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SCOR-BASED SUPPLY CHAIN PERFORMANCE EVALUATION AND IMPROVEMENT STRATEGY FOR GREENHOUSE CHERRY TOMATO

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Abstract

Background: Nudira Fresh, a vertically integrated hydroponic greenhouse cherry tomato producer under PT Nudira Sumber Daya Indonesia in Pangalengan, Bandung Regency, has faced a sustained decline in yield and profit since 2019, with the sharpest fall recorded in 2023 following storm damage to its greenhouse structure, compounded by intermittent nutrient stock shortages and gaps in workforce competence.
Purpose: This study evaluates the cherry tomato supply chain performance of Nudira Fresh using the Supply Chain Operations Reference (SCOR) model and formulates priority strategies to close the gaps that are most responsible for weak responsiveness and adaptability.
Design/methodology/approach: A single-firm case study was conducted with eight purposively selected respondents across management, production, logistics, and the supplier base. Chain structure was mapped through value-chain analysis; performance was scored with SCOR v12.0 across reliability, responsiveness, agility, and cost, benchmarked against company and literature targets, weighted by respondent judgement, and interpreted on a five-tier monitoring scale, followed by gap analysis, Pareto analysis, and a fishbone diagram.
Findings/Result: The overall performance score reached 85.17, classified as Good. Cost (95.40) and reliability (91.67) attained the Excellent category, while responsiveness (75.61) and agility (75.46) remained comparatively weak. Pareto analysis identified production recovery time (52.63), supplier recovery time (67.50), and transportation lead time (68.96) as the vital few metrics, jointly accounting for 84.19% of the cumulative performance gap.
Conclusion: Strong reliability and cost efficiency did not extend to the chain's capacity to recover from disruption; agility and responsiveness are the binding constraints. Four managerial strategies are proposed: structured supply chain risk management and contingency planning, nutrient supply diversification with reorder-point and safety-stock control, distribution route and schedule optimization, and workforce competence strengthening through shop-floor management.
Originality/value (State of the art): This study extends SCOR application to a single, technology-controlled greenhouse hydroponic enterprise whose disruption arises jointly from climate-related infrastructure damage, input-supply gaps, and labor competence, a combination distinct from the open-field vegetable chains that dominate prior SCOR-based agribusiness research.

Keywords: supply chain performance, cherry tomato, greenhouse, improvement strategy, SCOR model

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INTRODUCTION

Nudira Fresh, a horticultural business unit of PT Nudira Sumber Daya Indonesia established in 2018, cultivates cherry tomatoes (Solanum lycopersicum var. cerasiforme) on approximately 12,500 m² of land in Warnasari, Pangalengan District, Bandung Regency, at roughly 1,500 meters above sea level. Cultivation takes place inside a greenhouse of approximately 3,000 m² using a drip-irrigation hydroponic system, with a stated capacity of around 9,000 plants. The company positions this controlled-environment system as capable of raising productivity well above conventional open-field cultivation. Company records nevertheless show a steady decline in output from 2019 onward, and 2023 brought the sharpest fall in the firm's history, driven principally by storm damage to the greenhouse structure and compounded by intermittent shortages of hydroponic nutrient stock and gaps in workforce competence.

These three constraints are not confined to a single function; they are distributed across planning, procurement, and production activities, which limits the usefulness of a function-by-function review of the constraints. The Supply Chain Operations Reference (SCOR) model offers a more structured alternative because it decomposes a chain into discrete, measurable processes plan, source, make, and deliver (Supply Chain Council, 2017) so that losses traceable to nutrient procurement, cultivation practice, or distribution can be isolated and quantified rather than attributed to production in general.

The production shortfall also carries through to market presence. Consumption data for the tomato and cherry tomato group in Bandung City point to a monthly market of roughly 267 tonnes, against which Nudira Fresh's supply covers under one percent of demand evidence of a large unmet opportunity that a more reliable and resilient chain could help the firm capture, particularly as demand for hydroponic and health-oriented vegetables continues to grow among higher-income, health-conscious consumers (Masjid et al., 2019; Hadianti et al., 2019; Hasanah & Yanuar, 2024). Profitability has moved in a similar direction: earnings peaked in 2019 and then declined through 2023, with a loss of roughly 60% occurring across two distinct episodes the 2020–2021 downturn associated with the pandemic, and the 2022–2023 fall linked to the greenhouse damage. A notable anomaly appears between 2021 and 2022, when output was higher in 2021 yet revenue was higher in 2022, a pattern that points toward possible inefficiencies in supply chain cost or cycle time rather than production volume alone, which this study probes through metrics such as total supply chain management cost and order fulfilment cycle time.

The firm's difficulties therefore cannot be resolved by examining production in isolation; they call for an evaluation that spans planning (identifying bottlenecks), sourcing of nutrients and other inputs, cultivation, and delivery to customers. This study uses the SCOR model to measure Nudira Fresh's cherry tomato supply chain performance comprehensively, identify the metrics with the largest gaps against target, and translate the findings into a prioritized set of improvement strategies. Specifically, the objectives are (1) to analyse the current structure and mechanism of the cherry tomato supply chain; (2) to measure supply chain performance across the reliability, responsiveness, agility, and cost attributes and identify the metrics with the largest actual-to-benchmark gaps; and (3) to formulate priority managerial strategies based on Pareto analysis and fishbone diagram findings. SCOR has been widely applied to vegetable and horticultural supply chains; however much of that evidence concerns commodities grown in open fields, where the dominant risks are macro-climatic variability and fragmented, intermediary-heavy distribution channels. A controlled-environment producer such as Nudira Fresh reduces exposure to macro-climate swings, however in doing so concentrates a different kind of risk in greenhouse infrastructure, irrigation systems, and nutrient logistics a profile that remains comparatively unexamined in the SCOR literature. This study addresses that gap by evaluating a single, vertically integrated, technology-based cherry tomato producer as it recovers from an infrastructure-driven production shock, and by testing whether strong reliability and cost efficiency are, on their own, sufficient to sustain a perishable horticultural chain.

METHODS

This research was conducted at Nudira Fresh, the horticultural business unit of PT Nudira Sumber Daya Indonesia, in Warnasari, Pangalengan District, Bandung Regency, West Java. Data collection ran from March to August 2024, followed by data processing through 2025 and manuscript preparation in the first half of 2026.

Both primary and secondary data of a qualitative and quantitative nature were used (Sugiyono, 2021). Primary data on chain structure, cultivation and postharvest processes, and transaction prices and volumes were obtained through direct observation and semi-structured interviews. Secondary data including 2021–2023 purchase-order, supply, and delivery records, together with benchmarking references were drawn from internal company documents and the literature. Eight respondents were selected through purposive sampling: the chief executive, the operations manager, the finance manager, the marketing manager, the production head, the greenhouse supervisor, the logistics supervisor, and a supplier, so that every element of the chain was represented by at least one informant; a limitation of this design is that each division is represented by only one respondent. Source triangulation across interviews, observations, and documentary evidence was applied to safeguard data validity.

Supply Chain Structure Analysis

The first objective was addressed through supply chain analysis, which traced the movement of cherry tomatoes and related information from suppliers to final customers and identifying the actors, their roles, value-adding activities, and bottlenecks along the supply chain. Qualitative interview data were analyzed thematically through data reduction, coding, interpretation, and conclusion drawing and the findings were then visualized in as a supply chain flow diagram depicting the integrated flows of product, information, and finance.

Supply Chain Performance Measurement

The second objective was addressed by measuring supply chain performance using the SCOR v12.0 model, which groups performance indicators into four attributes: reliability, responsiveness, agility, and cost. The metrics assigned to each attribute at Nudira Fresh are summarized in Table 1. Each metric was benchmarked against target derived from the SCOR model, the supply chain literature, and the company's own standards, as presented in Table 2.

Table 1. SCOR performance dimensions and metrics at Nudira Fresh

Chain activity	Performance metric
Plan	Plan Cost
	Recovery Planning Time
	Production Capacity Increase
	Production Capacity Reduction
Source	Raw Material Quality Acceptance Rate
	Source Cost
	Supplier Recovery Time
Make	Product Quality Acceptance Rate
	Order Entry Time
	Order Handling Time
	Harvest Preparation Time
	Order Picking & Packing Time
	Production Recovery Time
	Make Cost
Deliver	Customer Quality Acceptance Rate
	Perfect Order Fulfillment
	On-Time Delivery
	Correct Document
	Transportation Lead Time
	Deliver Cost

Table 2. Targets/Benchmarks for SCOR performance metrics

Attribute	Performance metric	Target/Benchmark
Reliability	Perfect Order Fulfillment	≥ 95%
	On-Time Delivery	≥ 95%
	Raw Material Quality Acceptance Rate	≥ 95%
	Product Quality Acceptance Rate	≥ 95%
	Customer Quality Acceptance Rate	≥ 98%
	Correct Document	≥ 98%
Responsiveness	Order Entry Time	≤ 12 minutes
	Order Handling Time	≤ 20 minutes
	Harvest Preparation Time	≤ 120 minutes
	Order Picking & Packing Time	≤ 200 minutes
	Transportation Lead Time	≤ 300 minutes
Agility	Production Capacity Increase	≥ 90%
	Production Capacity Reduction	≥ 90%
	Recovery Planning Time	≤ 1 day
	Supplier Recovery Time	≤ 3 days
	Production Recovery Time	≤ 10 days
Cost	Plan Cost	Company target
	Source Cost	Company target
	Make Cost	Company target
	Deliver Cost	Company target

Source: SCOR Model (ASCM); Bolstorff and Rosenbaum (2007)

Table 3. Interpretation categories for SCOR performance scores

Monitoring score	Performance category
< 40	Poor
>40–<50	Marginal
≥50–<70	Average
≥70–≤90	Good
> 90	Excellent

The relative importance of each attribute and metric was established through the judgement of the eight respondents, who understood the firm's operational conditions and supply chain processes; the weights within each group summed to 1.00. The achievement of each metric was compared with its target, multiplied by its weight, and aggregated to obtain a score for each attribute and for the chain as a whole. The final score was interpreted using the monitoring scale in Table 3, adapted from the SCOR performance classification (Supply Chain Council, 2012).

Improvement Strategy Formulation

The third objective began with gap analysis, comparing the actual value of each metric with its target to reveal performance gaps (Garvin, 1993). Pareto analysis was then applied on the 80/20 principle (Pareto, 1906; Juran & Godfrey, 1999): metrics were ranked by gap size, and their contribution and cumulative contribution to the total gap were calculated, with metrics accounting for approximately 80% of the cumulative gap treated as improvement priorities. The fishbone (cause-and-effect) diagram, originally developed by Ishikawa (1985) as one of the seven basic quality-control tools, organizes potential causes of a problem into standard categories to support systematic root-cause identification here adapted to the man, machine, material, environment, and management categories relevant to Nudira Fresh's operations. Root causes of the priority metrics were then traced through a fishbone diagram organized around five categories: man, machine, material, environment, and

management. Improvement strategies were formulated from these root causes, drawing on supply chain best practices, management interviews, and the relevant literature (Chopra & Meindl, 2019; Christopher, 2016), while checking feasibility in terms of cost, time, and resource availability.

The success of each strategy is intended to be evaluated through its ability to narrow the gap on the priority metrics, raise the score of the associated SCOR attribute, and move actual performance closer to the established targets. The overall flow of the study, linking the research problem to the analytical stages and the resulting managerial implications, is summarized in the research framework (Figure 1).

RESULTS

Company Profile

Nudira Fresh operates under PT Nudira Sumber Daya Indonesia (PT NSDI), an agribusiness company established in 2013 and headquartered in Bogor, West Java, active in agricultural trading, greenhouse development, and agricultural training and consulting. Nudira Fresh was established in 2018 to produce fresh horticultural commodities using a modern, technology-supported cultivation system. Its main operation is located in Warnasari, Pangalengan District, Bandung Regency, at around 1,500 meters above sea level, on approximately 12,500 m² of land with a stated capacity of approximately 9,000 plants. Cherry tomato is cultivated inside a greenhouse of approximately 3,000 m² using a fertigation-based hydroponic system, which supports tighter control over the growing environment, more efficient water and nutrient delivery, and more uniform product quality. Alongside cultivation, the company also offers greenhouse construction and hydroponic training services, and supplies modern retail, hotels, restaurants and cafes (HORECA), and distributors.

Supply Chain Structure

The chain's members comprise the operations, finance and marketing, procurement, production, and logistics division, suppliers, and customers in the modern market and HORECA segments. The operations division coordinates activities across the firm; finance and marketing manage company finances alongside marketing and customer relationships; procurement secures production inputs and manages supplier relationships; production carries out cultivation through postharvest handling; and logistics manages storage, final packing, and distribution. Transactions are governed by a purchase-order system specifying product type, quantity, delivery schedule, and payment terms, and the firm's bargaining position toward both suppliers and customers is moderate, reflecting the need to secure continuous input supply while meeting agreed delivery specifications.

Product flow begins with suppliers, who provide seeds, nutrients, and other inputs to the procurement division; inputs then move to the production house (greenhouse) for cultivation and postharvest handling, are stored in the warehouse, and are distributed by the logistics division to customers (Figure 2). Information flows bidirectionally among customers, marketing, logistics, and procurement, covering demand, product availability, delivery schedules, and customer feedback, while financial flows move from customers to the company and onward to suppliers as payment for inputs used in production.

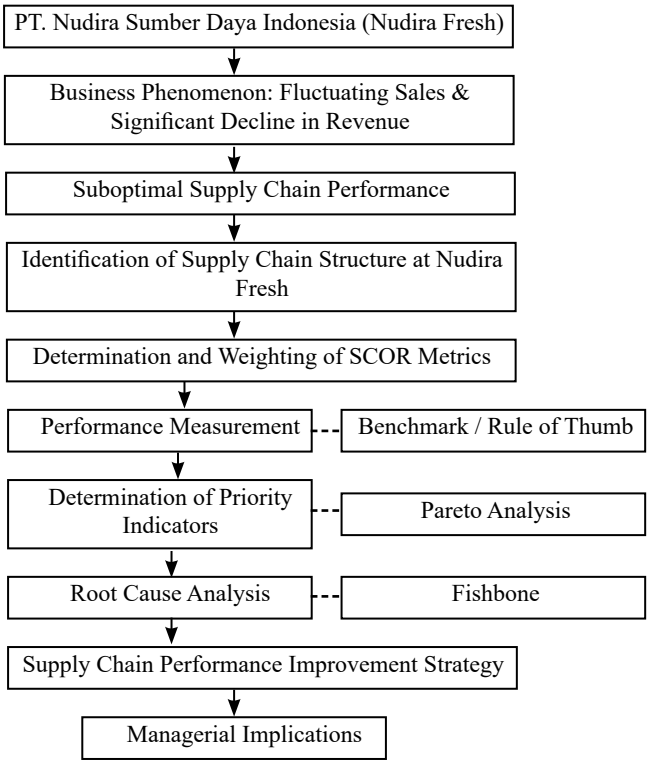

Figure 1. Research framework

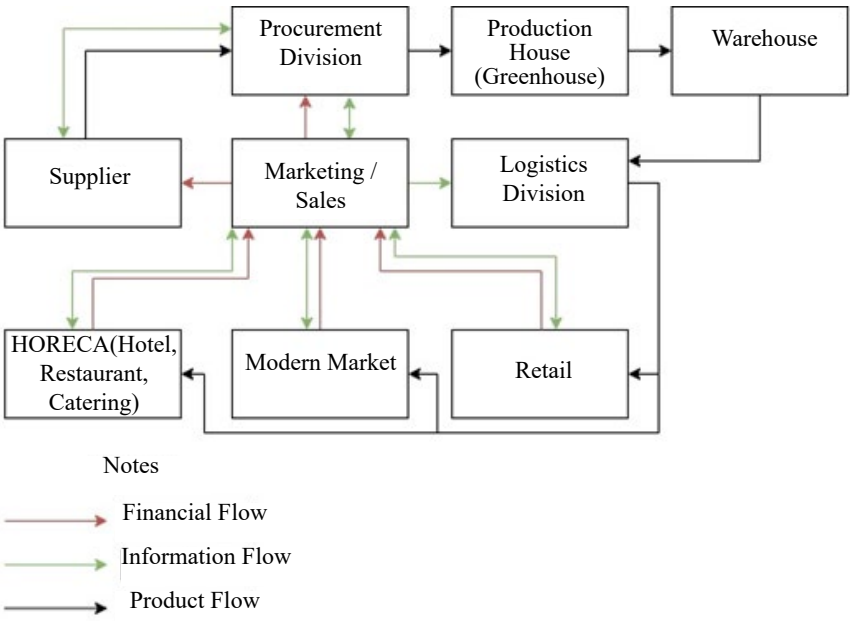

Figure 2. Cherry tomato supply chain flow at Nudira Fresh

SCOR Activity Mapping

Field observations and interviews mapped Nudira Fresh's activities onto the four core SCOR processes. Under Plan, the firm sets its cultivation schedule and coordinates with procurement to secure input availability while budgeting costs for each stage of the chain; this planning discipline is reflected in a Plan Cost score of 100.00, the highest metric under the Cost attribute. Under Source, input needs are defined from the production plan, suppliers are selected, and seeds, nutrients, pesticides, growing media, and packaging materials are procured and inspected on arrival; the Raw Material Quality Acceptance Rate reached 97.13, a strong result that nonetheless falls short of the ideal of 100. Under Make, activities span seedling raising through transplanting into the hydroponic system, ongoing crop maintenance, fertigation, and pest and disease control, followed by harvest, sorting, and grading to customer specification; Harvest Preparation Time scored only 83.34, making it a drag on the wider order fulfilment cycle. Under Deliver, orders are confirmed and a distribution schedule is set around harvest timing, order volume, and destination; packed products undergo a final check reflected in a Customer Quality Acceptance Rate of 89.90 before dispatch. On-Time Delivery (91.87) and Perfect Order Fulfillment (87.56) held up well, but Transportation Lead Time reached only 68.96, the second-lowest metric in the entire assessment, while Total Supply Chain Management Cost (TSCMC) scored 95.40.

Market and Resources

Business-to-consumer (B2C) sales dominated the 2021–2023 period at approximately 65.44% of volume, while business-to-business (B2B) partners including Amazing, Sayurbox, Croponic, Hiroto, RH Farm, and Super Fresh accounted for approximately 34.56%. Customers include individual buyers, resellers, and institutional or community buyers, reaching as far as Bogor, Bali, and Malang, indicating an expanding but still concentrated market footprint.

Regarding resources, the greenhouse's target capacity of roughly 28.8 tonnes per year compares with an actual 2023 output of about 9.4 tonnes, pointing to substantial underused capacity linked to the technical and supply disruptions described above. Cultivation is carried out by three permanent staff members under a greenhouse supervisor, while postharvest sorting and packing rely on casual laborers engaged as needed. The greenhouse is equipped with automated fertigation and climate, humidity, and pH sensors, but production, inventory, and distribution monitoring are not yet integrated in real time, which limits the firm's ability to anticipate and respond quickly to disruption.

Attribute Weighting

Reliability received the highest weight (0.35) because Nudira Fresh's modern-retail and HORECA customers require consistent product quality and on-time delivery,

and failure to meet specifications risks rejection and lost trust. Responsiveness followed (0.30), reflecting the importance of quickly receiving, processing, and fulfilling orders to preserve product freshness. Cost carried a weight of 0.20: important, but subordinate to accuracy, quality, and speed in the firm's own priorities. Agility received the lowest weight (0.15) because the company currently concentrates on meeting routine demand rather than adapting to volatility, and its limited production capacity and dependence on a small supplier base leave less room to treat adaptability as an immediate priority.

Supply Chain Performance Score

Nudira Fresh's overall supply chain performance score of 85.17 falls under the Good category, 4.83 points short of the Excellent threshold of 90. Cost (95.40) and reliability (91.67) both reached Excellent: the cost result is underpinned by strong Plan Cost (100.00), Source Cost (97.65), and Deliver Cost (95.36), despite a comparatively softer Make Cost (92.91); reliability draws on a Correct Document score of 100.00, a Quality Acceptance Rate of 94.23, On-Time Delivery of 91.87, and Perfect Order Fulfillment of 87.56. Responsiveness (75.61) and agility (75.46), by contrast, remain in the good category but are the two weakest attributes. Responsiveness is dragged down chiefly by Transportation Lead Time (68.96) despite a respectable Order Fulfillment Cycle Time (85.58), indicating that internal order processing is reasonably efficient while the physical distribution leg is not. Ponomarov and Holcomb's (2009) three-phase model of supply chain resilience readiness, response, and recovery maps closely onto Nudira Fresh's Recovery Planning Time, Supplier Recovery Time, and Production Recovery Time metrics. Agility is held back mainly by Time to Recover from Disruption (66.57), a composite score obtained by weighting Recovery Planning Time (100.00, weight 0.20), Supplier Recovery Time (67.50, weight 0.30), and Production Recovery Time (52.63, weight 0.50), alongside a still-limited Production Capacity Increase (80.00) and Production Capacity Reduction (83.33), alongside a still-limited Production Capacity Increase (80.00) and Production Capacity Reduction (83.33), showing that the firm's ability to scale output up or down in response to demand or disruption is constrained.

These results indicate that strong reliability and cost control have not, on their own, been sufficient to make the chain resilient, consistent with the broader resilient-enterprise literature emphasizing that recovery speed, not just reliability, determines a supply chain's resilience (Sheffi & Rice, 2005). This aligns with Christopher and Peck (2004), who define agility as the ability to respond rapidly to unpredictable changes in demand or supply, and identify four pillars of a resilient supply chain: re-engineering, collaboration, a risk-management culture, and agility. Among these, agility is the weakest link at Nudira Fresh. For a perishable commodity such as cherry tomatoes, slow recovery from disruptions and a relatively long transportation lead time pose a disproportionate risk of quality loss and unmet demand. Therefore agility and responsiveness despite already being in the good range are treated as the priorities for improvement (Table 4), ahead of the already-strong reliability and cost attributes.

Comparison with Previous Studies

Compared to earlier SCOR-based vegetable chain studies, Nudira Fresh's results show both continuity and divergence. Apriyani et al. (2018) likewise found reliability to be well managed, consistent with Nudira Fresh's Excellent score. Pratama et al. (2022) reported persistently low agility and responsiveness to demand fluctuations and delivery delays, matching Nudira Fresh's weakest attributes, although here the driver is slow recovery from infrastructure damage rather than demand volatility. Kinding et al. (2019) linked distribution effectiveness to actor coordination, echoing this study's fishbone finding that weak cross-department coordination lengthens recovery time.

The comparison also reveals a different risk profile between controlled-environment and open-field production. Open-field tomato studies (Oroh et al., 2023) identified bottlenecks in long marketing channels and unstable farm-gate prices. Nudira Fresh, a vertically integrated greenhouse operation, shows none of these problems; its constraint lies instead in its own infrastructure and recovery resilience, consistent with greenhouse cultivation trading macro-climate risk for infrastructure risk. The transportation and postharvest weaknesses found here also echo Baladraf et al. (2024), who reported persistently high postharvest losses in Indonesian tomato chains; Nudira Fresh's higher overall score suggests firm-level technology investment can raise baseline performance even as execution gaps persist.

Gap Analysis and Pareto Priority

Gap analysis compared each metric's actual value against its target across all attributes. Applying Pareto analysis to the resulting gaps ranked the metrics by their contribution to total performance loss and identified the smaller set of metrics responsible for most of that loss (Table 5).

The first three metrics, production recovery time, supplier recovery time, and transportation lead time together account for 84.19% of the cumulative gap and form the vital few requiring priority action, while order picking and packing time, at 15.81%, is the trivial many. Within agility, the weakness traces mainly to production recovery time rather than to supplier dependence alone, indicating that the slow recovery of internal cultivation activity after a disruption rather than reliance on external suppliers is the larger source of the attribute's low score, although supplier-side recovery still warrants attention.

Root-Cause Analysis

A fishbone diagram was used to trace the root causes of the four priority metrics across five categories: man, machine, material, environment, and management (Figure 4).

Man: cultivation through harvest is carried out by only three permanent staff under a greenhouse supervisor, while postharvest sorting and packing depend on casual labor brought in as needed. Direct timing showed permanent staff sorting roughly 1 kg in about 2 minutes, against about 2.5 minutes for casual staff, which is approximately 25% slower. This is consistent with interview evidence that casual workers are not always fully briefed on sorting and packing standards, which lengthens order picking and packing time and, in turn, transportation lead time.

Machine: postharvest handling still relies heavily on manual equipment, and delivery routes are not systematically optimized, both of which add to transportation lead time. Production, inventory, and distribution are not yet monitored in real time, leaving the company relatively reactive when disruptions or demand changes occur, which slows production recovery time.

Material: nutrient supply from suppliers has occasionally been delayed, and the absence of a systematic inventory-control system means that procurement is often triggered only once stock is already low, increasing the risk of disrupted cultivation and lengthening both supplier recovery time and production recovery time.

Environment: weather variability, heavy rainfall, pest and disease pressure, and the resulting greenhouse damage all extend production recovery time, while traffic conditions and demand fluctuations affect transportation lead time factors that lie largely outside the company's direct control.

Management: the company has not yet documented a risk-mitigation procedure, a production recovery plan, or a contingency plan, so disruptions are still handled reactively. Coordination across departments and routine performance monitoring are similarly under-formalized, which lengthens both production and supplier recovery time. The absence of consistently enforced work standards for sorting and packing contributes to longer order picking and packing time.

Managerial Implications and Improvement Strategies

Four priority strategies were derived from the Pareto and fishbone findings, each assigned an accountable role, a numerical target, and an implementation horizon (Table 6).

Supply chain risk management

The largest single gap, production recovery time (52.63), calls for a documented contingency plan, defined recovery time targets, clear role assignment during disruption, greenhouse spare materials, and arrangements with backup suppliers or contractors, supported by periodic emergency response drills. The operations manager and greenhouse supervisor are responsible for raising production recovery time to at least 75.00 within six months.

Inventory management for production flexibility

Slow supplier recovery time (67.50) is linked to irregular nutrient stock; an integrated nutrient-planning system tied to demand forecasting, together with a reorder point, safety stock, and diversification across more than one nutrient supplier, is proposed under the

operations manager working with the production head, targeting a supplier recovery time of at least 80.00 within six months.

Distribution efficiency

Transportation lead time (68.96) can be shortened through more structured delivery scheduling, route selection that accounts for traffic and distance, delivery zoning, and routine vehicle checks under the logistics supervisor, targeting a score of at least 80.00 within four months, a comparatively quick win given the urgency created by cherry tomato's perishability.

Workforce competence and shop-floor management

Order picking and packing time (79.18) can be improved through reinforced work instructions and brief training for casual staff before each shift, visible on-site work instructions, closer supervision during onboarding, and periodic compliance checks, complemented by shop-floor management applied at procurement, the production house, and a strengthened quality-control function. Responsibility lies with the production head, targeting a score of at least 90.00 within four months, alongside an increase in customer quality acceptance to at least 90%.

Table 4. Priority ranking of the SCOR attributes

Priority	Attribute	Score
1	Agility	75.46
2	Responsiveness	75.61
3	Reliability	91.67
4	Cost	95.40

Table 5. Pareto priority ranking of the SCOR performance gaps

Rank	Metric	Attribute	Score	Gap (100−score)	% Cumulative
1	Production Recovery Time	Agility	52.63	47.37 (35.96%)	35.96%
2	Supplier Recovery Time	Agility	67.50	32.50 (24.67%)	60.63%
3	Transportation Lead Time	Responsiveness	68.96	31.04 (23.56%)	84.19%
4	Order Picking & Packing Time	Responsiveness	79.18	20.82 (15.81%)	100.00%

Table 6. Roadmap for priority supply chain improvement strategies

Priority metric	Improvement strategy	Responsible	Target	Timeframe
Production recovery time	Contingency plan, disruption-response SOP, spare materials, backup suppliers/ contractors, periodic drills	Operations Manager & Greenhouse Supervisor	≥ 75.00	6 months
Supplier recovery time	Integrated nutrient planning, reorder point, safety stock, supplier diversification	Operations Manager & Production Head	≥ 80.00	6 months
Transportation lead time	Structured delivery schedule, route optimisation, delivery zoning, vehicle checks	Logistics Supervisor	≥ 80.00	4 months
Order picking & packing time	Reinforced work instructions, casual-staff training, shop-floor management, added QC function	Production Head	≥ 90.00	4 months

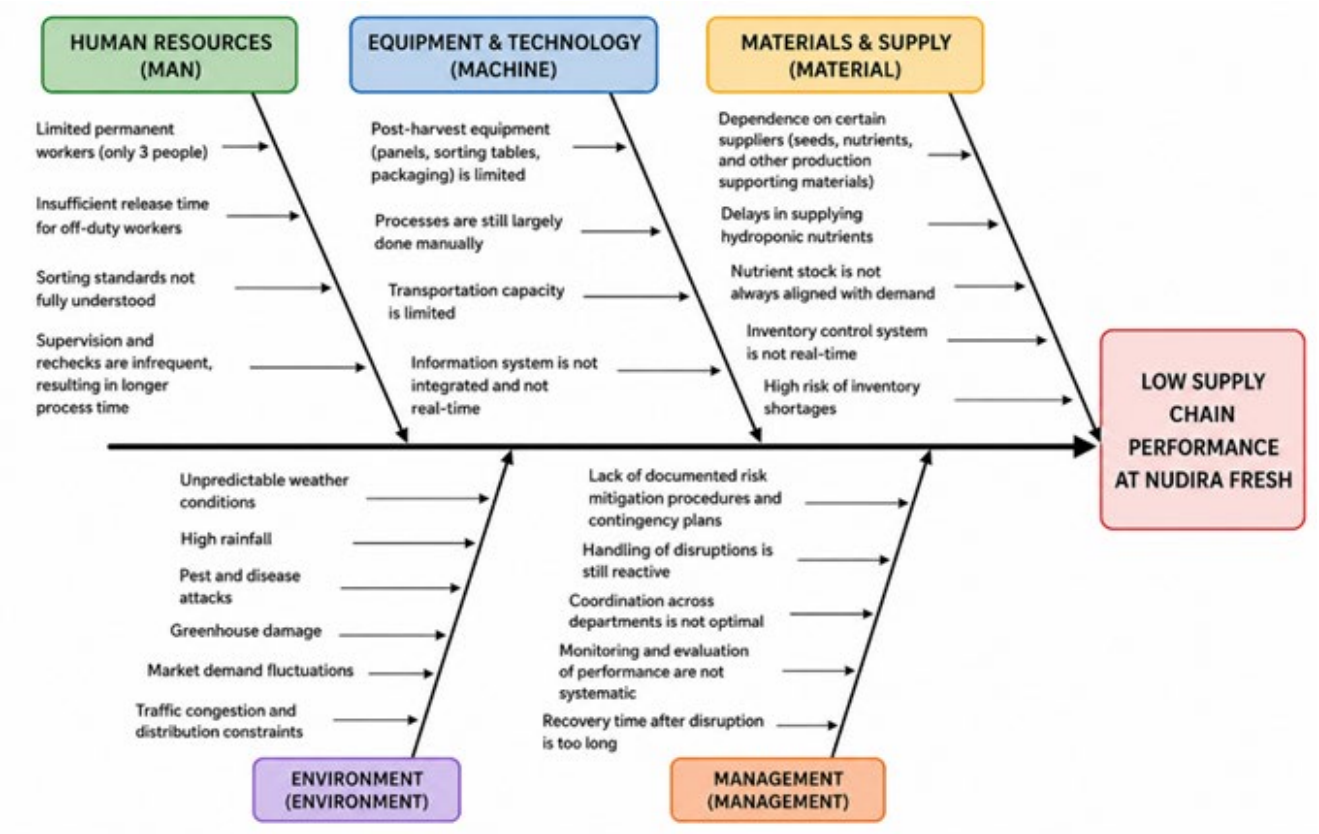

Figure 4. Fishbone diagram of root causes at Nudira Fresh

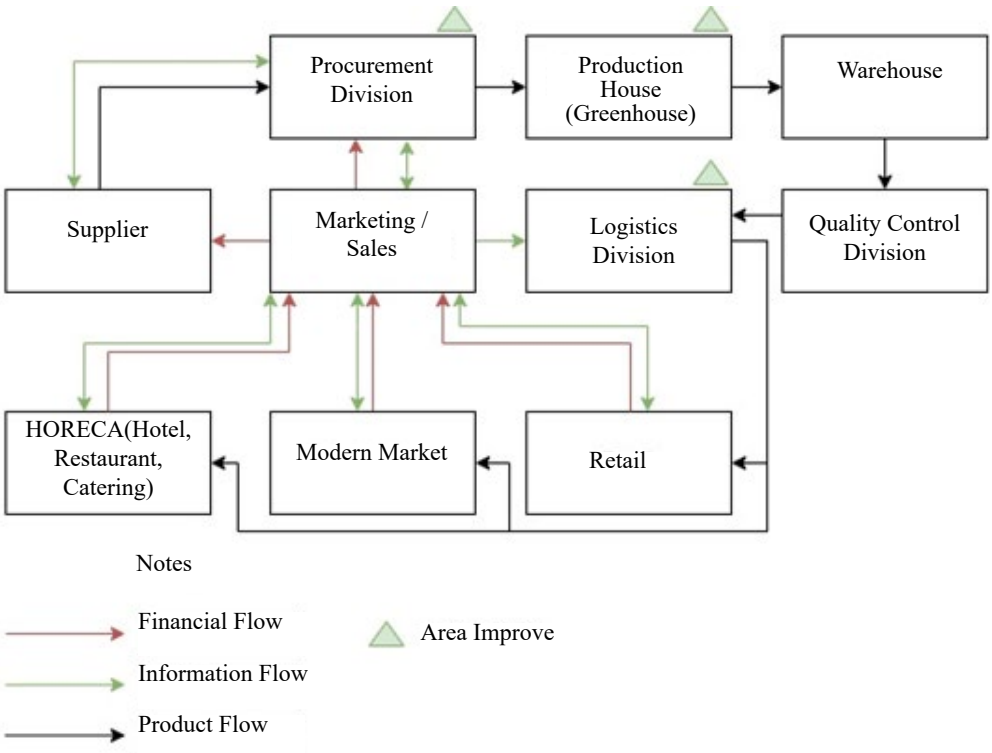

Figure 5. Proposed shop-floor management and QC mapping at Nudira Fresh

Three points in the chain are proposed for shop-floor management direct, real-time supervision at the point of work namely the procurement division, the production house, and a newly added quality-control function (Figure 5). Applying shop-floor management at these three points is intended to keep work aligned with standards as it happens rather than through after-the-fact correction, while the added QC function performs periodic checks on sorting and packing outcomes against specification so that deviations are caught before products reach the customer. Together with more uniform work standards and stronger worker supervision, this is expected to make order picking and packing faster, more accurate, and more consistent, lifting customer quality acceptance toward the 90% target.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The cherry tomato supply chain of Nudira Fresh links suppliers, a procurement division, the production house (greenhouse), a warehouse, a logistics division, and customers in the modern-market and HORECA segments through the four core SCOR processes of plan, source, make, and deliver. Product, information, and financial flows across these actors are broadly well integrated, though recovery from disruption and distribution activities still rely on reactive handling rather than standardised procedures.

The chain's overall performance score of 85.17 falls in the good category. Cost (95.40) and reliability (91.67) reached the Excellent category, while responsiveness (75.61) and agility (75.46) were the two weakest attributes, both still classified as Good. Pareto analysis of the underlying metrics identified production recovery time (52.63), supplier recovery time (67.50), and transportation lead time (68.96) as the vital few gaps, jointly accounting for 84.19% of the cumulative performance shortfall, with order picking and packing time (79.18) as a secondary priority. Fishbone analysis traced these gaps to five interacting causes: limited workforce competence, particularly among casual labour (man); manual postharvest equipment and non-real-time monitoring (machine); irregular nutrient supply and the absence of systematic inventory control (material); weather variability and greenhouse vulnerability (environment); and the lack of a documented risk-management and recovery system (management).

These findings both confirm and extend earlier SCOR-based studies on vegetable supply chains. Consistent with Apriyani et al. (2018), reliability emerged as the strongest-performing attribute, while the persistently weak agility and responsiveness echo Pratama et al. (2022) and Kinding et al. (2019), who likewise traced such weaknesses to demand fluctuation and to insufficiently coordinated actors along the chain. The comparison also points to a risk profile distinct from open-field production: whereas Oroh et al. (2023) located bottlenecks in long marketing channels and unstable farm-gate prices, Nudira Fresh's constraint lies in its own infrastructure and recovery capacity, indicating that a controlled-environment operation trades macro-climatic exposure for infrastructure and recovery risk. This pattern supports Sheffi and Rice's (2005) contention that recovery speed, and not reliability alone, determines a supply chain's resilience, and it reinforces Christopher and Peck's (2004) framing of agility as a defining pillar of chain resilience. Theoretically, the study contributes to the SCOR and supply chain resilience literature by showing that strong reliability and cost efficiency, however well managed, do not by themselves guarantee resilience in a perishable, technology controlled horticultural chain; recovery capability must be built and monitored as a distinct capacity rather than assumed to follow from operational excellence elsewhere in the chain.

Four priority strategies follow from these findings: strengthening supply chain risk management through a contingency plan and defined recovery targets; strengthening nutrient inventory management through reorder points, safety stock, and supplier diversification; improving distribution efficiency through route and schedule optimisation; and strengthening workforce competence through reinforced work instructions and shop-floor management. Collectively, these strategies target the agility and responsiveness attributes that represent Nudira Fresh's main constraint despite its already strong reliability and cost performance.

Recommendations

Nudira Fresh should implement the four priority strategies in a staged sequence, beginning with supply chain risk management given that production recovery time carries the largest performance gap and underlies the firm's low agility score. Strengthening nutrient inventory management and supplier diversification should follow closely, given its link to supplier recovery time. Distribution-route and scheduling improvements represent a comparatively quick win that should be pursued in parallel, given the urgency created by the product's perishability, while workforce competence and shop-floor management should be reinforced on an ongoing basis to sustain order picking and packing performance. Embedding these SCOR-based metrics in a routine monitoring system, rather than a one-off assessment, would help management track progress consistently.

Future research could extend this analysis with a cost-benefit assessment of the proposed investments, particularly the contingency plan and backup-capacity arrangements, to establish their financial feasibility. Comparative studies across other greenhouse-based horticultural producers, together with periodic re-evaluation of Nudira Fresh's own performance, would help generalise these findings and monitor the effectiveness of the strategies once implemented.

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