

COORDINATED UPGRADING OF CAP TIKUS AS A REGULATED RURAL BEVERAGE ENTERPRISE

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ABSTRACT

Traditional distilled beverages can sustain rural livelihoods while operating under interconnected technical, market, and regulatory constraints. This exploratory qualitative case note examines the Cap Tikus enterprise system in Keroit Village, South Minahasa, Indonesia, and develops a case-informed framework for future evaluation. The retained study record comprised perspectives from two farmer-producers, one collector/distributor, and one village official, together with reported observations of production practices and documentary materials. Because the retained record did not include raw transcripts, a complete coding archive, exact fieldwork dates, or verifiable ethics documentation, the analysis is reported as a bounded reconstruction of case indications rather than a fully auditable thematic study. Six indications were identified: climate and raw-material vulnerability; fragile equipment and occupational-safety concerns; limited process measurement and quality documentation; regulatory uncertainty; dependence on intermediaries and volatile prices; and fragmented collective and digital capability. These conditions appear to reinforce one another and constrain process consistency, lawful market access, bargaining power, and producer value capture. The paper proposes a five-stage intervention logic covering baseline mapping, risk reduction, shared quality governance, collective market coordination, and responsible market development. The reported possibility of a 45% income increase is retained only as an untested planning scenario. The contribution is a context-bound configuration proposition for regulated rural enterprises. Future studies should use multi-stakeholder samples, verified field records, laboratory testing, value-chain accounting, and longitudinal impact evaluation.

Keywords: Cap Tikus, Informal entrepreneurship, Regulatory formalization, Rural enterprise, Value-chain upgrading

INTRODUCTION

In the past decade, research on rural entrepreneurship has increasingly shifted from a narrow concern with firm creation toward a systems perspective that connects livelihoods, local resources, market institutions, cultural identity, and sustainable development. Rural micro and small enterprises frequently operate where formal infrastructure is thin, transaction costs are high, and production knowledge is embedded in households and communities rather than codified in technical manuals. Such enterprises can generate income and employment, preserve place-based knowledge, and reduce the need for migration, yet they also face persistent constraints in technology, finance, quality assurance, market access, and legal recognition. Their development is strongly shaped by place, local embeddedness, and the interaction between economic activity and rural social space (Korsgaard et al., 2015). Sustainable entrepreneurship scholarship therefore emphasizes that economic, social, and environmental value must be created together rather than treated as separable outcomes (Hall et al., 2010). This perspective is especially relevant for traditional food and beverage products, whose value depends not only on price but also on provenance, authenticity, sensory characteristics, and collective reputation (Bowen & De Master, 2011; Tregear et al., 2007).

Traditional products occupy an ambivalent position in contemporary markets. Their cultural embeddedness can distinguish them from standardized industrial goods, but the same informality that sustains local practice may prevent producers from meeting regulatory, safety, packaging, and traceability requirements. Product qualification can support rural development when producers collectively define quality, protect reputation, and coordinate market access; however, it can also exclude small producers when standards are costly or externally imposed

(Tregear et al., 2007). The tension is sharper for alcoholic beverages because production and distribution are governed by public-health, excise, licensing, and trade controls. Informal entrepreneurs may regard their activity as culturally legitimate and economically necessary even when parts of the activity fall outside formal rules, illustrating the institutional boundary between social legitimacy and legal compliance described by Webb et al. (2009). A credible development strategy must therefore avoid two simplistic positions: romanticizing informality as cultural preservation or treating prohibition and enforcement as sufficient solutions. It must instead examine how safety, livelihoods, legality, and value distribution can be improved simultaneously.

Cap Tikus is a distilled beverage produced from fermented sap of the sugar palm (*Arenga pinnata*) in North Sulawesi. Sugar palm is a multipurpose species whose sap contains fermentable sugars and can be transformed into sweeteners, vinegar, ethanol, and other products. Studies of palm sap and palm sugar show that raw-material composition, microbial communities, fermentation conditions, and thermal processing materially influence product characteristics (Limtong et al., 2020; Tomomatsu et al., 1996; Victor & Orsat, 2018). Experimental work on *Arenga* sap further indicates that fermentation temperature and duration affect ethanol yield (Fahrizal et al., 2013). These findings support the practical importance of controlling sap hygiene, fermentation time, temperature, and distillation conditions. In traditional production settings, however, process control is often experiential. Knowledge is transferred through practice, equipment is locally fabricated, and alcohol concentration or contamination may not be systematically measured. The central development question is therefore not whether traditional knowledge should be replaced, but how it can be combined with proportionate safety and quality controls without displacing local producers.

Keroit Village in West Motoling District provides a concentrated case of this challenge. The underlying study record reports that a large majority of village residents depend directly or indirectly on Cap Tikus production and that the activity finances household needs, including children's education. Production involves tapping palm sap, spontaneous fermentation for approximately two to three days, and distillation in a locally constructed bamboo-and-drum apparatus. The same record identifies weather sensitivity, aging equipment, inconsistent raw-material supply, absent quality standards, distribution restrictions, confiscation risk, dependence on collectors, and unstable prices. It further reports that producers may retain only approximately 30–40% of the final selling price. Although these figures require verification through systematic transaction records, they indicate a value-chain structure in which upstream producers bear substantial production and legal risk while having limited influence over downstream prices.

Value-chain analysis offers a useful general solution because it examines how activities, information, standards, power, and returns are distributed from input supply to production, exchange, and final consumption. Governance research shows that market participation is shaped by the degree to which transactions are codified, supplier capabilities are developed, and powerful buyers control access and specifications (Gereffi et al., 2005). Subsequent global value-chain scholarship emphasizes that governance also depends on conventions, institutional arrangements, and the modular combination of coordination mechanisms (Ponte & Sturgeon, 2014). In developing-country agricultural chains, upgrading is rarely achieved through technology alone; it depends on coordination, market institutions, information, finance, and supportive public policy (Trienekens, 2011). Smallholders commonly face low bargaining power when they sell individually, lack market information, and cannot aggregate consistent volumes. Collective action can reduce transaction costs, improve access to services, strengthen negotiation, and support quality management, although its effectiveness depends on trust, governance, member incentives, and managerial competence (Fischer & Qaim, 2012;

Markelova et al., 2009; Moustier et al., 2010). Broader agrifood research documents mixed patterns of smallholder inclusion and exclusion as procurement systems, quality requirements, and standards become more demanding (Maertens & Swinnen, 2009; Reardon et al., 2009).

Digital marketing has also been proposed as a route by which small enterprises can communicate directly with customers, build reputation, and reduce dependence on geographically bounded intermediaries. Research with small and medium-sized enterprises shows that social media can improve customer relations, information visibility, and performance when it is supported by managerial commitment, relevant skills, and a clear business model (Ainin et al., 2015; Odoom et al., 2017; Taiminen & Karjaluo, 2015). In Indonesia, e-commerce adoption among small enterprises is influenced by perceived benefits, organizational readiness, owner characteristics, technology competence, and environmental pressure (Rahayu & Day, 2017). More recent evidence likewise shows that self-efficacy and trust can mediate digital-market adoption among underserved micro, small, and medium enterprises (Juita et al., 2026). Digital channels are therefore not an automatic substitute for formal distribution. For regulated products, online communication must be integrated with licensing, age restrictions, traceability, responsible promotion, and lawful delivery arrangements.

Village-Owned Enterprises, commonly known as BUMDes, represent a locally available institutional mechanism for collective economic action in Indonesia. BUMDes can aggregate products, provide shared facilities, coordinate training, improve records, and retain a greater share of economic value within the village. Empirical research suggests that BUMDes can contribute to village income and local economic activity, but outcomes vary considerably according to managerial capability, accountability, market orientation, community participation, and business fit (Hilmawan et al., 2023; Kania et al., 2021; Kusmulyono et al., 2021; Puri & Khoirunurrofik, 2021). In the Cap Tikus context, BUMDes should therefore not be assumed to be effective merely because it exists. Its possible role must be specified in operational terms: common procurement, shared quality-control equipment, batch records, aggregation, negotiated sales, legal compliance, and reinvestment in safety and skills.

The unresolved problem is not the absence of individual solutions but the limited explanation of how technical reliability, market governance, collective organization, and formal legality condition one another in a regulated rural enterprise. Fermentation research identifies process variables, value-chain scholarship explains power and value capture, collective-action research explains coordination, and digital-adoption studies explain organizational readiness. However, these literatures do not by themselves establish which sequence of action is defensible when producers use locally fabricated equipment, sell through informal channels, and face uncertain regulatory status. Direct scholarship on Cap Tikus and its subnational institutional context is also limited in the present evidence base. The research gap is therefore a configuration and sequencing gap: which observed constraints can be supported by the case record, which interventions are imported from literature or policy logic, and under what conditions could those interventions be evaluated without treating them as demonstrated outcomes.

This study addresses that gap through an exploratory analysis of the retained record for Cap Tikus enterprises in Keroit Village. It asks: (1) Which production, marketing, and institutional constraints are documented in the retained case record? (2) How might these constraints interact to shape process consistency, market access, bargaining power, and producer value capture? and (3) Which staged interventions can be formulated as propositions for future testing rather than as proven solutions? The objective is to provide a transparent, case-bounded explanation and an evaluable intervention logic; it is not to estimate population parameters, establish regulatory compliance, assess chemical safety, or demonstrate an income effect.

The manuscript offers a configuration proposition rather than a claim of new general theory. Value-chain governance is the primary analytical lens, while collective action, digital readiness, and institutional legitimacy provide complementary explanations of coordination, information capability, and formalization. The specific contribution is the proposition that upgrading in a regulated traditional product is conditional on the alignment of process reliability, transparent chain governance, collective capability, and a verified legal pathway. The scope remains one village and four stakeholder perspectives. The absence of raw transcripts, laboratory evidence, audited cost and price series, regulators, consumers, and implementation outcomes limits the study to analytical exploration and program design. Any transfer to other settings requires comparable cultural embeddedness, fragmented production, intermediary dependence, and regulatory constraint.

Agroindustry upgrading begins with a reliable understanding of raw materials and process variability. Palm sap is biologically active and begins changing soon after collection. Its sugar composition and indigenous microbial community affect fermentation performance, while storage, temperature, sanitation, and fermentation time influence acidity and ethanol formation (Limtong et al., 2020; Tomomatsu et al., 1996). For Arenga sap, controlled experiments demonstrate that fermentation conditions affect ethanol production (Fahrizal et al., 2013). Distillation separates volatile components according to boiling behavior, but the quality and safety of the distillate depend on equipment materials, heat control, fraction management, and measurement. In a rural-enterprise setting, literature-informed process upgrading may include food-grade contact surfaces, calibrated instruments, safe operating procedures, cleaning routines, and batch documentation. These measures are propositions for technical validation, not findings established by the present dataset.

Gereffi et al. (2005) explain that value-chain governance varies according to transaction complexity, codifiability, and supplier capability. When producers have limited capacity to meet specifications and buyers control market information, relationships can become captive: upstream actors depend on a small number of intermediaries and have weak negotiating leverage. Trienekens (2011) extends this logic to agricultural chains in developing countries, where infrastructure, information, standards, finance, and institutional support constrain upgrading. Process, product, functional, and inter-chain upgrading offer useful categories, but their feasibility must be assessed against the legal and organizational conditions of the case.

Individual smallholders often cannot independently finance equipment, supply consistent volume, obtain certification, or negotiate with larger buyers. Collective action can address these disadvantages by pooling resources and coordinating functions (Markelova et al., 2009). Evidence from Kenya, Tanzania, Meso-America, and Vietnam indicates that farmer organizations may improve market participation and quality coordination, although benefits depend on membership incentives, institutional maturity, market characteristics, trust, service rules, and accountable governance (Barham & Chitemi, 2009; Fischer & Qaim, 2012; Hellin et al., 2009; Moustier et al., 2010). These studies support collective organization as a conditional mechanism, not an automatically beneficial intervention.

Indonesian BUMDes policy provides an organizational vehicle that can combine commercial activity with village development objectives. Research identifies both potential and risk: village-owned enterprises may mobilize assets and stimulate entrepreneurship, but weak planning, political interference, limited managerial capacity, and unclear accountability can inhibit performance (Hilmawan et al., 2023; Kania et al., 2021; Kusmulyono et al., 2021; Puri & Khoirunurrofik, 2021). For Cap Tikus, BUMDes is therefore treated as one possible coordination platform whose mandate, capability, accountability, and legal authority would require empirical and regulatory verification. Evidence from Indonesian smallholder certification further shows that legal status, organizational capacity, financing, and multi-

stakeholder support can determine whether formal standards include or exclude small producers (Watts et al., 2021).

Digital channels can lower the cost of communication, record keeping, market intelligence, and customer contact, but adoption among small enterprises is often partial. Fit with business needs, perceived usefulness, organizational readiness, owner capability, employee skills, digital strategy, self-efficacy, and trust influence sustained use (Ainin et al., 2015; Alford & Page, 2015; Eller et al., 2020; Juita et al., 2026; Odoom et al., 2017; Rahayu & Day, 2017; Taiminen & Karjaluoto, 2015; Tiago & Veríssimo, 2014; Yelfiarita et al., 2025). In a regulated beverage chain, digital capability should first support records, traceability, price information, and lawful business-to-business coordination rather than assume unrestricted retail promotion.

Informal-economy research distinguishes legal status from social legitimacy. Webb et al. (2009) show that enterprises may operate outside formal institutions while remaining locally accepted. This distinction is relevant to culturally embedded products, but it does not establish legal compliance or product safety. International evidence on unrecorded alcohol likewise cautions against assuming either universal contamination or universal safety without product-specific chemical and regulatory assessment (Rehm et al., 2014). The cited Indonesian instruments address alcoholic-beverage control, trade, village governance, and BUMDes (Republic of Indonesia, 2013, 2014, 2019, 2021); their current applicability to specific Cap Tikus activities must be verified by competent authorities. Formalization is therefore treated as an institutional boundary condition rather than an outcome inferred from local acceptance.

Value-chain governance serves as the primary analytical lens because it connects process capability, information, buyer control, and value capture. Collective-action scholarship explains how shared assets and negotiation may be coordinated; digital-adoption research explains the organizational readiness required for information systems; and institutional-legitimacy scholarship explains why local acceptance does not substitute for formal authorization. Sustainable entrepreneurship provides the broader normative concern with livelihood, social, and environmental value. The resulting case-informed logic proposes that external and institutional constraints influence process reliability; process reliability and chain governance shape value capture; and coordinated upgrading may improve outcomes only when collective capability and a verified legal pathway are aligned. Figure 1 is therefore a program logic for future testing, not a validated theoretical model or causal diagram.

METHOD

Research design and evidence provenance. The original record described a descriptive qualitative case study. Because the materials available for the present manuscript did not include raw interview transcripts, a complete coding archive, exact fieldwork dates, or a full audit trail, the paper is reported more conservatively as an exploratory qualitative case note. The unit of analysis is the local Cap Tikus enterprise system, including production practices, exchange relationships, village institutions, and the constraints described in the retained manuscript. Statements derived from the retained record are separated from literature-based interpretation and future recommendations. The manuscript does not claim full reproducibility or independent reanalysis of the primary data.

Site, participants, and sampling. The case concerns Keroit Village, West Motoling District, South Minahasa Regency, North Sulawesi, Indonesia. The retained record identifies four purposively selected perspectives: two farmer-producers, one collector/distributor, and one village official. The inclusion criteria, recruitment procedure, number of persons approached, participant experience, production scale, and reasons for non-participation were not documented in the materials available for revision. The sample provides initial system mapping across production, intermediation, and village administration, but it does not support saturation,

representativeness, or statistical inference. Regulators, health and laboratory personnel, consumers, additional traders, women and younger household members, and other producers were not included.

Data sources and collection documentation. The retained record describes three sources: qualitative interviews, direct observation, and documentary materials. The interviews were labeled in-depth interviews in the source manuscript and addressed tapping, fermentation, distillation, equipment, prices, market relationships, legal concerns, and development expectations. Observation reportedly covered production settings, equipment condition, tapping, fermentation, distillation, and marketing arrangements. Documents reportedly included village-profile information, photographs, price notes, and demographic material. The exact interview structure, language, duration, location, recording and transcription procedures, observation periods, participant codes, researcher composition, and researcher positionality were not preserved. No quotations are reproduced because no transcript or verified verbatim record was available.

Analytical procedure. The present revision used a structured reconstruction of the retained manuscript record rather than a fresh thematic analysis of primary transcripts. Evidence was organized by actor, activity, and stated source; recurrent constraints were grouped into provisional categories; categories were compared across reported interviews, observations, and documents; and their relationships were interpreted through value-chain governance and complementary literature. The six final categories are therefore reported as case indications. No qualitative software, inter-coder procedure, or independent coding verification can be claimed. Consistent with qualitative transparency standards, the report distinguishes retained case material, interpretation, and proposed action (Gioia et al., 2013; Nowell et al., 2017). This sequence was informed by qualitative category-development principles (Braun & Clarke, 2006), while remaining explicitly a reconstruction rather than a fresh thematic analysis.

Trustworthiness and reflexive boundaries. The original manuscript reported source and method triangulation. The retained materials, however, do not show the source-by-source matrix, conflicting evidence, negative cases, or the procedure used to resolve differences. Member confirmation was mentioned as a planned or general credibility procedure, but its implementation could not be verified and is not treated here as a completed safeguard. Researcher reflexivity and positionality were also not documented. Credibility is consequently limited to cautious convergence across the source types described in the record, and transferability depends on the contextual detail provided. These limitations preclude claims of theoretical saturation or full auditability. The cautious reporting approach also follows broader qualitative-quality criteria concerning credibility, sincerity, resonance, ethics, and meaningful coherence (Tracy, 2010).

Ethics, consent, confidentiality, and data governance. The retained study record did not contain an ethics committee name, approval or exemption number, documented informed-consent procedure, confidentiality protocol, or data-retention plan. No claim of formal ethics approval is therefore made. The revised manuscript uses role-level descriptions, omits names and quotations, and does not reproduce identifiable photographs. Because a small community and a regulated product create risks of deductive identification and possible legal, social, or economic harm, the authors and editor must verify whether the original study complied with the applicable institutional and journal requirements before submission or publication.

Analytical and evidentiary boundaries. The study did not include chemical or toxicological testing, formal food-safety assessment, audited enterprise accounts, a verified regulatory analysis, or an implemented intervention. Alcohol-concentration ranges, the reported 30-40% producer share of the final price, and the projected 45% income increase are treated only as unverified case-level reports. The record does not establish measurement units, instruments,

calibration, batch numbers, transaction dates, costs, or calculation procedures. These figures cannot be used to infer product safety, a fair chain margin, regulatory compliance, or causal impact.



Figure 1. Exploratory case-note reconstruction and analysis workflow

RESULTS AND DISCUSSION

Evidence Base and Reporting Boundaries

The article first clarifies the evidentiary status of the retained record because the interpretation of the case depends on what can and cannot be independently verified. Table 1 summarizes the design, evidence provenance, and reporting boundaries that govern all subsequent claims.

Table 1. Research design, evidence provenance, and reporting boundaries

Element	Retained evidence	Reporting boundary
Reporting format	Exploratory qualitative case note based on a reconstructed manuscript record	Not a fully auditable reanalysis of raw qualitative data
Unit of analysis	Village Cap Tikus enterprise system	Single-village, context-bound analysis
Participants	Two farmer-producers, one collector/distributor, and one village official	Four purposively selected perspectives; no saturation or representativeness claim
Sampling documentation	Purposive selection was reported	Inclusion criteria, recruitment, refusals, and participant characteristics were unavailable
Sources	Reported interviews, direct observation, photographs, price notes, village and demographic documents	Interview duration, language, recording, transcription, and observation periods were unavailable
Analysis	Structured reconstruction, category comparison, and literature-informed interpretation	No raw transcripts, full coding archive, software record, or inter-coder verification
Trustworthiness	Reported source and method triangulation	Member confirmation, negative cases, reflexivity, and audit trail were not verifiable
Ethics and data governance	Role-level, de-identified reporting; no quotations or identifiable images reproduced	Approval/exemption, consent, confidentiality, storage, retention, and disposal documentation were unavailable
Claim boundary	Qualitative case indications and propositions for future evaluation	No laboratory, audited financial, regulatory-compliance, or intervention-effect claims

Interconnected Case Indications

The retained record supports six recurrent case indications. They are not presented as saturated themes or statistically representative findings. Table 2 identifies the reported source types, the case-level indication, and the principal evidentiary boundary for each category.

Table 2. Case indications, reported source types, and evidentiary boundaries

Case indication	Reported source and case evidence	Evidentiary boundary
1. Climate and raw-material vulnerability	Interview and observation accounts of rain, heat, variable sap supply, and difficulty obtaining dry fuel	No seasonal production series, sap measurements, or meteorological linkage
2. Fragile equipment and safety concerns	Interview and observation accounts of leaks, equipment damage, hazardous tapping access, and open-heat exposure	No formal engineering, occupational-safety, or incident assessment
3. Limited measurement and quality documentation	Interview and observation accounts of experiential control and absent common batch records or verified testing	No calibrated measurement protocol, laboratory analysis, or batch-level quality data
4. Regulatory and formalization uncertainty	Participant accounts of confiscation risk and restricted distribution or promotion	No formal legal analysis or evidence from competent licensing, health, excise, or trade authorities
5. Intermediary dependence and price volatility	Interview accounts and reported price notes; producer share described as approximately 30-40% of final price	Reported estimate only; no dated transaction series, downstream cost accounting, or margin calculation
6. Fragmented upgrading capacity	Participant suggestions concerning shared equipment, training, BUMDes, digital records, and legal support	Mixes case suggestions with author and literature interpretation; no implementation or evaluation

Case indication 1: climate and raw-material vulnerability. The retained narrative describes daily dependence on sugar-palm sap and sensitivity to rainfall, heat, tree condition, access to suitable palms, and dry fuel. These reports suggest that variation enters the process before fermentation and distillation. However, no seasonal production log, sap-volume series, sugar concentration, acidity measurement, or time-to-processing record was available. The case therefore supports the existence of perceived raw-material vulnerability, not a quantified climatic effect.

Case indication 2: fragile equipment and occupational-safety concerns. The reported production apparatus used drums, iron components, and bamboo and was described as susceptible to leakage and damage. The record also mentions bamboo-ladder access during tapping. These accounts support concern about production interruption and worker exposure, but they do not constitute a formal safety or engineering assessment. Food-contact suitability, condenser performance, ventilation, fire control, protective equipment, and incident frequency were not evaluated.

Case indication 3: limited measurement and quality documentation. Fermentation was described as lasting approximately two to three days, and the source record reported alcohol-concentration ranges after distillation. The retained material did not specify whether the values were alcohol by volume, which instrument was used, the measurement temperature, calibration, batch number, or laboratory confirmation. Producers were described as relying mainly on experiential judgment, with no common batch sheet, shared specification, rejection rule, or traceability code. The evidence supports weak documentation and measurement, but it does not establish product purity, safety, or a validated quality range.

Case indication 4: regulatory and market-formalization uncertainty. Participants reportedly associated the product with confiscation risk and difficulty using open distribution and promotion channels. This indicates that perceived legal uncertainty influenced investment, finance, transport, channel choice, and bargaining relationships. The case record did not establish which permissions were legally required, whether requirements differed by production

or distribution activity, or how local enforcement was implemented. Regulatory conclusions must therefore remain provisional until verified by competent authorities.

Case indication 5: intermediary dependence, price volatility, and uncertain value capture. Producers reportedly sold through local collectors because they lacked direct access to wider or formal channels. The source record described the producer share as approximately 30-40% of the final selling price and reported lower prices during abundant production. This pattern is consistent with weak price information and limited negotiating alternatives, but the percentage is an unverified participant-level estimate. Without dated transactions, transport and storage costs, losses, credit, enforcement risk, and downstream resale data, the study cannot determine a fair margin or quantify unequal value capture.

Case indication 6: fragmented upgrading capacity. The retained material records suggestions for more durable equipment, improved process control, shared training and facilities, BUMDes coordination, digital records, market diversification, and regulatory facilitation. Some suggestions appear to originate in participant accounts, whereas others are literature- and policy-informed elaborations. Because the record does not preserve a source-by-proposal matrix, these elements are treated as inputs to a proposed framework rather than as empirically validated solutions.

Interaction among the case indications. The case suggests a reinforcing cycle: variable raw materials and fragile equipment may increase process inconsistency; weak measurement limits traceability; uncertain quality and legality restrict market options; restricted options increase dependence on intermediaries; and weak or volatile returns reduce the capacity to invest. This interaction is an analytical interpretation supported by convergent narrative patterns, not a tested causal model. Improvement at one point may be insufficient when constraints at other points remain.

Observed evidence versus projected outcomes. The original manuscript stated that an integrated strategy could increase farmer income by as much as 45%. No implemented program, baseline, comparison group, audited income data, or simulation assumptions were available. The figure is therefore retained only as an untested planning scenario and is not reported as an achieved or predicted effect. A defensible evaluation would require adoption and compliance costs, production and loss records, prices, channel margins, and longitudinal or comparative data.

Interpretation Through Value-Chain Governance

The case is best understood as a coupled configuration rather than a list of independent weaknesses. Technical variability, limited documentation, intermediary-controlled market access, and regulatory uncertainty may jointly constrain investment and producer value capture. This interpretation uses value-chain governance as the principal lens: limited codification and supplier capability increase dependence on actors who control information and distribution (Gereffi et al., 2005; Trienekens, 2011). Because the evidence is reconstructed from a small retained record, the configuration should be treated as a plausible explanation to be examined in subsequent fieldwork.

Raw-material and process variability make consistent market differentiation difficult. Research on palm sap supports the relevance of time, temperature, sanitation, sugar composition, and microbial conditions (Fahrizal et al., 2013; Limtong et al., 2020; Tomomatsu et al., 1996). The present case did not measure these variables, so the literature explains why measurement could matter rather than confirming the source of specific defects. Similarly, concerns about equipment and worker exposure justify qualified technical assessment; they do not authorize conclusions about food safety or engineering compliance from the available data. The need for verified quality and safety assessment is also consistent with the international

literature on unrecorded and artisanal alcohol, which recommends product-specific evidence rather than broad assumptions (Rehm et al., 2014).

Intermediaries should not be characterized as inherently exploitative. Collectors may provide liquidity, transport, aggregation, risk absorption, and market knowledge. The governance problem arises when producers cannot compare buyers, observe downstream prices, document service costs, or negotiate collectively. The reported 30-40% producer share may reflect information asymmetry, real downstream costs, risk premiums, or a combination of these factors. Only value-chain accounting can distinguish these explanations. Comparative agrifood studies show that market restructuring and standards can generate both inclusion and exclusion, depending on producer assets, contractual arrangements, and institutional support (Maertens & Swinnen, 2009; Reardon et al., 2009).

Regulatory uncertainty appears to operate as a business condition rather than a separate administrative issue. Perceived risk may discourage investment and restrict finance, transport, promotion, and channel choice. The cited national instruments provide a starting point for analysis (Republic of Indonesia, 2013, 2019, 2021), but the case did not include regulators or a formal legal method. Current national and subnational requirements must therefore be verified before any operational recommendation is adopted.

Figure 2 summarizes the analytical distinction between observed conditions, bounded case indications, proposed interventions, and future outcomes that require evaluation.

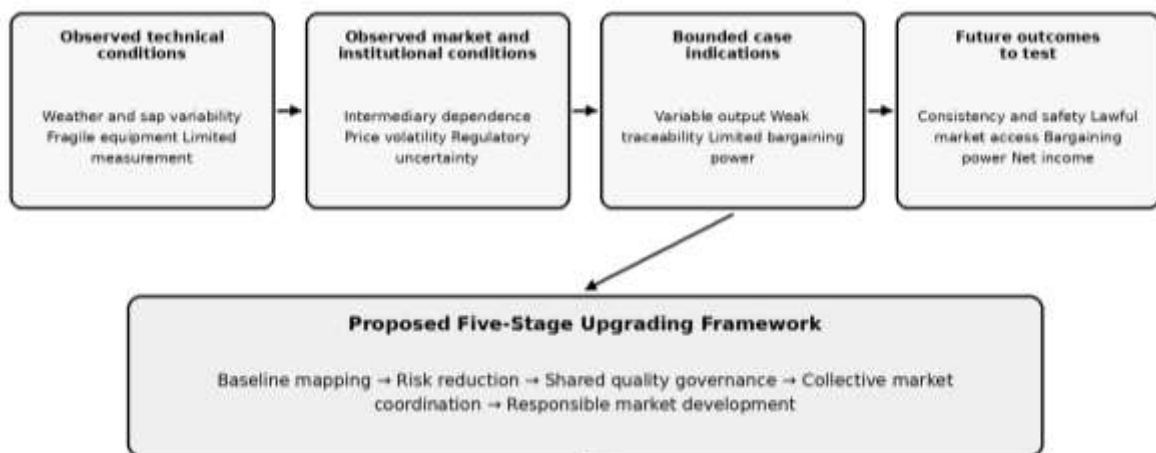


Figure 2. Case-informed intervention logic for the Cap Tikus enterprise system

Case-Informed Intervention Framework

The proposed framework combines three distinct sources that should not be conflated. Retained case indications identify perceived constraints; scientific literature provides reasons why process control, collective governance, and digital readiness may matter; and policy logic identifies questions that competent authorities would need to resolve. Table 3 presents the framework as a future evaluation sequence, not as an intervention already endorsed by participants, costed by technical experts, or approved by regulators.

The five stages are deliberately sequential: baseline mapping; risk reduction; shared quality governance; collective market coordination; and responsible market development. Baseline records are necessary before changes can be evaluated. Risk reduction and measurement precede market claims because quality and safety cannot be inferred from reputation alone. Collective coordination follows only after transparent service rules and producer participation are established. Lawful market development is the final stage because packaging, promotion, traceability, and distribution depend on verified authorization and consistent products.

BUMDes and digital tools are therefore conditional mechanisms. A BUMDes may provide shared services or aggregation, but its mandate, competence, accountability, and relationship with producers must be assessed rather than assumed (Kania et al., 2021; Kusmulyono et al., 2021; Puri & Khoirunurrofik, 2021). Digital capability may initially be more useful for records, prices, orders, and traceability than for public promotion. Adoption should fit actual business tasks, connectivity, skills, trust, and legal constraints (Ainin et al., 2015; Rahayu & Day, 2017; Taiminen & Karjaluo, 2015). This conditional approach is consistent with evidence that SME digitalization depends on combinations of technology, skills, organizational readiness, and strategy rather than on isolated tool adoption (Eller et al., 2020).

The 45% income scenario should be converted into a testable hypothesis or removed from future versions. Net income could rise through lower losses, improved recovery, quality premiums, shared procurement, or altered margins, but it could also fall because of equipment, testing, compliance, rejected batches, service fees, or restricted sales. Future evaluation should specify conservative, moderate, and optimistic assumptions and compare them with observed net household income.

Conceptual Contribution and Transfer Conditions

The paper makes a modest conceptual contribution by proposing that upgrading in a regulated traditional enterprise depends on alignment among four capabilities: reliable processes, transparent chain governance, credible collective organization, and a verified legal pathway. This configuration proposition refines a simple technology-or-marketing explanation and clarifies why isolated equipment grants, social-media promotion, or organizational creation may not generate durable value. It remains a proposition grounded in one exploratory case, not a general theory or causal finding.

Transferability is most plausible to settings that share several conditions: culturally embedded production, fragmented household-scale suppliers, tacit process knowledge, intermediary dependence, limited measurement, and significant regulatory control. It is less defensible where products are already standardized, producers have direct formal-market access, or regulation is clear and routinely implemented. Claims should therefore remain case-bounded unless comparative evidence is added. Comparable Indonesian evidence suggests that smallholder inclusion in formalized commodity systems depends on collective capacity, legal documentation, financing, and coordinated public-private support (Watts et al., 2021).

Important contextual information is absent: producer heterogeneity, production scale, seasonality, household labor and income allocation, gender and generational roles, market destinations, collector functions and costs, actual BUMDes capacity, and local enforcement practices. These omissions limit both theoretical interpretation and practical transfer. A future version should add a thick description only when it can be supported by verified field records.

Practical Implications and Research Agenda

The immediate implication is to generate evidence before scaling intervention. Producers and village institutions could document volumes, process times, equipment failures, prices, and losses; qualified technical and health personnel could assess equipment, worker safety, and product characteristics; and competent authorities could provide a written regulatory map. Any collective service model should disclose fees, decision rights, quality rules, and conflict-of-interest safeguards. These are literature- and policy-informed options for participatory assessment, not professional certifications or empirically tested prescriptions from this study.

The principal limitation is the incomplete empirical provenance of the retained record. The study involves four perspectives, no raw quotations, no documented fieldwork chronology, no complete coding archive, no verified member confirmation, no reflexive account, and no ethics

or data-governance documentation available for review. It also lacks regulators, consumers, additional traders and producers, laboratory data, safety assessment, and audited financial records. Future research should begin with documented ethical and consent procedures, a multi-stakeholder and multi-site design, transparent sampling and coding, source-linked evidence, laboratory and occupational-safety assessment, value-chain cost accounting, and longitudinal or quasi-experimental evaluation. These steps are necessary to convert the proposed framework into credible evidence.

Table 3. Proposed staged upgrading framework and indicators for future evaluation

Stage	Proposed action	Evidence basis	Indicators for future evaluation
1. Baseline mapping	Document producers, equipment, production cycles, costs, prices, losses, and regulatory questions	Required because the retained record lacks systematic baseline data	Coverage and completeness of records; verified regulatory map; documented stakeholder participation
2. Risk reduction	Commission qualified assessment of tapping, fire, equipment, hygiene, and basic measurement	Case-reported safety and equipment concerns plus technical literature	Verified hazards; incident rate; equipment failures; measurement coverage; intervention cost
3. Shared quality governance	Co-design batch records, minimum specifications, testing, rejection, and traceability procedures	Case-reported weak documentation plus process and collective-action literature	Batch conformity; test coverage; rejection rate; traceability completeness; producer acceptance
4. Collective market coordination	Pilot voluntary aggregation, reference-price reporting, service-fee disclosure, and payment rules	Case-reported intermediary dependence plus governance literature	Participation; price spread; payment time; service cost; complaints and dispute resolution
5. Responsible market development	Pursue only legally verified packaging, distribution, digital coordination, and product diversification	Policy-informed proposition requiring competent authority and market validation	Licensed transactions; compliance cost; repeat buyers; net margin; distribution of benefits; lawful diversified revenue

Table 3 should be interpreted as an evaluation plan rather than evidence that the proposed actions have been implemented or have generated the stated outcomes. Each stage requires verified baseline data, qualified technical input, lawful authorization, and prospective monitoring.

CONCLUSION

This exploratory case note aimed to identify constraints documented in the retained record of Cap Tikus enterprises in Keroit Village and to formulate a transparent framework for future testing. The record indicates a possible configuration of raw-material vulnerability, fragile equipment, limited measurement, regulatory uncertainty, intermediary dependence, price volatility, and fragmented coordination. The manuscript contributes a case-bounded proposition that upgrading may require alignment among process reliability, transparent value-chain governance, collective capability, and a verified legal pathway. It does not establish product safety, regulatory compliance, a fair producer margin, or an income effect; the reported 45% increase remains an untested planning scenario. Practical use of the framework should begin with verified baseline, ethical, technical, financial, and regulatory evidence. Future research should use documented multi-stakeholder fieldwork, laboratory and safety assessment, value-

chain accounting, and longitudinal or comparative evaluation before broader theoretical, policy, or commercialization claims are made.

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