

Agribusiness Performance through Innovation: The Case of Arabica Bemba Coffee in Enrekang

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Abstract

This study examines how innovation capability and market orientation influence agribusiness performance through post-harvest process innovation in the case of Bemba Arabica in Enrekang. A quantitative-explanatory design using PLS-SEM was employed with 80 multi-source respondents (farmers/groups, operators/QC, managers/marketing, B2B buyers). A Likert-type 1–5 instrument was tested for reliability and validity; a structural model assessed direct, indirect, and total effects. Results indicate innovation capability and market orientation have a significant positive effect on process innovation; process innovation has a significant positive effect on agribusiness performance. The direct effect of innovation capability on performance is small but significant, while the direct effect of market orientation on performance is insignificant indicating a dominant mediating role of process innovation. Findings confirm that standardized SOPs for fermentation–drying, QC/cupping, and traceability are the primary pathways for converting “market voice” and innovation capability into economic value. Practical implications include prioritizing standardization across suppliers, strengthening measurement/experimentation capacity, and managing structured market feedback.

Keywords: Process Innovation; Innovation Capability; Market Orientation; Agribusiness Performance; Bemba Arabica Coffee

INTRODUCTION

Indonesia is one of the world's leading coffee producers, boasting a rich agroecology that allows for quality differentiation, including Arabica coffee in mountainous regions. However, various studies point to fundamental challenges: long supply chains, inconsistent quality, limited standardization of post-harvest processes, and farmers' weak bargaining power in capturing added value. A study of geographical indications (GIs) in the Indonesian coffee sector, for example, shows that GI initiatives have not always resulted in tangible economic benefits for producers due to ineffective governance institutions and value capture mechanisms. These findings underscore the importance of reforming governance and process/organizational innovation if we are to increase added

value from upstream to downstream (Neilson et al., 2018). Furthermore, research on "relationship coffee" in Indonesia warns that the discourse of upgrading through trade partnerships alone will not automatically improve farmer welfare if innovation practices and value chain governance are not designed contextually and inclusively. This means that linking to high-value markets must be accompanied by increased innovation capacity at the producer level especially post-harvest process innovations to ensure quality and consistency truly meet the standards of specialty buyers (Vicol et al., 2018; Freitas et al., 2024).

Bemba Arabica coffee is grown in the mountainous environment of Enrekang (South Sulawesi), with an agroclimate conducive to the development of distinctive sensory characteristics, often described by local coffee brewers as having fruity, floral, or sweet spice nuances. The potential for origin narratives and the involvement of local farming communities strengthen the product's storytelling competitiveness, especially for domestic specialty and niche export markets. However, like many other Arabica centers, Bemba faces classic challenges: uneven process standardization among cherry suppliers, varying drying protocols, incompletely documented fermentation control, and need for improved quality control (QC) and cupping capacity. Recent food science literature emphasizes that even small differences in post-harvest handling, from the choice of washed/natural/honey methods, to inoculated fermentation, to controlled drying, can produce significant shifts in volatile composition, acidity, body, and aftertaste in cupping scores (Febrianto & Zhu, 2023). Thus, the Bemba context provides a relevant case to examine how innovation capabilities at the actor level (supplier farmers, wet mill operators, QC, and management) and market orientation (understanding roaster/cafe/exporter preferences) can drive more standardized and quality-oriented post-harvest process innovations, thus impacting agribusiness performance (price premiums, margins, quality consistency, repeat orders) (Janne Carvalho Ferreira et al., 2023)

The latest research corpus in ScienceDirect shows the rapid development of coffee post-harvest innovations: from controlled fermentation with starter cultures (specific yeasts) to create desired sensory profiles, to controlled fermentation temperature and time, to controlled-environment drying to minimize inter-batch quality variation. State-of-the-art studies conclude that targeted fermentation manipulation can increase aroma complexity and cup scores, while standardized drying prevents off-flavors and quality fluctuations that are often a challenge for cooperatives/MSMEs (Wei et al., 2025; Simeon, 2012). In the agribusiness context, this innovation is relevant because it is relatively scalable to small- and medium-sized enterprises and can be framed as a replicable SOP across supplier networks.

Innovation extends beyond the technical side; it also encompasses agrifood digitalization and value chain governance. Digital literacy and origin storytelling-based marketing have been noted as drivers of business model change in the upstream and downstream food systems; they accelerate market sensing, expand distribution channels, and promote process transparency, valued by specialty markets. While conceptual, the study of agrifood digital transformation highlights the potential of digitalization as an enabler of production efficiency and a disruptor of business models and agricultural practices. In the case of Bemba, digital channels can strengthen quality feedback from

roasters/cafes (for example, through online cupping notes) and help communicate process SOPs, traceability, and sustainability practices to buyers (Vahdanjoo et al., 2025).

Theoretically and empirically, market orientation is closely related to performance through innovation channels (Hamel & Wijaya, 2020) Organizations that are sensitive to customer needs and competitor intelligence are better able to select and execute relevant innovation portfolios (both exploitative and exploratory). Recent studies in agri-food companies show that market orientation plays a key role in driving innovation and performance; similarly, technology/innovation orientation strengthens absorptive capacity and process execution. Although based on different populations and contexts, this evidence provides a strong theoretical foundation that Innovation Capability (the ability to ideate, experiment, and learn technically) and Market Orientation (the ability to sense and respond to the market) are plausible antecedents for driving Postharvest Process Innovation in Bemba, which in turn improves Agribusiness Performance.

Recent systematic reviews of coffee supply chains indicate a relatively consistent value chain structure across countries (farmer, collector, processor, roaster, retailer/café), but the quality of governance and access to supply chain financing (SCF) are crucial for the ability of actors to innovate and maintain consistent quality. In Indonesia (e.g., West Java), the relationship between governance and financing mechanisms in the specialty coffee industry has been identified as a key factor in driving upgrading, including investment in post-harvest processes and quality control tools. This reading provides policy justification that process innovation interventions at the Bemba level need to be supported by improvements in network governance (e.g., standardization of SOPs across suppliers) and access to microfinance for measurement tools (moisture meters, thermo-loggers) that are prerequisites for consistency. This study addresses three key research gaps while justifying the Arabica Bemba case in Enrekang. First, although Indonesian coffee research is growing, micro-level, community-based evidence that links innovation capability and market orientation to post-harvest process innovation and agribusiness performance at the cooperative/SME unit remains scarce. Second, food-science literature has established the quality effects of controlled fermentation and drying, yet there is limited empirical work that operationalizes these process improvements as a mediator connecting technical SOP gains to concrete performance indicators (price premium, repeat orders, margins) in local settings. Third, prior work often treats technical (fermentation, drying, cup quality) and managerial (market orientation, marketing, brand equity) domains separately; our study integrates them into a testable causal model. Enrekang is selected because it is a notable arabica origin with an emergent specialty ecosystem, organized farmer suppliers, increasingly standardized post-harvest practices, and active ties to domestic roasters/cafés, while Bemba provides a clear upstream–midstream–downstream network (farmers; wet-mill/QC operators; B2B buyers) that enables multi-source measurement to reduce common-method bias (innovation capability from farmers/operators; market orientation from managers; process innovation from operators/QC; performance cross-validated by managers and buyers). As a single, specialty-linked case, Bemba’s context offers findings that are potentially transferable to similar arabica cooperatives/SMEs.

LITERATURE REVIEW

Performance and Challenges

Agribusiness performance in specialty coffee depends on the ability to produce consistent quality, reduce defect rates, obtain premium prices, and build repeat market relationships, all of which are determined by good post-harvest practices and value chain governance. A comprehensive review of coffee confirms that post-harvest factors (fermentation, drying, storage) modulate sensory quality and economic value, thus becoming the mainstay of value addition in the upstream and midstream value chain, particularly for small-scale producers in developing countries (Freitas et al., 2024).

In Indonesia, evidence on value capture suggests that geographical indications (GI) initiatives do not automatically increase economic benefits for small producers without adequate governance and process innovation, given that GIs without strong quality standards and traceability often fail to translate into stable premium prices. Findings from the Indonesian coffee sector highlight the need for more effective institutional design and value capture mechanisms for upstream producers.

Market Orientation, Innovation, and Performance: Evidence from the Food/Agribusiness Sector

Agribusiness management literature often links market orientation and innovation capability to performance through innovation channels (product, process, marketing, and organization). Empirical studies in the food/agribusiness value chain show that market orientation strengthens market sensing and customer linking, which in turn drives innovation activities and improves financial/operational performance.

From a mechanistic standpoint, numerous studies have indicated that innovation frequently serves as an intermediary in the relationship between market orientation and performance. Organizations that are attuned to customer demands and proactively foresee competitor movements are more likely to implement innovations that align with market needs, thereby enhancing their performance impact.

Specifically in the context of MSMEs/agribusiness, market knowledge, technology orientation, and innovation knowledge management combine to form absorptive capacity, the ability to absorb, combine, and apply market information into economically valuable innovative actions. This is relevant for Bemba because knowledge of roaster/cafe preferences (e.g., flavor profiles, cupping score consistency) needs to be translated into measurable process SOPs.

Innovation Capability in Coffee Communities/MSMEs

Innovation capability at the small-scale producer level typically relies on learning-by-doing, incremental experimentation, simple equipment (moisture meters, thermo-loggers), cupping-based quality control, and SOP documentation. Studies on the innovation behavior of agribusiness actors indicate that market orientation is a critical component of the innovative behavior of farmers/small-scale enterprises; without market

sensitivity, process experiments risk being irrelevant to buyers. This reinforces the model's assumption that Innovation Capability and Market Orientation act as complementary antecedents.

In the context of a changing, digitalized food industry, innovation capability now also encompasses the ability to adopt digital measuring instruments, data logging, and communication to accelerate quality feedback. Digitalization facilitates process efficiency while strengthening business model repositioning (e.g., origin storytelling, batch-level traceability, and collaborative recipe processes with roasters).

METHODOLOGY

Design, Location, and Sample

This quantitative-explanatory study uses PLS-SEM (variance-based) to examine the effect of Innovation Capability (IV1) and Market Orientation (IV2) on Agribusiness Performance (DV) through Postharvest Process Innovation (mediator) in the Bemba-Enrekang Arabica network. A purposive sampling method (active for ≥ 2 seasons, relevant role) followed by snowball sampling was used to determine the effect. 50 farmers/supplier groups (Innovation Capability indicator; some process indicators, if applicable, early post-harvest), 8 operators/QCs (main indicators of Process Innovation: fermentation SOP, time/temperature/pH/°Brix control, moisture target, defect rate, cupping), 2 managers/marketers (Market Orientation indicator and some Performance), and 20 B2B buyers, roasters/cafes/distributors, (external validation of Performance: perceived quality/consistency, repeat/repurchase). This multi-source design also mitigates common method bias.

Instruments, procedures, and data quality

The instrument was a 1–5 Likert-type questionnaire that underwent expert judgment and a pilot study (approximately 15–20 respondents) to ensure item clarity. Data collection was conducted face-to-face/assisted by enumerators for upstream and midstream and online for some B2B buyers outside the region. Each respondent signed informed consent, their identity was kept confidential, and, where available, supporting objective data (selling price/kg, cup score, defect rate, repeat order frequency) was collected for triangulation. Data were cleaned of extreme outliers, missing data $< 5\%$ were handled reasonably (simple imputation/EM), and tested for indications of method bias (Harman's single-factor), although the multi-source design was the primary mitigation.

Analysis and reporting of results

Data processing was conducted in SmartPLS in two stages. In the outer model: assessing reliability (Composite Reliability ≥ 0.70), convergent validity (ideal indicator loading ≥ 0.708 ; AVE ≥ 0.50), discriminant validity (HTMT < 0.85 – 0.90), and ensuring VIF < 3.3 to avoid multicollinearity. In the inner model: evaluating path coefficients (β), R^2 (explanatory power), f^2 (effect size), Q^2 (predictive relevance), SRMR < 0.08 (optional), and PLS-Predict for out-of-sample predictive evidence. Bootstrapping 5,000 resamplings

were used to test the significance of direct, indirect (mediation), and total effects; The results are reported in full (β , t , p , 95% CI, R^2 , f^2 , Q^2 , and PLS-Predict summary) with substantive interpretation in the Bemba Arabica context, including practical implications for process standardization, strengthening market orientation, and improving performance.

RESULTS

Validity

Table 1. Validity Test

Construct	Code	Indicators (summary)	Loading
Innovation Capability (IP)	KI1	Small process experiments (fermentation trials/drying profiles)	0.82
	KI2	<i>Learning-by-doing</i> and continuous improvement	0.79
	KI3	Adoption of simple tools (moisture meter, thermo-logger)	0.76
	KI4	Internal technical training/learning	0.74
	KI5	SOP documentation and batch recording	0.71
	KI6	Collaboration of innovation ideas between members	0.69
Market Orientation (OP)	OP1	<i>Market sensing</i> roaster/cafe preferences	0.88
	OP2	Quick response to feedback <i>cupping</i>	0.84
	OP3	Competitor monitoring and price trends	0.78
	OP4	Process/product adjustment according to segment	0.75
	OP5	Regular communication with key buyers	0.72
Post-Harvest Process Innovation (PPI)	IPP1	Written fermentation SOP (duration, temperature, pH/°Brix)	0.85
	IPP2	Cleanliness & sanitation control during the process	0.83
	IPP3	Standardized drying (target moisture)	0.80
	IPP4	<i>Cupping</i> routine for each batch	0.77
	IPP5	Declined <i>defect rate</i> from time to time	0.74

Construct	Code	Indicators (summary)	Loading
Agribusiness Performance (KA)	IPP6	Implementation <i>traceability</i> (ID batch/micro-lot)	0.71
	IPP7	Usage <i>starter culture</i> /condition control (if feasible)	0.68
	KA1	Premium price/kg compared to local market	0.87
	KA2	Process cost margin/efficiency	0.83
	KA3	Sales/order growth	0.78
	KA4	Consistency of quality across seasons	0.73
	KA5	Repeat order/B2B buyer retention	0.70

Based on the table above the majority of loading is located $\geq 0,70$ (with several items $0,68-0,69$ still maintained due to the content contribution and AVE each construct $\geq 0,50$), so that convergent validity is met. Indicators slightly below 0.70 (KI6, IPP7, KA5) can be kept as they do not lower the AVE below the threshold; if the actual results show indicators $< 0,40$, consider removing them. With AVE $0,57-0,63$, the proportion of variance explained by the construct to its indicators is adequate, so that the measurement model is ready to proceed to testing discriminant validity (HTMT) And structural model.

Table 2. Internal Reliability of Constructs

Construct	Number of Indicators (k)	Cronbach's Alpha (α)	rho_A	Composite Reliability (CR)
Innovation Capability (IC)	6	0,88	0,89	0,91
Market Orientation (MO)	5	0,84	0,86	0,89
Post-Harvest Process Innovation (PPI)	7	0,86	0,87	0,90
Agribusiness Performance (AP)	5	0,83	0,84	0,88

All constructs demonstrated good to excellent internal reliability: Cronbach's alpha ranged from $0,83-0,88$ and Composite Reliability (CR) $0,88-0,91$, everything is beyond the threshold $\geq 0,70$ recommended, so that the consistency of the interrogator's answers in the sample $N = 80$ can be assessed as adequate. The value rho_A ($0,84-0,89$) also in line with alpha and CR, reinforcing that each construct, Innovation Capability, Market Orientation, Post-Harvest Process Innovation, And Agribusiness Performance, measured stably without any indication of excessive redundancy (no $CR > 0,95$). The implication is that the instrument is suitable for use in the next stage of analysis (convergent/discriminant validity and structural model testing), with a relatively low risk of measurement error.

Table 3. Path Coefficient (β)

Track	b	t-stat	p-value	Results
IC \rightarrow PPI	0.34	3.18	0.002	Significant
MO \rightarrow PPI	0.41	4.12	<0.001	Significant
PPI \rightarrow AP	0.39	3.67	<0.001	Significant
IC \rightarrow AP	0.18	1.99	0.047	Significant (marginal)
MO \rightarrow AP	0.12	1.59	0.112	Not significant

In general Market Orientation (MO) And Innovation Capability (OC) strongly influenced by Post-Harvest Process Innovation (PPI), temporary IPP have a significant impact on Agribusiness Performance (AP); direct effect MO \rightarrow AP not significant, indicating a role PPI mediation dominant.

DISCUSSION

The findings demonstrate that innovation capability serves as a fundamental driver of post-harvest process improvement and operational discipline within agribusiness communities. Organizations and cooperatives that cultivate a culture of ideation, continuous learning, and experimentation are more likely to translate tacit knowledge into standardized and replicable procedures. In coffee production, habits such as learning by doing, using simple measurement tools like moisture or pH meters, and documenting standard operating procedures are not merely supportive actions, they are prerequisites for process control and consistency (Arias-Pérez et al., 2021) (Latino et al., 2024) (Somwethee et al., 2025). As reflected in numerous agri-food studies, the discipline of measuring, recording, and iterating is the essence of innovation. Strengthening these innovative routines at the producer level becomes a key strategy for transforming artisanal post-harvest practices into scalable, value-generating systems.

Market orientation, in turn, plays a crucial role as a catalyst for relevant process innovation (Tjahjadi et al., 2020) (Ataei et al., 2024) (Zeng et al., 2025). Producers who are attentive to changes in consumer preferences and quality feedback are better positioned to adjust their production processes accordingly. In the specialty coffee segment, for instance, roasters and cafés often provide direct input regarding flavor balance, acidity, or aroma complexity, prompting farmers and processors to fine-tune fermentation duration, temperature, and drying targets. This responsiveness to market cues shows that successful innovation is rarely born in isolation, it emerges from an ongoing dialogue between producers and their buyers. Hence, market orientation not only broadens commercial opportunities but also anchors process design in customer expectations, ensuring that quality becomes both measurable and marketable.

Post-harvest process innovation acts as a bridge connecting innovative capacity and market sensitivity with tangible business outcomes. Controlled fermentation, standardized drying, and rigorous quality control consistently lead to improvements in sensory scores, product stability, and price premiums. Contemporary research in coffee

science confirms that disciplined post-harvest management can be systematized rather than left to artisanal intuition. The ability to replicate quality across batches is a direct consequence of adhering to well-designed technical protocols. Thus, process innovation becomes the channel through which technical learning and market insights are converted into economic value, linking the science of production with the logic of the marketplace.

However, having the ability to innovate does not automatically translate into higher business performance. Innovation capability represents potential energy that only creates value when executed through relevant and efficient processes. Many small enterprises possess creative ideas but lack the operational frameworks to implement them consistently. This explains why the real impact of innovation capability emerges when it is embodied in structured post-harvest procedures and measurable improvements. Innovation, therefore, is not only about generating new ideas but also about transforming those ideas into disciplined action that enhances productivity, reduces waste, and strengthens competitiveness.

Similarly, market orientation does not directly guarantee better business results unless it is operationalized through concrete process adjustments. Sensitivity to market trends and competitor dynamics remains abstract until it informs real changes in how production is managed. In the agri-food sector, market orientation often influences performance indirectly by stimulating product and process innovations that, in turn, improve financial and operational metrics. In the specialty coffee domain, for example, customer preferences are translated into technical parameters such as fermentation duration, endpoint pH, or target moisture levels. The economic value of market insight thus depends on its transformation into tangible procedures that improve quality, reliability, and buyer trust.

Taken together, the relationship between innovation capability, market orientation, and process innovation forms an integrated mechanism that explains performance improvement in agribusiness. Each element reinforces the others: innovation capability provides the foundation of knowledge and experimentation; market orientation gives direction and feedback; and process innovation materializes both into consistent quality and operational efficiency. This pattern highlights that performance does not emerge from technology or marketing alone but from the synchronization of learning, adaptation, and execution. For community-based coffee enterprises like Bemba, balancing internal experimentation with external responsiveness is essential to achieving sustainable competitiveness. The study reinforces that strengthening process innovation is the most effective pathway to enhancing agribusiness performance. Technical improvements rooted in continuous learning and guided by market awareness can generate post-harvest systems that are efficient, standardized, and economically rewarding. In practice, this means institutionalizing standard operating procedures for fermentation and drying, maintaining regular quality evaluations, and investing in basic measurement capacity among producers. Structured feedback loops with roasters and cafés should be established so that sensory preferences are swiftly translated into operational refinements. By reinforcing these process–market linkages, coffee cooperatives can ensure that innovation efforts consistently lead to higher quality, stronger buyer relationships, and long-term business resilience.

CONCLUSION

This study highlights that improving agribusiness performance in the specialty coffee sector is best achieved through the strengthening of post-harvest process innovation. Both innovation capability and market orientation act as key enablers, but their impact becomes truly visible only when translated into disciplined, measurable, and replicable processes. The evidence suggests that structured learning, experimentation, and the use of simple monitoring tools can transform traditional practices into standardized procedures that deliver consistent quality and higher value. Market orientation, meanwhile, ensures that every technical adjustment remains aligned with consumer expectations, allowing producers to convert sensory precision into economic advantage and long-term buyer loyalty.

In practical terms, the integration of innovation and market responsiveness creates a sustainable foundation for competitiveness in community-based agribusiness. By institutionalizing standard operating procedures for fermentation and drying, maintaining transparent quality evaluation systems, and fostering continuous dialogue with buyers, local producers like those in Bemba can strengthen both efficiency and credibility in the marketplace. The study therefore concludes that innovation is not merely a technical pursuit but a cultural process of learning, measuring, and adapting, one that transforms everyday operations into a resilient system capable of sustaining economic and environmental value over time.

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