

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

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ABSTRACT

This study examined supply chain management (SCM) practices and their relationship with non-financial business performance among agri-farm businesses in the Province of Rizal, Philippines. Guided by the Supply Chain Operations Reference (SCOR) model, it assessed Plan, Source, Make, Deliver, and Return alongside cost efficiency, operational efficiency, and customer satisfaction. A quantitative descriptive-correlational design involved 57 agri-farm owners, managers, or supervisors and 285 customers ($N = 342$), selected through stratified sampling. Validated five-point questionnaires were analyzed using frequencies, percentages, weighted means, group-comparison tests, and Pearson correlation. Overall SCM implementation was high ($M = 3.92$), led by Source ($M = 4.17$), whereas Return ranked lowest ($M = 3.80$). Customer satisfaction ($M = 4.07$),

operational efficiency ($M = 4.01$), and cost efficiency ($M = 3.86$) also received high assessments. SCM assessments did not significantly differ by the reported respondent profile categories. Among agri-farm representatives, overall SCM was positively associated with overall business performance ($r = .838$, $p < .001$). Deliver and Return had strong positive correlations with cost efficiency ($r = .887$ and $.889$, respectively; both $p < .001$); Source was positively associated with operational efficiency ($r = .367$, $p = .005$). The findings identify delivery reliability and return management as priority areas for process improvement, while supporting a locally grounded, SCOR-based management framework. Because the study is cross-sectional and relies on self-reported assessments, the relationships should not be interpreted as causal.

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

INTRODUCTION

Agricultural enterprises connect primary producers with input suppliers, distributors, traders, and consumers. Their performance depends not only on productive capacity but also on the coordination of procurement, inventory, harvesting, post-harvest handling, transportation, and customer service. The perishable and seasonal nature of agricultural products makes interruptions particularly consequential: delayed deliveries, variable yields, and handling losses may undermine service reliability and resource efficiency (Ahumada & Villalobos, 2011; Chopra & Meindl, 2019). Supply chain management (SCM) therefore offers a framework for aligning farm operations with changing market requirements rather than treating each activity as an isolated function (Mentzer et al., 2001).

In the Philippines, provincial agri-farm enterprises operate alongside larger and increasingly interconnected food markets. Rizal Province combines agricultural communities with rapid urban expansion and proximity to the Metro Manila market, creating both commercial opportunities and pressures on land use, logistics, and service responsiveness (Malaque & Yokohari, 2007). According to the Philippine Statistics Authority (2022), Rizal recorded a 41.9% decline in the value of agriculture and fisheries production in 2021 at constant 2018 prices.

This province-specific result should not be treated as an estimate for all of CALABARZON, but it illustrates the context in which stronger farm-level coordination and operational decision-making are relevant.

SCM research has established the importance of integration and information exchange for organizational outcomes, yet evidence from large or manufacturing-oriented supply chains does not always translate directly to small provincial agricultural enterprises (Alfalla-Luque et al., 2013; Prajogo & Olhager, 2012). A further measurement gap arises when business performance is assessed primarily through financial results, while farm operators may be more readily able to assess the consistency of operations, cost-control practices, and customer experiences. Non-financial performance indicators can complement a process-based view of SCM by capturing operational and customer-facing outcomes (Callado et al., 2015; Kaplan & Norton, 1996).

Against this background, the study examined SCM implementation among agri-farm businesses in Rizal using the Supply Chain Operations Reference (SCOR) dimensions of Plan, Source, Make, Deliver, and Return. It characterized the respondents and their businesses, assessed SCM practices and performance in terms of cost efficiency, operational efficiency, and customer satisfaction, compared SCM assessments across demographic groupings, investigated associations between SCM and business performance, and developed a SCOR-based improvement framework. The work contributes province-specific evidence for managerial planning and local agricultural enterprise support without presuming that observed associations establish causal effects.

Literature Review

Supply Chain Management and the SCOR Process Framework

SCM comprises the coordination of interdependent activities that connect suppliers, enterprises, and customers. Mentzer et al. (2001) conceptualized SCM as the systemic and strategic coordination of business functions across firms, while Chopra and Meindl (2019) emphasized managing flows of products, information, and resources to support customer value. Supply chain integration literature likewise identifies information-sharing arrangements and enduring supplier relationships as foundations for improved coordination (Alfalla-Luque et al., 2013; Prajogo & Olhager, 2012). These perspectives are relevant to agri-farms, whose production and market access often depend on multiple actors beyond the farm boundary.

The SCOR model organizes activities into five linked processes: Plan, covering demand, inventory, and resource alignment; Source, addressing procurement and supplier performance; Make, covering transformation and production; Deliver, encompassing order handling, storage, and distribution; and Return, addressing returned products and reverse flows. These process categories provide a common language for diagnosing operations and setting performance priorities (Supply Chain Council, 2012; APICS Supply Chain Council, 2017). A SCOR-based approach also connects process mapping with performance measurement and management improvement (Bolstorff & Rosenbaum, 2011; Lockamy & McCormack, 2004).

For agricultural firms, SCOR processes must be interpreted in light of perishable products, crop variability, and limited logistics infrastructure. Planning and production decisions may affect the freshness, timing, and eventual marketability of farm outputs, while reliable sourcing and distribution can protect quality and reduce avoidable losses (Ahumada & Villalobos, 2011). In this study, the five SCOR dimensions were used as separate measures of reported SCM practice rather than as an assumed single, equally developed capability.

Supplier Coordination, Production, and Logistics in Agri-Farms

Procurement relationships shape input quality, delivery consistency, and access to production materials. Supplier evaluation, clear standards, and timely information allow enterprises to respond more effectively to changing conditions (Chopra & Meindl, 2019). Gunasekaran et al. (2017) further discussed the potential of data-driven information systems for organizational and supply chain performance, while Gunasekaran and Ngai (2004) emphasized the importance of information systems for supply chain integration. For small farms, digital tools can support transaction records and inventory tracking even when highly sophisticated systems are not feasible.

Production efficiency is also shaped by resource availability, workforce capability, and the ability to handle changes in volume and quality. Swink et al. (2017) situated workforce and process management within

integrated operations, while Silver et al. (2017) examined how inventory and production planning affect service and cost objectives. In agrifood settings, the short market life of produce places additional importance on preventive equipment maintenance, packaging, storage, and transport scheduling. The location and quality of transportation connections are therefore relevant to the reliability of delivery (Rodrigue et al., 2017).

Downstream operations require attention not only to timely delivery but also to returns and unsold products. Reverse logistics covers the movement and disposition of unwanted or rejected goods, including opportunities for product recovery (Rogers & Tibben-Lembke, 1999). Sustainability research similarly emphasizes the integration of environmental criteria and supply chain activities (Seuring & Müller, 2008). Together, these perspectives suggest that better coordination of sourcing, distribution, and return-handling may be operationally important for farm enterprises, although the magnitude of any association must be determined empirically.

Non-Financial Business Performance

Business performance need not be represented only by revenue, profit, or investment returns. The Balanced Scorecard perspective combines multiple measures of organizational functioning, including internal processes and customer-related results (Kaplan & Norton, 1992, 1996). For this study, business performance was operationalized as respondents' assessments of cost efficiency, operational efficiency, and customer satisfaction. These were perceptual measures of performance, not audited financial savings or independently verified productivity outcomes.

Cost efficiency concerns resource use, inventory control, purchasing, and expenditure-sensitive processes. Silver et al. (2017) linked inventory decisions to service and cost trade-offs, while Lambert and Cooper (2000) highlighted the management of network-wide supply chain activities. Operational efficiency reflects continuity of work processes, workforce productivity, data recording, and the timeliness of logistics; the quality of information systems is relevant to these outcomes (Gunasekaran & Ngai, 2004). The use of non-financial measures among agribusinesses has also been examined by Callado et al. (2015).

Customer satisfaction provides a complementary external perspective on whether products and services meet expectations. Pricing fairness, dependable quantities, communication, and consistent delivery contribute to perceived value; pricing decisions can be understood in relation to customer-perceived benefits rather than cost alone (Nagle et al., 2016). By collecting satisfaction reports directly from customers, the present study distinguished customer-facing assessments from internal evaluations made by farm representatives. This distinction is substantively important and affects how the two respondent groups may be compared.

Research Gap and Integrated Conceptual Perspective

Although supply chain integration, operational performance, and customer value are well represented in management scholarship, province-level evidence specific to agri-farm businesses remains essential for locally usable recommendations. Different farm sizes and geographic contexts may present different constraints, and research focused entirely on financial performance can overlook everyday process weaknesses. The combined SCOR and non-financial performance approach addresses this gap by measuring process implementation alongside internal and customer-facing assessments (APICS Supply Chain Council, 2017; Callado et al., 2015).

The conceptual framework treats Plan, Source, Make, Deliver, and Return as the independent variable dimensions and non-financial business performance as the dependent construct, with respondent-related characteristics represented as a moderating component. Its proposed output was a supply chain management framework based on the observed findings. Figure 1 presents the research model; it expresses the guiding research model and should not be read as evidence of statistically established mediation or moderation.

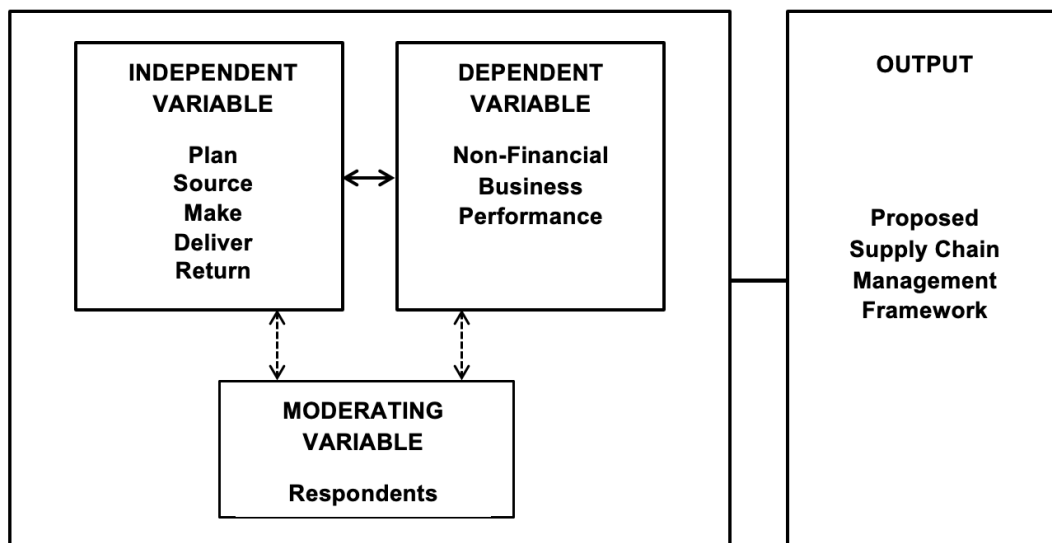


Figure 1. *Conceptual Framework of Supply Chain Management and Business Performance of Agri-Farm Businesses in the Province of Rizal.*

METHODS

Research Design

The study employed a quantitative descriptive-correlational research design. Its descriptive component summarized SCM implementation and perceived business performance; its inferential component examined differences across respondent profiles and correlations between SCM and performance. Variables were observed without experimental manipulation, so the results were interpreted as differences and associations rather than as causal effects (Creswell & Creswell, 2018; Fraenkel et al., 2019).

Research Locale

Data were gathered from agri-farm businesses and their customers in Rizal Province, CALABARZON, Philippines. The study covered Antipolo City and the municipalities of Angono, Baras, Binangonan, Cainta, Cardona, Jala-Jala, Morong, Pililla, Rodriguez, San Mateo, Tanay, Taytay, and Teresa. The province represents an agricultural and peri-urban setting exposed to both rural production requirements and metropolitan market demand (Malaque & Yokohari, 2007).

Participants and Sampling Technique

The study involved 342 respondents: 57 owners, managers, or supervisors who described their businesses' SCM practices, cost efficiency, and operational efficiency, and 285 customers who assessed customer satisfaction. A stratified sampling strategy was employed to distribute participation across locations and customer segments. Slovin's formula with a 5% margin of error was used to derive the 57 farm representatives, then selecting five customers per establishment to obtain 285 customer responses. These groups supplied different measures and were not treated as interchangeable ratings of a single identical construct.

Research Instrument

Two structured and validated questionnaire versions were used: a farm-representative form containing respondent and business profiles, SCOR process assessments, and internal business performance indicators; and a customer form covering background characteristics and satisfaction indicators. Both forms used a five-point Likert-type scale ranging from 1 (To a Very Low Extent) to 5 (To a Very High Extent). The SCOR domains followed the model's five processes (Supply Chain Council, 2012), while the non-financial measures drew on

internal-process and customer perspectives associated with the Balanced Scorecard (Kaplan & Norton, 1996). Instrument validation and reliability documentation were identified, although the methodology did not report a numerical reliability coefficient.

Data Gathering Procedure

Following academic approval and permission from participating businesses, the researcher administered the appropriate questionnaires to farm representatives and customers. Respondents were informed of the purpose of the research and invited to participate voluntarily. Completed questionnaires were encoded and tabulated for quantitative analysis, with respondents' identities protected in the reporting of aggregate results.

Data Analysis

Frequencies and percentages summarized demographic and business profiles, while weighted means described the extent of SCM practice and the three performance indicators. One-way analysis of variance (ANOVA) was used for profile categories with more than two groups, and an independent-samples t-test was reported for sex. Pearson's product-moment correlation coefficient examined associations between SCOR measures and internal business performance indicators, with significance assessed at $\alpha = .05$ (Pallant, 2020). The results are reported from the study's aggregate statistical tables.

Ethical Consideration

Participation was voluntary and based on informed consent. Respondents were informed of the study's objectives, confidentiality protections, and freedom to withdraw without penalty. Data were anonymized and summarized in aggregate form, and the researcher reported efforts to avoid harm, bias, and unauthorized disclosure. The source describes academic and business permissions but does not provide a research ethics committee approval number; none is claimed here.

RESULTS AND DISCUSSION

Respondent and Business Profile

The sample comprised 57 agri-farm representatives and 285 customers. The largest participating farm group was in Tanay (28.1%), followed by Antipolo and Morong (10.5% each); the customer sample followed the same geographic proportions. In the farm sample, 22 businesses (38.6%) had operated for 8–10 years, while business size was distributed among micro (29.8%), small (33.3%), and medium (36.8%) enterprises. Most farm representatives were women (59.6%), and the largest age category was 46–55 years (36.8%). Among customers, 144 (50.5%) had been clients for six months to one year, and 158 (55.4%) were women. These distributions situate the findings in the participating farms and clientele rather than establishing province-wide population estimates.

Table 1. *Selected Characteristics of the Two Respondent Groups*

Characteristic	Farm representatives (n = 57)	Customers (n = 285)
Largest locale: Tanay	16 (28.1%)	80 (28.1%)
Women	34 (59.6%)	158 (55.4%)
Age 46–55 years	21 (36.8%)	85 (29.8%)
8–10 years in operation	22 (38.6%)	Not applicable
Clients for 6 months–1 year	Not applicable	144 (50.5%)

The geographic distribution was concentrated in municipalities with notable agricultural activity, while the participation of micro, small, and medium farms captured different operating scales. The respondents' operational experience and the substantial representation of repeat customers offered complementary internal and external views. These descriptive patterns did not themselves demonstrate better SCM or performance for any profile category.

Extent of Supply Chain Management Implementation

The composite SCM weighted mean was 3.92, verbally interpreted as High Extent. Source received the highest average (4.17), followed by Plan (3.90), Make (3.89), Deliver (3.84), and Return (3.80). All five processes were assessed as highly implemented, but the range of scores indicates uneven maturity between established sourcing practices and downstream return handling. This pattern supports the practical usefulness of viewing the supply chain as distinct but interdependent processes, as emphasized in the SCOR framework (APICS Supply Chain Council, 2017).

Table 2. *SCM Implementation by SCOR Dimension (n = 57)*

SCOR dimension	Weighted mean	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
Overall SCM	3.92	High Extent

The highest Source indicators included formal evaluations of suppliers ($M = 4.67$) and the use of digital procurement tools ($M = 4.49$), while sustainable sourcing criteria received a lower score ($M = 3.75$). Within Plan, strategic alignment was highly rated ($M = 4.44$), whereas whole-cost analysis and routine sales and operations planning each received $M = 3.58$. These results suggest that strong supplier monitoring and business-level strategic intent were not uniformly matched by formal forecasting and analytical planning, consistent with literature emphasizing the benefits of integrated systems and coordinated planning (Gunasekaran & Ngai, 2004; Chopra & Meindl, 2019).

In Make, by-product and waste management was rated $M = 4.21$, but operational flexibility ($M = 3.54$) and proactive equipment maintenance ($M = 3.56$) scored lower. Within Deliver, communication on order status and delivery times ($M = 3.54$) and on-time, in-full order delivery ($M = 3.56$) were relatively weaker. Return showed the lowest SCOR composite score, including value recovery from surplus products ($M = 3.63$) and complaint resolution ($M = 3.65$). These downstream gaps matter to perishables management and reverse flows, areas addressed by agricultural planning and reverse logistics research (Ahumada & Villalobos, 2011; Rogers & Tibben-Lembke, 1999).

Differences in SCM Assessment across Respondent Profiles

The reported ANOVA and t-test results did not identify significant differences in SCM assessments across the listed respondent profile groupings at $\alpha = .05$. Years in operation, business size, capitalization, revenue, expenses, customer volume, age, length of service, and sex all yielded p-values above .05 in the reported statistical summary. Accordingly, the null hypothesis of no profile-based differences was not rejected. These tests describe the results in this sample; they do not demonstrate that demographic or business characteristics are irrelevant in every agricultural context.

Table 3. *Profile-Based Tests of Differences in SCM Assessment (n = 57)*

Respondent / business grouping	Reported test	p-value
Years of operation	F = 0.781	.5099
Business size	F = 0.134	.8750
Initial capital	F = 0.134	.8750
Present capital	F = 0.134	.8750
Average monthly revenue	F = 0.134	.8750
Average monthly expenses	F = 0.134	.8750
Average customers per day	F = 0.246	.8636
Age	F = 0.928	.4339
Years of service	F = 2.585	.0847
Sex	t = 0.593	.5553

Although business performance was also to be compared between the respondent groups, the groups rated different constructs: representatives assessed internal cost and operational efficiency, whereas customers assessed satisfaction. The table designated for group differences presents SCM-performance correlations rather than a direct group-comparison test. Accordingly, a separate conclusion about statistical differences between the two respondent groups cannot be supported by the reported test statistics.

Non-Financial Business Performance

All three performance indicators were rated at a High Extent. Customer satisfaction ranked highest ($M = 4.07$), followed by operational efficiency ($M = 4.01$) and cost efficiency ($M = 3.86$). In cost efficiency, maintenance of optimal inventory levels ranked highest ($M = 4.05$), while use of locally available resources to reduce input costs ranked lowest ($M = 3.54$). Inventory practice is especially pertinent to cost and service trade-offs in supply chains (Silver et al., 2017).

Table 4. *Non-Financial Business Performance Assessments*

Indicator	Respondents	Weighted mean	Interpretation
Cost efficiency	Farm representatives (n = 57)	3.86	High Extent
Operational efficiency	Farm representatives (n = 57)	4.01	High Extent
Customer satisfaction	Customers (n = 285)	4.07	High Extent

Operational efficiency was strongly rated for workforce skill and productivity ($M = 4.67$) and uninterrupted supply chain operations ($M = 4.49$), but data-recording accuracy ($M = 3.54$) and timeliness and cost effectiveness of logistics ($M = 3.56$) were lower. This distinction highlights a potential operational gap between employee capability and the information or transport systems supporting everyday work (Gunasekaran & Ngai, 2004; Rodrigue et al., 2017).

Customers gave comparatively high ratings to fair pricing ($M = 4.36$), consistent service ($M = 4.31$), and tailored services ($M = 4.25$). The lowest customer satisfaction item was order-quantity accuracy ($M = 3.63$). Although the overall customer assessment was favorable, relatively weaker order accuracy and communication reinforce the need to prioritize complete, correctly fulfilled customer orders. These concerns fit a customer-value interpretation of performance (Kaplan & Norton, 1996; Nagle et al., 2016).

Relationship between SCM and Business Performance

Pearson correlations showed that overall SCM was strongly and positively related to cost efficiency ($r = .862$, $p < .001$) and overall internal business performance ($r = .838$, $p < .001$), but not operational efficiency ($r = -.053$, $p = .694$). The Source dimension was positively associated with operational efficiency ($r = .367$, $p = .005$), whereas the Plan and Make dimensions showed no statistically significant association with any reported internal

performance measure. This pattern indicates that SCM dimensions were not equally associated with performance in the participating farms.

Table 5. *Pearson Correlations between SCOR Dimensions and Internal Performance (n = 57)*

SCOR measure	Cost efficiency r (p)	Operational efficiency r (p)	Overall internal performance r (p)
Plan	.102 (.449)	.071 (.602)	.127 (.346)
Source	-.129 (.338)	.367 (.005)	.004 (.978)
Make	.121 (.370)	.239 (.074)	.206 (.124)
Deliver	.887 (< .001)	-.106 (.434)	.844 (< .001)
Return	.889 (< .001)	.302 (.022)	.785 (< .001)
Overall SCM	.862 (< .001)	-.053 (.694)	.838 (< .001)

The strongest reported positive links with cost efficiency were for Return ($r = .889$, $p < .001$) and Deliver ($r = .887$, $p < .001$), while these dimensions were also related to overall internal performance ($r = .785$ and $.844$, respectively; both $p < .001$). Return had a weaker but significant positive correlation with operational efficiency ($r = .302$, $p = .022$), as reported in the correlation matrix. These results suggest that farms reporting better logistics and reverse-flow management also tended to report more favorable internal outcomes, without establishing which condition preceded the other.

The association of supplier management with operational efficiency is consistent with the role of supplier coordination and information sharing in supporting uninterrupted operations (Prajogo & Olhager, 2012). Likewise, delivery networks and return processes offer mechanisms through which product loss, transport effort, and resource recovery may be better managed (Lambert & Cooper, 2000; Rogers & Tibben-Lembke, 1999). However, the relatively small organizational sample, self-report measures, and cross-sectional design require restraint: the strength of a correlation is not evidence that a particular intervention will produce a proportional improvement in performance. Customer satisfaction could not be included in this farm-representative correlation matrix because the available customer responses were reported separately.

Proposed SCOR-Based Improvement Framework

Based on the composite ratings, comparatively weaker items, and significant associations, the findings informed a management improvement framework spanning all five SCOR dimensions. It sought to preserve existing strengths in supplier assessment and workforce capability while directing attention to formal planning, production responsiveness, delivery accuracy, and return handling. Table 6 consolidates the action matrix into its operational priorities without presenting the recommendations as interventions already tested for effectiveness.

Table 6. *Consolidated SCOR-Based Strategies Derived from the Study*

SCOR dimension	Priority actions	Intended focus
Plan	Use inventory and budget data; formalize demand and disruption planning.	Resource alignment and resilience
Source	Sustain supplier evaluations; expand digital procurement and supplier alternatives.	Procurement reliability
Make	Improve flexibility and preventive maintenance; strengthen skills and waste recovery.	Production continuity
Deliver	Verify orders; improve transport/cold-chain arrangements and delivery updates.	Fulfillment and product quality
Return	Standardize complaint handling; sort and recover value from unsold or rejected produce.	Reverse flows and loss reduction

Implementation may begin with low-cost tools such as inventory spreadsheets, supplier scorecards, order verification logs, and standardized complaint procedures. More capital-intensive improvements, particularly cold-chain and transportation infrastructure, may require cooperative arrangements or public support. The SCOR structure supplies a coherent basis for prioritizing these activities, while subsequent evaluation should measure whether they produce sustained improvements in actual farm performance (Bolstorff & Rosenbaum, 2011; APICS Supply Chain Council, 2017).

CONCLUSION

The study established that participating agri-farm businesses in Rizal reported a high overall extent of SCM implementation, with sourcing as their most established process and return management as the least developed. Internal assessments of cost efficiency and operational efficiency, together with customers' ratings of satisfaction, were also high. SCM assessments did not significantly vary across the recorded demographic and business profile categories in the source analyses. Within the farm-representative sample, overall SCM was positively associated with overall internal business performance; Deliver and Return showed especially strong positive relationships with cost efficiency, while Source was positively related to operational efficiency.

These findings support a SCOR-based improvement framework that builds on sourcing competence while prioritizing delivery reliability, better order communication and accuracy, formalized planning, flexible production, and structured product-return or value-recovery systems. The study contributes locally situated, process-specific evidence for farm managers and development institutions. Its cross-sectional, perceptual measures, geographic scope, and limitations in available group-comparison reporting prevent causal claims and call for validation using objective and longitudinal measures.

Recommendation

Agri-farm owners, managers, and supervisors should introduce regular demand and budget reviews, maintain current inventory and supplier records, and adopt simple order verification and customer notification procedures. Farms may also benefit from preventive equipment-maintenance schedules and clear standards for resolving complaints and redirecting usable surplus produce, focusing first on weaknesses identified in the Plan, Deliver, and Return results. Digital procurement tools should complement, rather than replace, consistent supplier assessment and practical staff training.

Cooperatives, the Rizal Provincial Government, and relevant agricultural and enterprise-support agencies should consider shared logistics, cold-chain access, procurement training, and technical assistance designed for micro, small, and medium farms. Future research should expand geographic coverage, repeat data collection over time, use objective cost and logistics records, report psychometric coefficients, and apply a valid common-measure design before testing differences between farm representatives and customers. Additional analysis may also evaluate how information sharing and collaborative governance influence SCM outcomes across the provincial value chain.

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