geospatial analysis. *Philippine Agricultural Scientist*, 106(2), 88–101.
- Bugador, R. (2015). *The agribusiness sector in the Philippines: Structure, performance, and challenges* [DLSU Research Congress Paper]. De La Salle University. <https://www.dlsu.edu.ph/wp-content/uploads/2019/03/2015-26.pdf>
- Burgess, K., Singh, P. J., & Koroglu, R. (2006). Supply chain management: A structured literature review and implications for future research. *International Journal of Operations & Production Management*, 26(7), 703–729. <https://doi.org/10.1108/01443570610672202>
- Calderon, J. F., & Gonzales, E. C. (2020). *Methods of research and thesis writing* (Rev. ed.). National Book Store.
- Callado, A. A. C., Jack, L., & Leon-Callado, A. L. (2015). Use of non-financial metrics and the role played by agribusiness companies within the supply chain structure. *Revista Base (Administração e Contabilidade) da UNISINOS*, 12(3), 183–192.

- Cavalleri, S. A. E., Tanwattana, P., & Clemens, M. (2022). Systemizing a rural livelihood diversification framework for sustainable community-based agritourism: A participatory approach to ensure resilience. *Frontiers in Sustainable Food Systems*, 6, Article 993892. <https://doi.org/10.3389/fsufs.2022.993892>
- Cheema, S. (2013). Customer satisfaction in service industries: A conceptual model. *International Journal of Business and Management*, 8(13), 100–106.
- Chopra, S., & Meindl, P. (2019). *Supply chain management: Strategy, planning, and operation* (7th ed.). Pearson. (Original work published 2015)
- Ćirić, M., Tešanović, D., Kalenjuk Pivarski, B., Ćirić, I., Banjac, M., Radivojević, G., & Šmugović, S. (2021). Analyses of the attitudes of agricultural holdings on the development of agritourism and the impacts on the economy, society and environment of Serbia. *Sustainability*, 13(24), Article 13729. <https://doi.org/10.3390/su132413729>
- Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approach* (5th ed.). SAGE Publications.
- Cruz, D. A. (2022). *Future-proofing Philippine agriculture and food systems*. University of the Philippines Center for Integrative and Development Studies. <https://cids.up.edu.ph/wp-content/uploads/2022/09/Future-Proofing-Philippine-Agriculture-and-Food-Systems.pdf>
- Cruz, J., & Layaoen, H. (2019). Urban transition and agricultural land conversion in peri-urban Rizal: Patterns, drivers, and policy responses. *Philippine Journal of Development*, 46(1), 55–78.
- Del Prado, F. (2022). *Provincial value of production in agriculture and fisheries: CALABARZON, 2021*. Philippine Statistics Authority. <https://psa.gov.ph>
- Denend, L., & Plambeck, E. (2007). *Wal-Mart's sustainability strategy* [Case study OIT-71]. Stanford Graduate School of Business.
- Department of Agriculture, Philippines. (n.d.). *Women in agriculture: Participation in the agricultural value chain*. Official website. <https://www.da.gov.ph>
- De Vera, M., & Rosete, A. (2019). Agricultural land use dynamics and agribusiness clustering in Rizal Province. *Journal of Rural Development*, 38(2), 201–215.
- Dominici, G., & Guzzo, R. (2010). Customer satisfaction in the hotel industry: A case study from Sicily. *International Journal of Marketing Studies*, 2(2), 3–12. <https://doi.org/10.5539/ijms.v2n2p3>
- Drucker, P. F. (1999). *Management challenges for the 21st century*. HarperBusiness.
- Edwards, C., & Schultz, C. (2005). Toward a comprehensive definition of agribusiness. *International Food and Agribusiness Management Review*, 8(4), 1–16.
- El-Garaihy, W. H. (2021). Supply chain operations reference model and performance measurement: Evidence from Saudi firms. *Management Science Letters*, 11(3), 905–916. <https://doi.org/10.5267/j.msl.2020.10.005>
- Escrow, J. (2001). Managing customer expectations in service organizations: A process model. *Journal of Service Research*, 4(1), 20–31.
- Estrella, R. (2020). High-value vegetable production in Eastern Rizal: Opportunities and constraints for smallholder farmers. *Philippine Journal of Crop Science*, 45(1), 12–24.
- Farsi, H., Imanipour, N., & Salamzadeh, A. (2017). Entrepreneurial university conceptualization: Case of developing countries. *Global Business and Management Research*, 4(2), 170–186.
- Fiona, L. (2023). *The evolution of agribusiness: Current challenges and future trends*. Stanton Chase. <https://www.stantonchase.com/insights/blog/the-evolution-of-agribusiness-current-challenges-and-future-trends>
- Food and Agriculture Organization of the United Nations. (2023). *The state of food and agriculture 2023: Revealing the true cost of food*. FAO. <https://www.fao.org>
- Forozia, A., Zadeh, M. S., & Gilani, M. H. (2013). Customer satisfaction in hospitality industry: Middle East tourists at 3-star hotels in Malaysia. *Research Journal of Applied Sciences, Engineering and Technology*, 5(17), 4329–4335.
- Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2019). *How to design and evaluate research in education* (10th ed.). McGraw-Hill Education.
- Gajić, T., Petrović, M. D., Blešić, I., Radovanović, M. M., Spasojević, A., Sekulić, D., & Dubover, D. A. (2024). The contribution of the farm to table concept to the sustainable development of agritourism homesteads. *Agriculture*, 14(8), Article 1314. <https://doi.org/10.3390/agriculture14081314>

- Global Green Growth Institute. (2021). *Agribusiness: Philippine government and international organizations team up to support micro enterprises in Oriental Mindoro*. <https://gggi.org/agribusiness-philippine-government-and-international-organizations-team-up-to-support-micro-enterprises-in-oriental-mindoro/>
- Goldberg, R. A. (1957). *Agribusiness coordination: A systems approach to the wheat, soybean, and Florida orange economies*. Harvard University Graduate School of Business Administration.
- Gunasekaran, A. (2001). Agile manufacturing: A framework for research and development. *International Journal of Production Economics*, 62(1–2), 87–105. [https://doi.org/10.1016/S0925-5273\(00\)00151-1](https://doi.org/10.1016/S0925-5273(00)00151-1)
- Gunasekaran, A., & Ngai, E. W. T. (2004). Information systems in supply chain integration and management. *European Journal of Operational Research*, 159(2), 269–295. <https://doi.org/10.1016/j.ejor.2003.08.016>
- Gunasekaran, A., Papadopoulos, T., Dubey, R., Wamba, S. F., Childe, S. J., Hazen, B., & Akter, S. (2017). Big data and predictive analytics for supply chain and organizational performance. *Journal of Business Research*, 70, 308–317. <https://doi.org/10.1016/j.jbusres.2016.08.004>
- Harahap, B., Fauzi, A., Juanda, B., & Panjaitan, N. K. (2025). Demand forecasting improvement in agricultural supply chains using machine learning. *Agricultural Systems*, 215, Article 103865. <https://doi.org/10.1016/j.agsy.2024.103865>
- Harlem Brundtland, G. (1987). *Our common future: Report of the World Commission on Environment and Development*. Oxford University Press.
- Haryati, N., Lasitya, D. S., Nurirrozak, M. Z., Herdianti, D. F., Fibrianiyngtyas, A., & Hidayat, A. R. R. T. (2024). Demographics and course choices: Impact on youth farming intention in Indonesia. *International Journal of Adolescence and Youth*, 29(1), Article 2358088. <https://doi.org/10.1080/02673843.2024.2358088>
- Hayes, A. (2024). *Demographics: How to collect, analyze, and use demographic data*. Investopedia. <https://www.investopedia.com/terms/d/demographics.asp>
- Heizer, J., Render, B., & Munson, C. (2017). *Operations management: Sustainability and supply chain management* (12th ed.). Pearson.
- HL Agro. (2024). *Understanding the global impact of agribusiness*. <https://hlagro.com/blog/understanding-the-global-impact-of-agribusiness/>
- Hollas, C. R., Chase, L., Conner, D., Dickes, L., Lamie, R. D., Schmidt, C., & Quella, L. (2021). Factors related to profitability of agritourism in the United States: Results from a national survey of operators. *Sustainability*, 13(23), Article 13334. <https://doi.org/10.3390/su132313334>
- Hsiang-Yung, C., Lin, Y., & Kao, T. (2026). Customer loyalty in agri-farm tourism: Effects of satisfaction, experience quality, and relationship quality. *Tourism Management*, 94, Article 104920.
- Huan, S. H., Sheoran, S. K., & Wang, G. (2004). A review and analysis of supply chain operations reference (SCOR) model. *Supply Chain Management: An International Journal*, 9(1), 23–29. <https://doi.org/10.1108/13598540410517557>
- Iktriniasari, Z. F., Harianto, H., & Yuslistyari, E. I. (2020). Implementation of SCOR model for supply chain performance measurement in the food industry. *IOP Conference Series: Materials Science and Engineering*, 847, Article 012058. <https://doi.org/10.1088/1757-899X/847/1/012058>
- Ilagan, R. (2020). Agribusiness clustering in Philippine peri-urban zones: Evidence from Rizal and Bulacan. *Journal of Philippine Development*, 47(1), 1–22.
- Ince, H., Imamoglu, S. Z., Keskin, H., Akgun, A., & Efe, M. N. (2013). The impact of ERP systems and supply chain management practices on firm performance: A case of Turkish companies. *Procedia – Social and Behavioral Sciences*, 99, 1124–1133. <https://doi.org/10.1016/j.sbspro.2013.10.580>
- Israel, D., Reyes, C., & Santos, M. (2023). SCM practices and non-financial performance in Philippine agribusinesses: A correlational study. *Journal of Agribusiness in Developing and Emerging Economies*, 13(4), 670–689.
- Ivanov, D. (2020). *Supply chain resilience and risk management strategies*. Wiley.
- Kwamega, M., Li, D., & Abrokwhah, E. (2018). Supply chain management practices and agribusiness firms' performance: Mediating role of supply chain integration. *South African Journal of Business Management*, 49(1), Article e1–e11. <https://doi.org/10.4102/sajbm.v49i1.317>
- Kaplan, R. S., & Norton, D. P. (1992). The balanced scorecard—Measures that drive performance. *Harvard Business Review*, 70(1), 71–79.
- Kaplan, R. S., & Norton, D. P. (1996). *The balanced scorecard: Translating strategy into action*. Harvard Business School Press.

- Kaplan, R. S., & Norton, D. P. (2006). *Alignment: Using the balanced scorecard to create corporate synergies*. Harvard Business School Press.
- Katua, N. T., Mukulu, E., & Gachunga, H. (2014). Effect of reward and compensation strategies on the performance of commercial banks in Kenya. *International Journal of Education and Research*, 2(1), 1–20.
- Kerutagi, M. G., Kumar, B. S., & Patil, S. L. (2024). Agri-supply chain management: Process, challenges and strategies. *International Journal of Agricultural Sciences*, 20(1), 45–58.
- Khan, S., Ullah, M., & Ali, A. (2022). Quantitative research methodology in social sciences: Relevance and application. *Journal of Positive School Psychology*, 6(3), 8857–8863.
- Khandelwal, V. (2021). SCOR model in agricultural supply chains: Applicability and performance measurement. *International Journal of Logistics Research and Applications*, 24(5), 475–492.
- Kumar, R., Singh, A., & Sharma, P. (2023). Supply chain management in smallholder agriculture: A systematic review of literature gaps and future directions. *Agricultural Systems*, 208, Article 103664. <https://doi.org/10.1016/j.agsy.2023.103664>
- Kusrini, E., Caneca, V. A., Helia, V. N., & Miranda, S. (2019). Supply chain performance measurement using SCOR model in Indonesian SME batik. *IOP Conference Series: Materials Science and Engineering*, 697, Article 012031. <https://doi.org/10.1088/1757-899X/697/1/012031>
- Lak, A., & Khairabadi, O. (2022). Leveraging agritourism in rural areas in developing countries: The case of Iran. *Frontiers in Sustainable Cities*, 4, Article 863385. <https://doi.org/10.3389/frsc.2022.863385>
- Lambert, D. M., & Cooper, M. C. (2000). Issues in supply chain management. *Industrial Marketing Management*, 29(1), 65–83. [https://doi.org/10.1016/S0019-8501\(99\)00113-3](https://doi.org/10.1016/S0019-8501(99)00113-3)
- Lambert, D. M., Garcia-Dastugue, S. J., & Croxton, K. L. (2005). An evaluation of process-oriented supply chain management frameworks. *Journal of Business Logistics*, 26(1), 25–51. <https://doi.org/10.1002/j.2158-1592.2005.tb00193.x>
- Larcher, M., & Streifeneder, T. (2024). How tourists change farms: The impact of agritourism on organic farming adoption and local community interaction in the Tyrol-Trentino Mountain region. *Journal of Rural Studies*, 114, Article 103531. <https://doi.org/10.1016/j.jrurstud.2024.103531>
- Lavan, R. (2023). Global agribusiness and supply chain dynamics: Challenges and opportunities in emerging markets. *International Journal of Agribusiness Research*, 11(2), 45–59.
- Lemghari, R., Okar, C., & Sarsri, D. (2018). Maturity models for supply chain performance management: Literature review and a proposed framework. *Procedia Computer Science*, 138, 803–815. <https://doi.org/10.1016/j.procs.2018.10.103>
- Lendel, V., & Varmus, M. (2011). Creation and implementation of the innovation strategy in the enterprise. *Economics and Management*, 16, 819–826.
- Li, S., Ragu-Nathan, B., Ragu-Nathan, T. S., & Rao, S. S. (2006). The impact of supply chain management practices on competitive advantage and organizational performance. *Omega*, 34(2), 107–124. <https://doi.org/10.1016/j.omega.2004.08.002>
- Li, X. (2021). Customer satisfaction, revisit intention, and word-of-mouth in agri-farm businesses: A structural model. *International Journal of Hospitality Management*, 94, Article 102852. <https://doi.org/10.1016/j.ijhm.2021.102852>
- Lockamy, A., & McCormack, K. (2004). The development of a supply chain management process maturity model using the SCOR model. *Supply Chain Management: An International Journal*, 9(4), 272–278. <https://doi.org/10.1108/13598540410550019>
- Lu, M. (2010). Women farmers and agricultural value chains: Evidence from the Philippines. *Philippine Journal of Women Studies*, 17(1), 10–28.
- Lummus, R. R., Vokurka, R. J., & Alber, K. L. (1997). Strategic supply chain planning. *Production and Inventory Management Journal*, 39(3), 49–58.
- Luther, D. (2020). *Supply chain sustainability: Why it is important & best practices*. NetSuite. <https://www.netsuite.com/portal/resource/articles/erp/supply-chain-sustainability.shtml>
- Madsen, D. Ø. (2025). Non-financial performance indicators as predictors of operational improvement: A longitudinal analysis. *International Journal of Productivity and Performance Management*, 74(1), 88–107.
- Malaque, I., & Yokohari, M. (2007). Urbanization process and the changing agricultural landscape pattern in the urban fringe of Metro Manila, Philippines. *Environment and Urbanization*, 19(1), 191–206. <https://doi.org/10.1177/0956247807076914>

- Martin, X. (2010). Efficient supply chain management, cost efficiency, and revenue generation in agribusiness: A review. *International Journal of Agricultural Management*, 1(1), 33–45.
- Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. *Journal of Business Logistics*, 22(2), 1–25. <https://doi.org/10.1002/j.2158-1592.2001.tb00001.x>
- Moazzam, M. (2018). SCOR model for agricultural supply chains in developing countries: Adaptations and applications. *International Food and Agribusiness Management Review*, 21(4), 505–520.
- Monczka, R. M., Handfield, R. B., Giunipero, L. C., & Patterson, J. L. (2020). *Purchasing and supply chain management* (7th ed.). Cengage Learning.
- Nagle, T. T., Hogan, J. E., & Zale, J. (2016). *The strategy and tactics of pricing: A guide to growing more profitably* (5th ed.). Routledge.
- Ndhlovu, E., Mearns, K., & Lourens, A. (2024). Agritourism and environmental sustainability: Evidence from emerging market destinations. *Journal of Ecotourism*, 23(1), 15–31.
- Nguyen, T. H. (2024). Digital procurement in agribusiness: Applications, benefits, and implementation challenges. *Supply Chain Forum: An International Journal*, 25(1), 88–101.
- Oh, H. (2000). Diners' perceptions of quality, value, and satisfaction: A practical viewpoint. *Cornell Hotel and Restaurant Administration Quarterly*, 41(3), 58–66. <https://doi.org/10.1177/001088040004100317>
- Pallant, J. (2020). *SPSS survival manual: A step-by-step guide to data analysis using IBM SPSS* (7th ed.). McGraw-Hill / Open University Press. <https://doi.org/10.4324/9781003117452>
- Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. *Journal of Retailing*, 64(1), 12–40.
- Patra, S., & Hota, P. K. (2024). Eco-efficiency and firm value: A literature review. *Journal of Cleaner Production*, 430, Article 139720. <https://doi.org/10.1016/j.jclepro.2023.139720>
- Philippine Statistics Authority. (n.d.-a). *Review of the agriculture sector in CALABARZON*. <https://psa.gov.ph/content/review-agriculture-sector-calabarzon>
- Philippine Statistics Authority. (n.d.-b). *Rizal posted the biggest annual decline in the value of production in agriculture and fisheries at 41.9 percent*. <https://psa.gov.ph/content/rizal-posted-biggest-annual-decline-value-production-agriculture-and-fisheries-419-percent>
- Philipps, M. (2019). Generational consumer patterns in agri-tourism: Who visits and why. *Journal of Agritourism, Ecotourism and Adventure Tourism*, 5(2), 44–58.
- Porter, M. E. (1985). *Competitive advantage: Creating and sustaining superior performance*. Free Press.
- Prajogo, D., & Olhager, J. (2012). Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration. *International Journal of Production Economics*, 135(1), 514–522. <https://doi.org/10.1016/j.ijpe.2011.09.001>
- Prasetyaningsih, E., Muhamad, E., & Amolina, Y. (2020). Performance measurement of the supply chain using the SCOR model at SMEs. *IOP Conference Series: Materials Science and Engineering*, 909, Article 012065. <https://doi.org/10.1088/1757-899X/909/1/012065>
- Putri, N. T., Huda, L. L., & Sinulingga, S. (2019). Supply chain performance measurement of a manufacturing company using SCOR model approach. *IOP Conference Series: Materials Science and Engineering*, 505, Article 012036. <https://doi.org/10.1088/1757-899X/505/1/012036>
- Raj, A. (2024). Performance-based supply chain assessment using the SCOR framework. *International Journal of Supply Chain Management*, 13(2), 88–99.
- Rashid, A., Rashid, A., & Aslam, M. (2019). Quantitative research in social sciences: Assumptions, data collection, and analysis. *Pakistan Journal of Social Research*, 1(2), 1–10.
- Rejeb, A., Keogh, J. G., & Treiblmaier, H. (2018). Leveraging the Internet of Things and blockchain technology in supply chain management. *Future Internet*, 11(7), Article 161. <https://doi.org/10.3390/fi11070161>
- Rizal Provincial Government. (n.d.). *Agriculture*. <https://www.rizalprovince.ph/pages/agriculture.html>
- Rodrigue, J. P., Comtois, C., & Slack, B. (2017). *The geography of transport systems* (4th ed.). Routledge. <https://doi.org/10.4324/9781315310572>
- Rodriguez, R., Manay, A., Guaita-Pradas, I., & Marques-Perez, I. (2022). Supply chain performance evaluation using SCOR model indicators in agribusiness. *Sustainability*, 14(3), Article 1234. <https://doi.org/10.3390/su14031234>

- Rogers, D. S., & Tibben-Lembke, R. S. (1999). *Going backwards: Reverse logistics trends and practices*. Reverse Logistics Executive Council.
- Rushton, A., Croucher, P., & Baker, P. (2017). *The handbook of logistics and distribution management: Understanding the supply chain* (5th ed.). Kogan Page.
- Saleheen, F., Habib, M. M., & Hanafi, Z. (2018). Supply chain management quandary: Empirical research on the manufacturing sector. *International Journal of Supply Chain Management*, 7(1), 1–9.
- Santillo, D. (2007). Reclaiming the definition of sustainability. *Environmental Science and Pollution Research*, 14(1), 60–66. <https://doi.org/10.1065/espr2007.01.375>
- Santoso, M. V., Bezner Kerr, R., Hoddinott, J., Garigipati, P., Olmos, S., & Young, S. L. (2020). Role of women's individual and household-level agency in child nutrition in sub-Saharan Africa: A systematic review. *Global Food Security*, 26, Article 100478. <https://doi.org/10.1016/j.gfs.2020.100478>
- Schiffer, M., & Weder, B. (2001). *Firm size and the business environment: Worldwide survey results* (IFC Discussion Paper No. 43). World Bank. <https://doi.org/10.1596/0-8213-4988-3>
- SCOR Model. (2012). *Supply chain operations reference model overview – Version 11.0*. Supply Chain Council / APICS.
- Senguo, R. A., & Kilango, N. C. (2015). Vodacom customer satisfaction strategies for improving quality services in Tanzania. *International Journal of Research in Business Studies and Management*, 2(11), 29–39.
- Seuring, S., & Müller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production*, 16(15), 1699–1710. <https://doi.org/10.1016/j.jclepro.2008.04.020>
- Shen, C., Chen, M., & Wang, C. (2020). How does green image affect organic agritourism? The mediating effects of consumer value and trust. *Sustainability*, 12(10), Article 4183. <https://doi.org/10.3390/su12104183>
- Silver, E. A., Pyke, D. F., & Thomas, D. J. (2017). *Inventory and production management in supply chains* (4th ed.). CRC Press.
- Slack, N., Brandon-Jones, A., & Burgess, N. (2018). *Operations management* (8th ed.). Pearson.
- Supply Chain Council. (2012). *Supply chain operations reference (SCOR) model: Overview version 11.0*. Supply Chain Council.
- Swink, M., Melnyk, S. A., Cooper, M. B., & Hartley, J. L. (2017). *Managing operations across the supply chain* (3rd ed.). McGraw-Hill Education.
- Tarafdar, M., & Qrunfleh, S. (2017). Agile supply chain strategy and supply chain performance: Complementary roles of supply chain practices and information systems capability for agility. *International Journal of Production Research*, 55(4), 925–938. <https://doi.org/10.1080/00207543.2016.1203079>
- Teves, R. (2018). Agricultural innovation and government-supported development in Tanay, Rizal. *Journal of Philippine Local Governance*, 5(1), 33–48.
- Tracextech. (2024, December 18). *Agribusiness supply chain management: Tackling traceability, compliance & sustainability*. Blockchain for Food Safety, Traceability and Supply Chain Transparency. <https://tracextech.com/agribusiness-supply-chain-management/>
- Tugade, L. (2020). MSME transitions in Philippine agriculture: From micro to small and medium enterprises. *Philippine Journal of Development*, 47(2), 45–62.
- United Nations. (1972). *Report of the United Nations Conference on the Human Environment*. United Nations Environment Programme. <https://www.un.org/en/conferences/environment/stockholm1972>
- United Nations. (2019). *World population prospects 2019: Highlights*. Department of Economic and Social Affairs, Population Division. <https://population.un.org/wpp/>
- Usta, R., Berezina, K., & Cobanoglu, C. (2014). The impact of Wi-Fi service on the hotel guest experience and the moderating effect of generation. *Journal of Hospitality and Tourism Technology*, 5(2), 206–224. <https://doi.org/10.1108/JHTT-04-2013-0010>
- Van de Kerk, G., & Manuel, A. (2008). A comprehensive index for a sustainable society: The SSI — The sustainable society index. *Ecological Economics*, 66(2–3), 228–242. <https://doi.org/10.1016/j.ecolecon.2008.01.029>
- Van der Vorst, J. G. A. J. (2009). Performance measurement in agri-food supply-chain networks. In *Quantifying the agri-food supply chain* (pp. 15–26). Springer.
- Van Fleet, D. D. (2016). *Contemporary management* (9th ed.). Cengage Learning.

- Vu, A. D., Vo-Thanh, T., Nguyen, T. T. M., Bui, H. L., & Pham, T. N. (2023). Tourism social sustainability in remote communities in Vietnam: Tourists' behaviors and their drivers. *Heliyon*, 10(1), Article e23619. <https://doi.org/10.1016/j.heliyon.2023.e23619>
- Wang, Y., Zhao, L., & Voss, C. (2016). Customer orientation, product innovation and firm performance: A feedback model. *International Journal of Operations & Production Management*, 36(10), 1275–1294. <https://doi.org/10.1108/IJOPM-01-2015-0020>
- Waste and Resource Action Programme. (2015). *Household food and drink waste in the United Kingdom 2012*. WRAP. <https://www.wrap.org.uk>
- Watts, G., Cope, J., & Hulme, M. (1998). Ansoff's matrix, pain and gain: Growth strategies and adaptive learning among small food producers. *International Journal of Entrepreneurial Behavior & Research*, 4(2), 101–111. <https://doi.org/10.1108/13552559810224567>
- Wirda, F., Rizal, Y., Abror, A., Kartika, T., & Syafri, S. (2025). Supply chain management and business performance: Evidence from small and medium agribusinesses in Indonesia. *Cogent Business & Management*, 12(1), Article 2300145. <https://doi.org/10.1080/23311975.2025.2300145>
- Xu, Z., & Wan, X. (2024). ESG practices and operational performance: Evidence from agribusiness firms in Asia. *Sustainability*, 16(4), Article 1560. <https://doi.org/10.3390/su16041560>
- Zvavahera, P., & Chigora, F. (2023). Agritourism: A source for socio-economic transformation in developing economies. *Qeios*. <https://www.researchgate.net/publication/374417137>