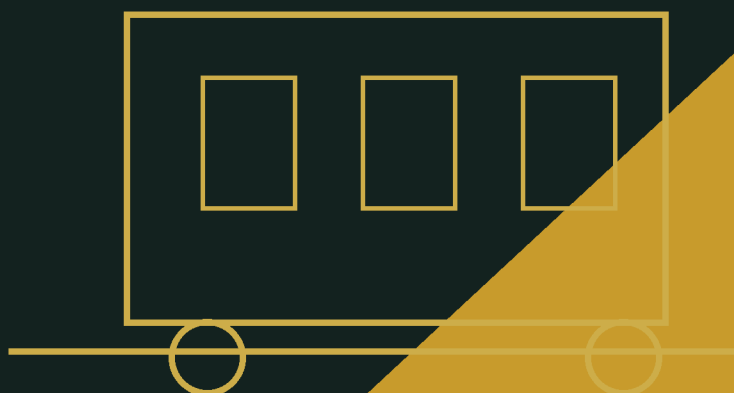


CLIMATE-SMART AGRICULTURE IMPLEMENTATION SERIES

VOLUME 2

POST-HARVEST & LOGISTICS

A Comprehensive Manual for Loss Reduction, Quality Protection, Cold Chain, Traceability and Market Logistics



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VOLUME 2: Post-Harvest & Logistics

A Comprehensive Manual for Loss Reduction, Quality Protection, Cold Chain, Traceability and Market Logistics

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HUNTER'S GLOBAL NETWORK | FARMERS PRIDE INTERNATIONAL INVESTMENT

Publication purpose This volume provides a farm-to-market operating system for protecting product value after harvest through controlled handling, grading, drying, storage, cold chain, food safety, traceability, warehousing, transport, export logistics and business continuity.

How to Use This Manual

This manual is designed for implementation teams, governments, development partners, agribusinesses, farmer organisations, technical service providers, training institutions and investors. It can be used at programme, district, cluster, enterprise and farm level. The recommended approach is to begin with a baseline, define measurable targets, select context-appropriate interventions, cost the implementation package, assign accountability, train implementers, deploy systems in phases, measure performance and revise the package using evidence.

Series Integration

The three volumes are intended to operate as one system. Volume 1 establishes climate-smart primary production. Volume 2 protects product quality and value between harvest and market. Volume 3 converts agricultural output into higher-value industrial products. Programme managers should use common traceability identifiers, data definitions, quality standards, risk registers and monitoring cycles across all three volumes.

Core Principles

- **Productivity and profitability:** interventions must improve viable output, resource efficiency, quality or market access rather than add technology for its own sake.
- **Climate resilience:** systems should reduce sensitivity to drought, heat, floods, pests, supply disruption and market shocks.
- **Mitigation where feasible:** reduce emissions intensity, energy waste, nutrient losses and avoidable waste while protecting soil carbon and biomass.
- **Evidence and traceability:** decisions should be based on records, measurements and clearly assigned responsibilities.

- Do-no-harm safeguards: protect workers, communities, consumers, land, water, biodiversity and vulnerable groups.
- Scalability: every pilot should include a pathway for financing, institutionalisation, replication and continuous improvement.

Abbreviations

Term	Meaning
CSA	Climate-Smart Agriculture
MEL	Monitoring, Evaluation and Learning
KPI	Key Performance Indicator
SOP	Standard Operating Procedure
HACCP	Hazard Analysis and Critical Control Point
GMP	Good Manufacturing Practice
CAPEX	Capital Expenditure
OPEX	Operating Expenditure
GHG	Greenhouse Gas
QA/QC	Quality Assurance / Quality Control

Executive Summary

This volume provides a farm-to-market operating system for protecting product value after harvest through controlled handling, grading, drying, storage, cold chain, food safety, traceability, warehousing, transport, export logistics and business continuity. The manual is structured to move from diagnosis and design to operating controls, evidence, assurance and scale-up. Every intervention should be linked to a measurable problem, a responsible owner, a financing approach and a verification method.

Management rule Technology does not make a system climate-smart by itself. The intervention must solve a defined risk or performance gap, fit the local context, be economically maintainable and be measured after implementation.

Volume 2 Operating Model

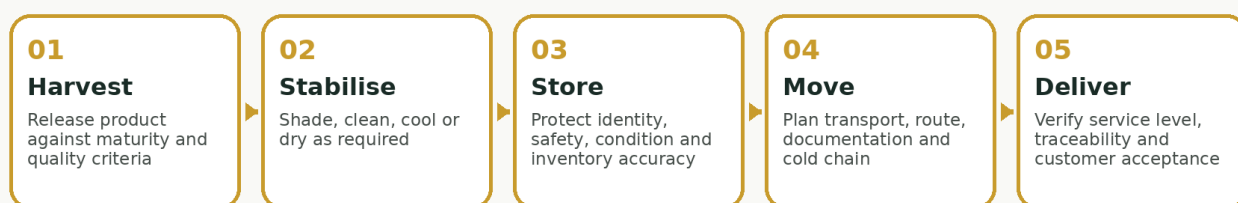


Figure 1. Integrated operating model for this volume.

Implementation at a Glance

Phase	What happens	Primary owner	Timing	Key output	KPI	Primary risk	Mitigation
1. Baseline & mobilisation	Confirm geography, beneficiaries, climate/market risks, current practices and assets.	Programme lead + local institutions	Months 0-2	Approved baseline; stakeholder map	Baseline completed; participation rate	Weak data / low buy-in	Use triangulation, field verification and signed mobilisation plan
2. Detailed design	Prioritise interventions, technical standards, sites, procurement lots and financing.	Technical lead + finance + procurement	Months 2-4	Investment plan; BoQ; implementation schedule	% interventions costed and approved	Over-design / unaffordable package	Phase investments; apply value-for-money gates

3. Capacity building	Train trainers, operators, farmers, supervisors and QA personnel.	Training lead + technical specialists	Months 3-8; refresher quarterly	Competency records; training materials	Pass rate; adoption rate	Training without application	Field demonstrations; competency checks; coaching
4. Infrastructure & systems	Procure, install, commission and document physical and digital systems.	Engineering / operations	Months 4-12	Commissioned assets; asset register	On-time commissioning ; uptime	Delays / poor installation	Milestone payments; factory/site acceptance tests
5. Controlled rollout	Operate priority sites, capture evidence and correct bottlenecks.	Operations + MEL	Months 8-18	Operational pilot clusters	Yield/quality/ loss/cost targets achieved	Pilot not representative	Use diverse sites and predefined success criteria
6. Scale-up	Replicate proven packages through finance, extension, suppliers and offtake.	Programme board + partners	Years 2-5	Scaled clusters and market linkages	Coverage; unit cost reduction; revenue growth	Scaling faster than systems	Stage-gates, audit readiness, supplier qualification
7. Continuous improvement	Quarterly reviews, annual assurance, lessons and standards updates.	MEL + QA + leadership	Quarterly / annual	Corrective action logs; updated SOPs	Closure rate; trend improvement	Data not acted on	Management review with accountable owners

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1. Post-Harvest System Architecture

Implementation intent: This chapter defines the minimum management system, operational controls and evidence required to make the subject practical at field, facility or programme level.

Organisations should adapt thresholds and technical specifications to crop, geography, regulation and buyer requirements, while preserving the underlying control logic.

1.1 Protecting value after harvest

Post-harvest management is a controlled chain from field release to final customer. The design objective is to preserve safety, identity, quality, quantity and commercial value while using time, energy and transport efficiently. Every product should have a handling specification covering maturity, maximum field-to-cooling or field-to-processing time, temperature/humidity needs, permissible packaging, cleanliness, stacking and rejection criteria.

1.2 Loss mapping

Map where physical loss, quality downgrade, moisture loss, contamination, theft, delay and documentation errors occur. Quantify both visible waste and hidden value loss from downgraded product. A loss map should identify process step, cause, frequency, severity, financial value and corrective action owner.

1.3 Facility network design

Select collection centres, packhouses, stores, cold rooms and distribution hubs based on production density, road access, service radius, power and water, buyer locations and transport economics. Design the network to minimise unnecessary handling and backtracking.

Chapter Control Points

Control	Required action	Evidence
Plan	Define objective, baseline, specification and responsible owner.	Approved plan / specification
Implement	Apply the technical procedure with trained people and suitable resources.	Completed records / asset or process evidence
Check	Measure performance and verify compliance against target.	KPI result / inspection / test
Act	Correct deviations, investigate root causes and update controls.	Corrective-action closure / revised SOP

2. Harvest Maturity, Field Handling and Receiving

Implementation intent: This chapter defines the minimum management system, operational controls and evidence required to make the subject practical at field, facility or programme level.

Organisations should adapt thresholds and technical specifications to crop, geography, regulation and buyer requirements, while preserving the underlying control logic.

2.1 Harvest maturity standards

Define objective maturity indicators by commodity: days from planting, size, colour, firmness, dry matter, moisture, soluble solids or botanical maturity indicators as relevant. Train harvesters with physical samples or visual standards. Harvesting too early or too late can reduce yield, shelf life and processing quality.

2.2 Field hygiene and containers

Use clean, fit-for-purpose tools and containers. Keep harvested product shaded and off bare soil. Avoid overfilling, throwing, standing on containers or mixing damaged and sound material. Containers should be identifiable, cleanable and compatible with transport and cooling systems.

2.3 Receiving controls

At collection or packhouse receiving, verify supplier, lot, time, product, quantity, condition, contamination indicators and temperature where applicable. Nonconforming lots should be segregated and dispositioned, not silently blended.

Chapter Control Points

Control	Required action	Evidence
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Check	Measure performance and verify compliance against target.	KPI result / inspection / test
Act	Correct deviations, investigate root causes and update controls.	Corrective-action closure / revised SOP

3. Cleaning, Sorting, Grading and Packaging

Implementation intent: This chapter defines the minimum management system, operational controls and evidence required to make the subject practical at field, facility or programme level. Organisations should adapt thresholds and technical specifications to crop, geography, regulation and buyer requirements, while preserving the underlying control logic.

3.1 Process design

Arrange flow from dirty to clean zones. Separate incoming, washing/cleaning, sorting, packing, finished goods and waste. Minimise cross-traffic between workers, product, waste and vehicles. Use physical separation or procedural zoning where facilities are simple.

3.2 Grading systems

Grade against written specifications linked to customer needs. Use tolerances for size, colour, defects, foreign matter, moisture and other relevant attributes. Record grade-out percentage because it is a key signal of field and handling performance.

3.3 Packaging engineering

Packaging must protect product through the expected distribution environment. Consider ventilation, compression strength, moisture, pallet pattern, recyclability, labelling, export requirements and cost. Test packaging under actual stacking and transport conditions before large procurement.

Chapter Control Points

Control	Required action	Evidence
Plan	Define objective, baseline, specification and responsible owner.	Approved plan / specification
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4. Drying, Moisture Control and Botanical Raw Materials

Implementation intent: This chapter defines the minimum management system, operational controls and evidence required to make the subject practical at field, facility or programme level.

Organisations should adapt thresholds and technical specifications to crop, geography, regulation and buyer requirements, while preserving the underlying control logic.

4.1 Drying as a critical operation

For herbs, leaves, roots, spices and other botanicals, drying strongly affects colour, microbiological stability, active constituents and storage life. Define maximum time from harvest to drying, preparation method, loading density, temperature range, endpoint moisture and cooling procedure.

4.2 Moringa and leafy materials

Leaf products require rapid hygienic handling, removal of foreign matter, controlled drying away from contamination and protection from high humidity after drying. The programme should validate drying conditions for the intended product and buyer specification rather than use a single universal temperature.

4.3 Turmeric, garlic, hibiscus and roots

Root, bulb and calyx crops may require washing, trimming, slicing or curing before drying. Cross-contamination controls are essential where soil is present. Moisture targets, water activity where relevant and packaging barrier properties should be confirmed through product testing.

Chapter Control Points

Control	Required action	Evidence
Plan	Define objective, baseline, specification and responsible owner.	Approved plan / specification
Implement	Apply the technical procedure with trained people and suitable resources.	Completed records / asset or process evidence
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5. Cold Chain and Temperature-Controlled Logistics

Implementation intent: This chapter defines the minimum management system, operational controls and evidence required to make the subject practical at field, facility or programme level.

Organisations should adapt thresholds and technical specifications to crop, geography, regulation and buyer requirements, while preserving the underlying control logic.

5.1 Precooling and cold-chain entry

Remove field heat as quickly as the commodity requires and infrastructure permits. Select forced-air, room cooling, hydro-cooling or other methods based on product tolerance and economics. Track time and temperature from harvest to first cooling.

5.2 Cold-room operation

Use mapped temperature zones, calibrated sensors, alarm limits, door discipline, loading clearances, defrost management, hygiene schedules and preventive maintenance. Avoid using a cold room as a substitute for correct precooling where rapid heat removal is necessary.

5.3 Transport temperature control

Verify vehicle cleanliness, setpoint, airflow, pre-cooling, loading pattern and door opening control. Record departure and receiving temperatures. Investigate excursions using product-specific risk criteria rather than assuming every deviation has the same consequence.

Chapter Control Points

Control	Required action	Evidence
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Plan	Define objective, baseline, specification and responsible owner.	Approved plan / specification
Implement	Apply the technical procedure with trained people and suitable resources.	Completed records / asset or process evidence
Check	Measure performance and verify compliance against target.	KPI result / inspection / test
Act	Correct deviations, investigate root causes and update controls.	Corrective-action closure / revised SOP

6. Warehousing and Inventory Management

Implementation intent: This chapter defines the minimum management system, operational controls and evidence required to make the subject practical at field, facility or programme level.

Organisations should adapt thresholds and technical specifications to crop, geography, regulation and buyer requirements, while preserving the underlying control logic.

6.1 Warehouse zoning

Separate food-grade raw material, packaging, chemicals, allergens where applicable, rejected goods, returns and waste. Define pallet clearances, pest-monitoring points, cleaning access, fire routes and quarantine areas.

6.2 Stock control

Apply FEFO where shelf life matters and FIFO where appropriate. Use lot-level inventory and cycle counts. Differences between physical and system stock should be investigated for transaction errors, shrinkage, moisture changes or theft.

6.3 Pest and moisture management

Prevent infestation through building integrity, sanitation, inspection, controlled treatments and environmental monitoring. Avoid practices that contaminate product. For dry commodities, humidity and moisture ingress control are central to shelf-life protection.

Chapter Control Points

Control	Required action	Evidence
Plan	Define objective, baseline, specification and responsible owner.	Approved plan / specification
Implement	Apply the technical procedure with trained people and suitable resources.	Completed records / asset or process evidence
Check	Measure performance and verify	KPI result / inspection / test

	compliance against target.	
Act	Correct deviations, investigate root causes and update controls.	Corrective-action closure / revised SOP

7. Food Safety, Quality Systems and Compliance

Implementation intent: This chapter defines the minimum management system, operational controls and evidence required to make the subject practical at field, facility or programme level.

Organisations should adapt thresholds and technical specifications to crop, geography, regulation and buyer requirements, while preserving the underlying control logic.

7.1 Food-safety management

Build prerequisite programmes for hygiene, cleaning, water quality, pest control, maintenance, supplier approval, allergen management where relevant, waste and traceability. Apply HACCP principles to identify significant hazards and establish controls. Certification requirements should be selected based on law and customer demand.

- Define acceptance criteria before receiving or processing product.
- Use controlled records for monitoring, deviation, disposition and corrective action.
- Verify critical measurements with calibrated or otherwise suitable equipment.

7.2 Sampling and testing

Define sampling plans for microbiological, chemical, physical and quality attributes based on risk. Use competent laboratories, preserve sample identity and establish action limits. Do not over-test low-risk parameters while ignoring high-risk process controls.

7.3 Nonconformance and corrective action

Document deviations, quarantine affected product, assess disposition, investigate root cause and verify corrective action. Rework or release decisions should be authorised and traceable.

Chapter Control Points

Control	Required action	Evidence
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Implement	Apply the technical procedure with trained people and suitable resources.	Completed records / asset or process evidence
Check	Measure performance and verify compliance against target.	KPI result / inspection / test
Act	Correct deviations, investigate root causes and update controls.	Corrective-action closure / revised SOP

8. Traceability, Digital Systems and Recall Readiness

Implementation intent: This chapter defines the minimum management system, operational controls and evidence required to make the subject practical at field, facility or programme level.

Organisations should adapt thresholds and technical specifications to crop, geography, regulation and buyer requirements, while preserving the underlying control logic.

8.1 Lot coding

Create lot codes that connect receiving, processing, packing, storage and dispatch records. Codes should be unique, legible and robust through the distribution environment.

8.2 Digital traceability

Barcodes, QR codes, warehouse systems and mobile applications can improve speed and visibility. The technology must be supported by master-data governance, user permissions, backups and reconciliation with physical stock.

8.3 Recall and incident response

Maintain a recall plan with decision authority, contact lists, product isolation steps, customer notification, regulator communication where required, reconciliation, disposal and post-incident review. Conduct mock recalls and measure traceability completion time and quantity reconciliation.

Chapter Control Points

Control	Required action	Evidence
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Implement	Apply the technical procedure with trained people and suitable resources.	Completed records / asset or process evidence
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9. Transport, Route Planning and Export Logistics

Implementation intent: This chapter defines the minimum management system, operational controls and evidence required to make the subject practical at field, facility or programme level.

Organisations should adapt thresholds and technical specifications to crop, geography, regulation and buyer requirements, while preserving the underlying control logic.

9.1 Transport planning

Match vehicle type, payload, route and dispatch time to product requirements. Plan routes around road conditions, border hours, customer delivery slots, driver hours and refuelling. Use backhauls where safe and commercially sensible.

9.2 Load security and handling

Standardise palletisation, load restraint, stacking and unloading. Inspect vehicle floors, walls, odour, residues and pest evidence. Protect packaging from rain and direct sun during cross-docking.

9.3 Export readiness

Create shipment checklists covering commercial invoice, packing list, certificates, phytosanitary or health documentation where required, origin documents, labels, buyer approvals, customs instructions and insurance. Requirements vary by product and destination; verify them before production and again before dispatch.

Chapter Control Points

Control	Required action	Evidence
Plan	Define objective, baseline, specification and responsible owner.	Approved plan / specification
Implement	Apply the technical procedure with trained people and suitable resources.	Completed records / asset or process evidence
Check	Measure performance and verify compliance against target.	KPI result / inspection / test
Act	Correct deviations, investigate root causes and update controls.	Corrective-action closure / revised SOP

10. Logistics Economics and Service-Level Management

Implementation intent: This chapter defines the minimum management system, operational controls and evidence required to make the subject practical at field, facility or programme level.

Organisations should adapt thresholds and technical specifications to crop, geography, regulation and buyer requirements, while preserving the underlying control logic.

10.1 Cost-to-serve

Measure transport, handling, packaging, storage, energy, loss and administration cost by channel or customer. High sales value does not guarantee a profitable route if logistics intensity is excessive.

10.2 Service levels

Define on-time-in-full, temperature compliance, damage rate, claims, lead time and stock availability targets. Balance service with cost; emergency deliveries should be analysed for root causes rather than normalised.

10.3 Provider management

Use contracts and scorecards for carriers, warehouses, laboratories and fumigation or sanitation providers. Include safety, insurance, compliance, equipment condition, data reporting and corrective-action expectations.

Chapter Control Points

Control	Required action	Evidence
Plan	Define objective, baseline, specification and responsible owner.	Approved plan / specification
Implement	Apply the technical procedure with trained people and suitable resources.	Completed records / asset or process evidence
Check	Measure performance and verify compliance against target.	KPI result / inspection / test
Act	Correct deviations, investigate root causes and update controls.	Corrective-action closure / revised SOP

11. Business Continuity and Climate Disruption

Implementation intent: This chapter defines the minimum management system, operational controls and evidence required to make the subject practical at field, facility or programme level.

Organisations should adapt thresholds and technical specifications to crop, geography, regulation and buyer requirements, while preserving the underlying control logic.

11.1 Disruption scenarios

Plan for floods, heatwaves, power outages, fuel shortages, road closure, border delay, cold-room failure, cyber incidents and labour disruption. Identify critical loads, alternative facilities, backup power, rerouting and emergency communication.

11.2 Product triage

When capacity is constrained, prioritise products by safety risk, perishability, value, customer commitment and recovery options. Predefine who can authorise diversion, processing, donation, downgrade or disposal.

11.3 Continuity exercises

Run tabletop exercises and selected live tests. Capture action items and verify closure before peak season.

Chapter Control Points

Control	Required action	Evidence
Plan	Define objective, baseline, specification and responsible owner.	Approved plan / specification
Implement	Apply the technical procedure with trained people and suitable resources.	Completed records / asset or process evidence
Check	Measure performance and verify compliance against target.	KPI result / inspection / test
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12. Governance, MEL and Scaling Post-Harvest Systems

Implementation intent: This chapter defines the minimum management system, operational controls and evidence required to make the subject practical at field, facility or programme level.

Organisations should adapt thresholds and technical specifications to crop, geography, regulation and buyer requirements, while preserving the underlying control logic.

12.1 Governance

Assign ownership for food safety, quality, cold chain, warehouse, transport, traceability and customer claims. Use cross-functional review because failures often occur at handoffs.

12.2 Performance dashboard

Track post-harvest loss percentage, grade-out, shrinkage, on-time-in-full, claim rate, temperature excursions, inventory accuracy, warehouse utilisation, energy per tonne and cost per delivered unit.

12.3 Scale-up

Standardise packhouse modules, mobile collection points, cold-room packages, software and training where possible. Scale infrastructure only when supply volume, utilisation, maintenance and market demand justify it.

Chapter Control Points

Control	Required action	Evidence
Plan	Define objective, baseline, specification and responsible owner.	Approved plan / specification

Implement	Apply the technical procedure with trained people and suitable resources.	Completed records / asset or process evidence
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Act	Correct deviations, investigate root causes and update controls.	Corrective-action closure / revised SOP

13. Implementation Matrix and Five-Year Roadmap

The matrix below is a programme-level template. It should be converted into annual work plans with named individuals, approved budgets, geographic targets and procurement references. Baselines must be established before targets are finalised.

Period	Priority actions	Expected milestone	Management test
Year 1	Baseline, standards, pilots, training-of-trainers, priority infrastructure	2-4 representative clusters operational	Baseline + pilot scorecard
Year 2	Refine technical packages, expand suppliers, strengthen data and market contracts	First scaled replication wave	Adoption, quality and unit-cost trends
Year 3	Scale finance and infrastructure; deepen certification/assurance where needed	Regional/cluster expansion	Coverage, profitability, compliance
Year 4	Optimise productivity, resource efficiency, logistics and industrial linkages	Integrated value-chain performance	Water/energy/loss reductions; market growth
Year 5	Institutionalise standards, independent assurance, replication toolkit and next strategy	Sustainable operating model	Financial sustainability; verified outcomes

Detailed Implementation Matrix

Activity	Output	Responsibility	Timing	Resources	KPIs	Risk	Mitigation
Baseline and risk assessment	Baseline report and maps	Programme manager / MEL	0-2 months	Field teams, GIS/data tools, labs as needed	Baseline approval; % sites profiled	Incomplete data	Triangulate records, field checks and stakeholder validation
Technical standards and SOPs	Approved standards pack	Technical lead / QA	1-4 months	Subject experts, document control	% critical SOPs approved	Standards too generic	Pilot against real sites before approval

Training and competency	Competent implementers	Training lead	2-8 months + refreshers	Trainers, demo sites, assessments	Pass rate; field adoption	Attendance without competence	Practical assessment and coaching
Infrastructure deployment	Commissioned assets	Operations / engineering	4-18 months	CAPEX, procurement, contractors	Commissioning on time; uptime	Poor specifications / delays	BoQ review, FAT/SAT, staged payments
Operations and assurance	Stable controlled operations	Operations + QA	6 months onward	Supervisors, records, audits	KPI attainment; deviation closure	Records without action	Management review and corrective actions
Market/finance integration	Contracts and viable cash cycle	Commercial + finance	6-24 months	Offtake, working capital, insurance	Sales conversion; DSO; margin	Production ahead of market	Stage expansion to contracted demand
Scale-up	Replicated clusters	Programme board	Years 2-5	Finance, suppliers, extension	Coverage; unit-cost trend	Loss of control at scale	Accredited providers and common data system

14. Budget and Resource Framework

Budgets should distinguish one-time capital costs, recurring operating costs, training and technical assistance, monitoring and assurance, contingency and working capital. Unit-cost assumptions should be documented and refreshed through competitive quotations or verified market data. The percentages below are planning bands only and must not substitute for a bill of quantities.

Budget line	Indicative planning band	What to include
Technical design & baseline	3-8%	Diagnostics, surveys, engineering, technical design
Infrastructure / equipment	35-60%	Physical assets, installation, commissioning
Training & extension	8-15%	Training materials, demonstrations, coaching
Digital / monitoring systems	3-10%	Data collection, sensors/software where justified
Quality, certification & assurance	3-8%	Testing, audits, verification, documentation
Operations / working capital	10-25%	Inputs, labour, utilities, packaging, transport
Contingency	5-10%	Price, scope and implementation uncertainty

15. SOP and Control Templates

Post-Harvest Facility Checklist

- Receiving specification and lot coding
- Dirty/clean zoning
- Cleaning and sanitation programme
- Grading standards and defect examples
- Packaging validation
- Temperature/humidity monitoring
- Pest-management programme
- Warehouse FEFO/FIFO rules
- Carrier approval and vehicle inspection
- Recall plan and mock-recall test

Core Post-Harvest KPIs

- Post-harvest loss %
- Grade-out %
- On-time-in-full %
- Temperature excursion rate
- Inventory accuracy %
- Customer claims per 1,000 units
- Warehouse utilisation %
- Energy/tonne handled
- Recall trace completion time
- Logistics cost/tonne

Minimum SOP Template

Field	Required content
Document control	Title, code, version, owner, approval, effective date
Purpose	What risk or process the SOP controls
Scope	Sites, products, equipment or roles covered
Responsibilities	Who performs, supervises, verifies and approves
Procedure	Step-by-step method with decision points
Limits / criteria	Specifications, thresholds, tolerances or escalation rules
Records	Forms, logs, system entries and retention
Safety / environment	PPE, hazards, waste and emergency actions

Deviation	Containment, escalation, disposition and corrective action
Verification	Inspection, testing, audit or management review

16. Monitoring, Audit and Reporting Tools

Use a monthly operating dashboard, quarterly management review and annual assurance cycle. Dashboards should show target, actual, trend, owner and corrective action. Avoid collecting metrics that do not trigger decisions.

KPI	Baseline	Target	Frequency	Owner	Verification
Post-harvest loss %	Define baseline	Set annual target	Monthly / seasonal	Named process owner	Source record + spot check
Grade-out %	Define baseline	Set annual target	Monthly / seasonal	Named process owner	Source record + spot check
On-time-in-full %	Define baseline	Set annual target	Monthly / seasonal	Named process owner	Source record + spot check
Temperature excursion rate	Define baseline	Set annual target	Monthly / seasonal	Named process owner	Source record + spot check
Inventory accuracy %	Define baseline	Set annual target	Monthly / seasonal	Named process owner	Source record + spot check
Customer claims per 1,000 units	Define baseline	Set annual target	Monthly / seasonal	Named process owner	Source record + spot check
Warehouse utilisation %	Define baseline	Set annual target	Monthly / seasonal	Named process owner	Source record + spot check
Energy/tonne handled	Define baseline	Set annual target	Monthly / seasonal	Named process owner	Source record + spot check
Recall trace completion time	Define baseline	Set annual target	Monthly / seasonal	Named process owner	Source record + spot check
Logistics cost/tonne	Define baseline	Set annual target	Monthly / seasonal	Named process owner	Source record + spot check

Risk Register Template

Risk	Cause	Likelihood	Impact	Existing controls	Further action	Owner	Due
Climate / extreme weather	Site exposure and variability	M	H	Season planning, drainage/water controls	Trigger-based contingency plan	Operations	Before season
Market / price	Demand or	M	H	Offtake,	Downside	Commercial	Quarterly

	buyer change			diversified channels	sensitivity and alternate buyers		
Quality / safety	Process or handling failure	M	H	SOPs, QA, traceability	Trend review and verification testing	QA	Monthly
Financial	Cash-flow mismatch	M	H	Budget and approvals	Working-capital plan; staged growth	Finance	Monthly
Skills / turnover	Insufficient competence	M	M	Training records	Cross-train critical roles	HR/Technical	Quarterly

17. Annexes and References

Annex A. Commodity Handling Control Matrix

Commodity	Immediate priority	Stabilisation	Storage focus	Typical failure to prevent
Moringa leaf	Shade, hygienic separation	Prompt controlled drying	Dry, protected from humidity	Browning, contamination, moisture uptake
Turmeric	Soil removal and hygienic wash	Cure/slice/dry as process requires	Dry, pest protected	Soil contamination, mould, uneven drying
Hibiscus calyx	Clean collection, protect from rain	Controlled drying	Dry, colour protected	Foreign matter, mould, colour loss
Garlic	Avoid bruising, manage harvest maturity	Curing / drying	Ventilated dry storage	Rot, sprouting, mechanical damage
Black carrot	Shade and quick transfer	Cooling or prompt processing	Cold or processed-state control	Wilting, decay, colour degradation

References and Standards

Food and Agriculture Organization of the United Nations (FAO). Climate-Smart Agriculture Sourcebook. FAO, Rome.

World Bank. Climate-Smart Agriculture Investment Plans: Bringing CSA to Life. World Bank, 2019.

ISO. ISO 22000:2018 - Food safety management systems - Requirements for any organization in the food chain. Current edition confirmed in 2023; revision work ongoing as of 2026.

Codex Alimentarius Commission. General Principles of Food Hygiene (CXC 1-1969) and HACCP system guidance, as revised.

FAO and related technical guidance on post-harvest management, food loss reduction, irrigation, soil management and sustainable value chains.

Applicable national legislation, phytosanitary rules, pesticide law, food law, labour law, environmental requirements and destination-market standards should always be verified for the operating country and product.

Important Application Note

This manual is an implementation framework, not a substitute for local law, engineering design, crop-specific agronomy, laboratory validation, certification rules, professional safety advice or destination-market regulatory requirements. Implementers should verify current legal and technical requirements in each operating jurisdiction and maintain evidence of that verification.

Annex B. First 90 Days Mobilisation Plan

Period	Management priority	Required evidence
Days 1-15	Appoint accountable leads; confirm sites, beneficiaries, market assumptions and critical risks.	Signed governance chart, site list, stakeholder map, initial risk register
Days 16-30	Complete baseline data collection and verify the most important technical constraints.	Baseline dataset, field/facility verification notes, gap analysis
Days 31-45	Approve technical standards, priority SOPs, procurement specifications and training plan.	Controlled standards pack, BoQ/specifications, training calendar
Days 46-60	Train first-line implementers and begin priority procurement / site preparation.	Competency records, purchase/contract milestones, readiness checklist
Days 61-75	Commission first systems or controlled pilot operations; begin KPI reporting.	Commissioning records, pilot logs, first dashboard
Days 76-90	Management review: correct failures, approve next rollout stage and lock resource plan.	Corrective-action log, stage-gate decision, 12-month work plan

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