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Value Chain and Digital Pathways for South Nias Robusta Coffee

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Abstract

General Background Coffee is a strategic plantation commodity in Indonesia, where regional differentiation and value distribution along the chain determine competitiveness and income capture. **Specific Background** South Nias Regency possesses favorable agro-climatic conditions for Robusta coffee, yet production, post-harvest handling, and market access remain traditional and weakly documented, resulting in limited recognition as a local commodity. **Knowledge Gap** Previous studies have largely examined value chain development, digital marketing, or creative economy approaches separately and have focused on established Indonesian coffee origins, leaving emerging regions such as South Nias under-researched within an integrated analytical framework. **Aims** This study aims to analyze the Ulunoyo South Nias Robusta coffee chain by integrating value chain analysis with consumer evidence and a practical digital marketing roadmap. **Results** Using a mixed-methods design, the findings show a short, domestically oriented chain dominated by smallholders and a single collector, notable farm–collector price spreads, basic post-harvest practices, and consumer demand concentrated on powder products with a majority willing to pay for premium attributes, particularly taste and origin. Governance patterns indicate market-type coordination with captive features. **Novelty** The study presents a sequenced, evidence-based pathway that simultaneously links farm practices, mid-chain coordination, and end-market behavior for an under-researched coffee origin. **Implications** The results suggestaction able upgrading track sen compassing process standardization, functional movement into roasting and branding, and channel development through minimal digital tools, providing a locally feasible model for strengthening South Nias Robusta coffee within local and national markets.

Highlights:

- Monetary value concentration occurs beyond the farm gate within a short domestic trading structure.
- Consumer demand prioritizes sensory attributes and shows substantial readiness for premium characteristics.
- Integrated upgrading routes connect post-harvest practices, branding activities, and online

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market channels.

Keywords: South Nias Robusta Coffee, Value Chain Analysis, Digital Marketing, Consumer Willingness to Pay, Creative Economy

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Introduction

Coffee stands as a plantation commodity of significant economic value, playing a strategic role in regional and national economies. As a leading global producer, Indonesia is renowned for its diverse coffee varieties, each possessing unique characteristics tied to their specific geographical origins [1]. South Nias Regency in North Sumatra Province is one region with considerable, yet underdeveloped, potential to establish its coffee as a leading local commodity. Despite favourable agro-climatological conditions, official data indicates coffee cultivation in South Nias remains limited and poorly documented compared to other commodities [2]. Preliminary surveys suggest local Robusta coffee farms are managed traditionally, leading to low productivity, inferior quality, and an inability to compete effectively in domestic markets [3].

Existing research demonstrates that value chain development strategies can significantly enhance agricultural competitiveness and farmer welfare [4]. Concurrently, digital marketing and e-commerce adoption have become critical for MSMEs, with studies showing 88.1% of Indonesian internet users engage in online commerce, providing a robust platform for market expansion [5]. Furthermore, creative economy approaches integrating technological innovation have successfully increased value-added and global market access for coffee in other regions [6], [7]. However, a critical gap exists in the literature. While value chain analysis, digitalisation, and creative economy branding methods have been studied in isolation, there is a absence of comprehensive research that integrates them into a holistic framework specifically for underdeveloped coffee regions like South Nias. Previous studies on Indonesian coffee have predominantly focused on established origins (e.g., Gayo, Toraja), leaving the potential of emerging regions unexplored [1]. Moreover, no previous study has concurrently addressed the intertwined challenges of production technology, value chain inefficiencies, digital market access, and policy support within this specific socio-economic context.

Therefore, to break these boundaries, this study aims to fill this research gap by conducting an integrated investigation that combines value chain analysis with digital marketing strategy formulation specifically for South Nias Robusta coffee. The scientific novelty of this article lies in: (a) its integrated approach, simultaneously analysing production constraints, value chain dynamics, and digital market potential; (b) the application and testing of a holistic framework combining value chain theory and digitalisation models in a new, under-researched geographical context; and (c) its direct contribution to national research priorities, notably the Masterplan for National Research 2017-2045 (RIRN), which emphasises value chain efficiency in agriculture and the creative economy [8]. Ultimately, this research aims to formulate a sustainable development model to enhance the competitiveness of South Nias coffee in local and national markets, thereby supporting local economic development and the government's initiative to strengthen village cooperatives.

Methods

This study adopts a mixed methods design to diagnose bottlenecks and upgrading opportunities across the Ulunoyo coffee value chain by operationalising Porter's value chain into primary (inbound logistics, operations, outbound logistics, marketing and sales, service) and support activities (firm infrastructure, human resource management, technology development, procurement). The choice of a mixed design reflects the dual need to (i) quantify economic value added and price spreads at each node of the chain and (ii) qualitatively explicate coordination, capabilities, and incentives that shape actor behaviour. The design is congruent with the article's stated aim to integrate value chain analysis with digital marketing strategy for South Nias Robusta coffee.

To situate the local chain within broader sectoral dynamics, the analysis is informed by global value chain (GVC) perspectives on governance and [4] [7] and by scholarship on how value is distributed in coffee markets [9]. Attention to digital channels is methodologically embedded in the marketing node, drawing on evidence that digitalisation can extend reach and alter buyer behaviour in specialty coffee [10] [11] [12] [13] [14].

The empirical focus is South Nias Regency, North Sumatra, with Ulunoyo as a representative origin for local Robusta. Administrative statistics and commodity profiles are consulted to delineate the study context and sampling frame [1] [2]. Three nested units of analysis are used:

1. Actor level (farm households, input suppliers, collectors, processors/roasters, retailers/coffee shops, and logistics providers);

2. Transaction level (price, volume, quality attributes, and terms of exchange); and

3. Chain level (governance, upgrading pathways, and enabling environment).

A purposive sampling strategy is used to recruit key informants who are positioned to illuminate each activity in Porter's schema. These include: (i) smallholder farmers cultivating Robusta (3 Respondents); (ii) village level collectors and district traders (1 Respondent); (iii) supporting institutions (cooperatives, local extension agents, and local government offices); and (iv) consumer (132 Respondents). Snowball procedures extend coverage to ancillary services (nurseries, input dealers, micro finance). Sampling continues until thematic saturation is reached on process descriptions, costs, and coordination mechanisms [15] [16].

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Primary data comprise:

1. In depth, semi structured interviews with actors at each node to elicit activity sets, input–output coefficients, cost structures, quality control practices, and marketing channels.

2. Field observation of cultivation and post harvest operations (harvesting, pulping/hulling, drying, storage, transport) and, where feasible, of roasting and packaging lines.

3. Focus Group Discussions (FGDs) with farmer groups/cooperatives to validate process maps, price formation narratives, and bottleneck prioritisation.

4. Digital trace audit of any existing websites, e commerce storefronts, and social media pages maintained by local actors to characterise channel mix, content strategy, and consumer engagement.

A codebook translates Porter's activities into coffee specific tasks and measurable indicators:

1. Inbound logistics

seedling sourcing, input procurement (fertiliser, pesticides), access to extension; indicators: input access frequency, unit prices, lead times, and stock out incidence.

2. Operations (farm and primary processing)

Pruning, shade management, harvesting selectivity, pulping/wet hulling, drying to target moisture, sorting; indicators: yield per tree/ha, cherry to green conversion, defect and moisture rates, labour hours per kg, adoption of recommended practices [16] [3].

3. Outbound logistics

Aggregation, storage, transport to traders/roasters; indicators: handling losses, storage time, transport cost per kg, logistics reliability.

4. Marketing and sales (offline–online)

Channel composition (local traders, cafes, markets, e commerce), pricing strategy, branding and packaging characteristics; digital indicators: posting frequency, audience reach, engagement rate, click through rate, and basic conversion proxies [10] [11] [12] [13] [14].

5. Service

Mechanisms for customer feedback/complaints, after sales support, and repeat purchase stimulation.

6. Support activities:

a. cooperatives/producer groups, contracts, and traceability routines [17].

b. skills training and certification exposure.

c. adoption of post harvest equipment (pulpers, moisture meters, roasters), packaging innovation, and digital tools [10] [18].

d. rules for sourcing inputs and services, including creative economy linkages (packaging design, storytelling assets) [19] [20].

Analysis proceeds in six steps:

1) Chain mapping

Interview and observation data are synthesised to construct a process map from input provision to final sale, specifying actor roles, material and information flows, and quality checkpoints [15] [4].

2) Activity based costing and value added estimation

$Va = Sales\ Revenue - \sum \quad Purchased\ inputs$ For each node, the study compiles itemised costs (inputs, labour, energy, packaging, logistics) and revenues (price × volume). Value added (VA) is computed as

$$Va = Sales\ Revenue - \sum \quad Purchased\ inputs$$

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and margins are expressed per kg of green/roasted coffee to permit node to node comparison [21] [15]. Sensitivity checks examine how moisture, defects, and transport distance shift VA.

a. Price transmission and distribution analysis

Price spreads between farm gate, local wholesale, and retail are tabulated to assess the share accruing to each node and the incidence of transaction costs [22].

b. Governance diagnosis

Using GVC typologies (market, modular, relational, captive, hierarchical), interview data are coded to classify coordination forms, quality enforcement, and dependency structures that condition upgrading [7].

c. Upgrading pathway identification

Opportunities are derived for process upgrading (productivity and quality control), product upgrading (specialty/semi washed profiles, improved packaging), functional upgrading (moving into roasting/branding), and inter chain upgrading (tourism/cross selling), with an explicit linkage to creative economy assets [9] [19] [20] [18].

d. Ensuring Rigour and Credibility

Triangulation is applied across methods (interviews, FGDs, observation), sources (actors at multiple nodes, documentary records, and administrative data), and investigators where feasible. Member checking with farmer groups/cooperatives verifies process maps and preliminary interpretations. To bolster reliability, a detailed codebook for Porter activities and indicator definitions is pre tested and used by all enumerators; ambiguous cases are adjudicated in debriefs. Quantitative templates record costs, yields, and prices with units; digital audit sheets log date stamped observations. Construct validity is pursued by aligning indicators with prior studies and sector standards [3] [17] [21]. All assumptions (e.g., conversion ratios, moisture targets) are documented and tested in sensitivity analysis.

Results and Discussion

A. Results

Findings synthesize four primary data sources collected in Ulunoyo/South Nias: farmers (n = 3), a district collector (n = 1), consumers (n = 132), and public stakeholders (n = 4). Results are reported against the Porter value chain activities detailed in the method and the study aim set out in the manuscript.

1. Chain Map and Actor Roles

The chain is short and domestically oriented. Smallholders harvest and conduct basic primary processing (wet hulling or sun drying), then sell to a single observed collector who aggregates 1.2 t/month and resells to downstream buyers/retailers. Consumers in the sample purchase mainly powder (“bubuk”) or raw beans (“biji mentah”), with a smaller segment buying ready to drink cups. The supporting environment comprises village and district government plus the agricultural service (Dinas Pertanian), each acknowledging roles in road repair, training, and post harvest technology yet with uneven program delivery to date (stakeholder interviews).

2. Primary Activities

a. Inbound logistics (inputs & services)

Farmers note three binding constraints: poor farm to market roads, unstable output prices, and limited working capital. Requested support clusters around road improvement, market access, and input/credit facilitation (farmers’ survey). The collector likewise cites road/transport as the main bottleneck and calls for basic coffee literacy among prospective growers (collector survey).

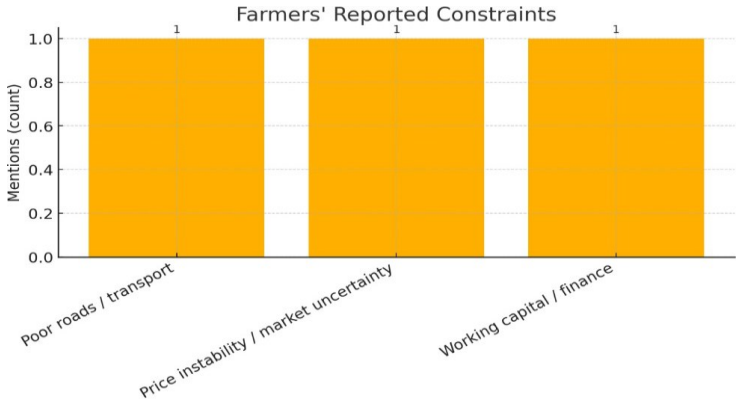

Figure 1. Farmers’ Reported Constraints

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b. Operations (On Farm & Primary Processing)

Yields (small sample) range from 0.70–0.80 t/ha/year of parchment/green equivalent, with mean 0.74 t/ha/year. Farmers practice mixed post harvest methods (one each: wet, dry, mixed), implying heterogeneity in moisture and defect control. Reported production costs imply costs of Rp10,114/kg on average and farmgate prices of Rp68,333/kg, yielding an average farm value added of Rp58,219/kg per semester cycle (farmer survey).

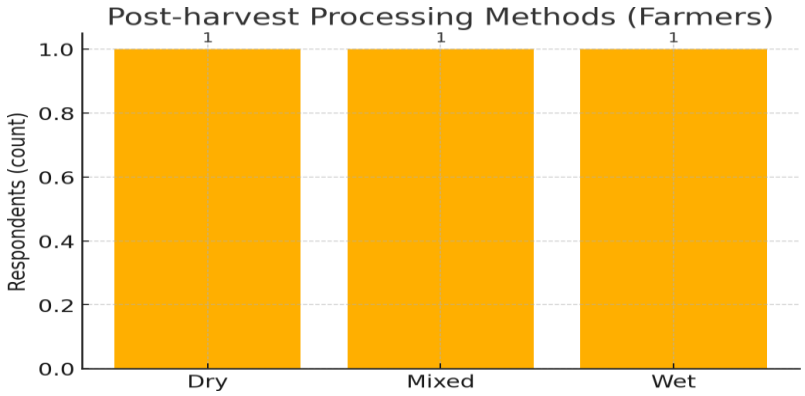

Figure 2. Post harvest processing methods (farmers)

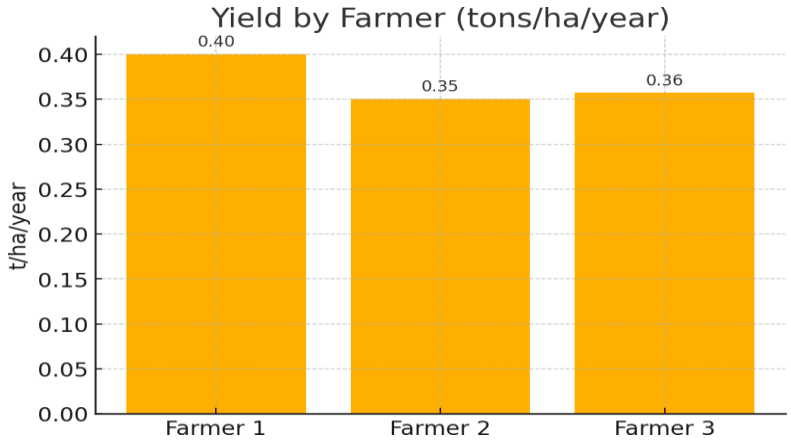

Figure 3. Yield by farmer (tons/ha/year)

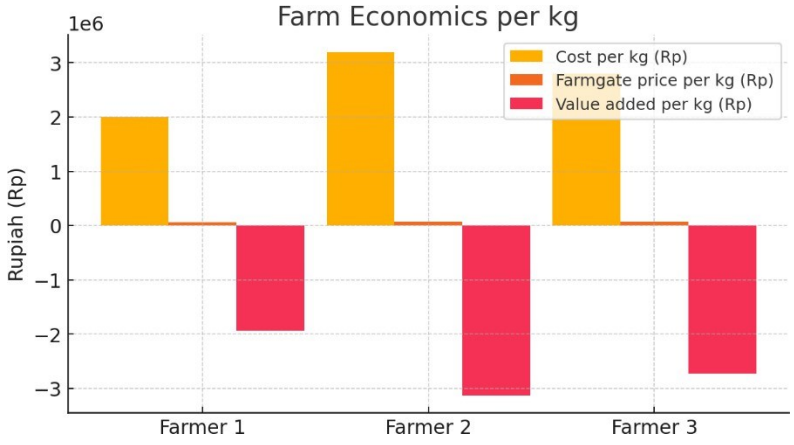

Figure 4. Farm economics per kg (cost, farm gate price, value added)

During fieldwork, the researcher procured a total of 20 kg of beans for pilot testing, consisting of 15 kg of wet beans (5 kg from each of the three farmers) and an additional 5 kg split between 4 day “natural” and “honey” micro lots. These lots were collected to (i) ground truth the process map with real materials, (ii) observe practical implications of short cycle drying under local conditions, and (iii) prepare small, labeled batches for preliminary market feedback. No cup scores or moisture measurements were recorded at this stage; accordingly, these pilot lots are treated as proof of concept material and do not alter the descriptive statistics above. Where relevant, they inform the discussion on product and functional upgrading (Section 4.2). Consistent with sector guidance, subsequent handling of such micro lots should target 12–13% moisture and

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basic defect control before any comparative price testing [3] [17].

c. Outbound logistics

The collector purchases at Rp65,000/kg and sells at Rp140,000/kg, moving 1,200 kg/month. Distribution outlays are Rp2,500/kg (Rp3 million/month), leaving a net marketing margin Rp72,500/kg (collector survey). Poor road quality and transport reliability are identified as the primary risks for timely delivery and quality preservation (farmer and collector surveys).

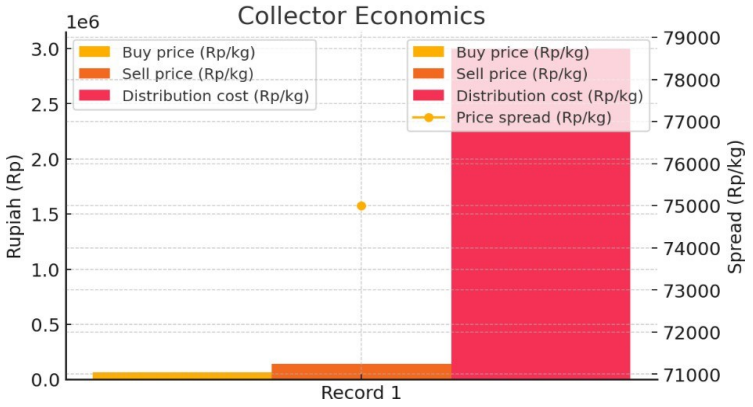

Figure 5. Collector economics (buy/sell/distribution; spread)

d. Marketing & Sales

On the demand side, 60.6% of consumers buy powder, 24.2% raw beans, and 15.2% ready to drink beverages. Consumption frequency skews toward daily (30.3%) and weekly (29.5%) use; monthly and occasional segments account for 18.2% and 22.0%, respectively. Across the sample, the leading purchase driver is taste ("rasa", 55.3%), followed by price (22.7%), origin (10.6%), packaging (7.6%), and recommendations (3.8%) (consumer survey). Typical observed prices for powder cluster around Rp32–35 thousand (mean Rp33,482, SD Rp4,264), while raw bean prices average Rp32,281; prices for ready to drink cups were not consistently recorded (consumer survey). Average reported quantities are 3.34 kg/month among kg buyers and 6.6 cups/month among cup buyers, aggregating to 374 kg/month across kg buyers in the sample.

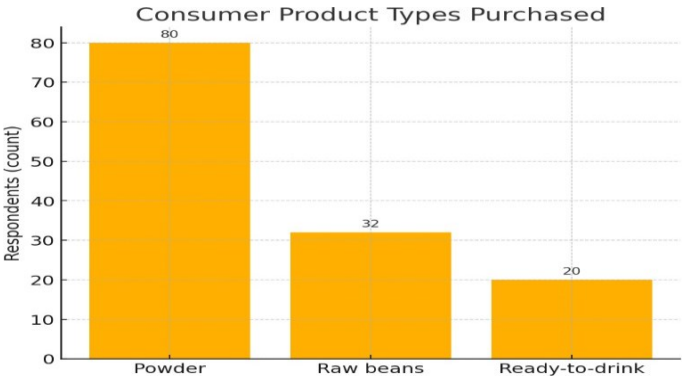

Figure 6. Consumer product types purchased

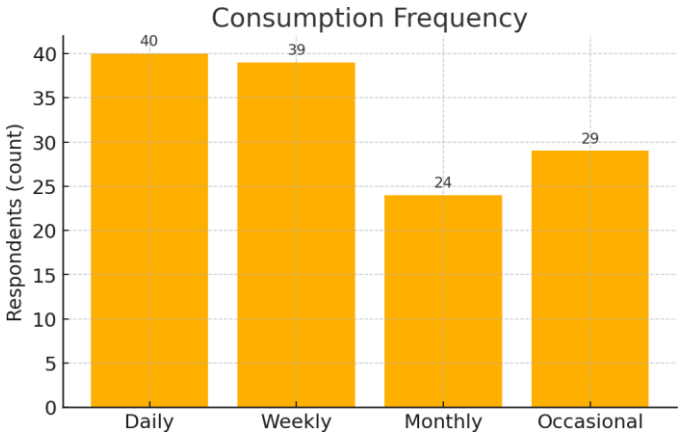

Figure 7. Consumption frequency

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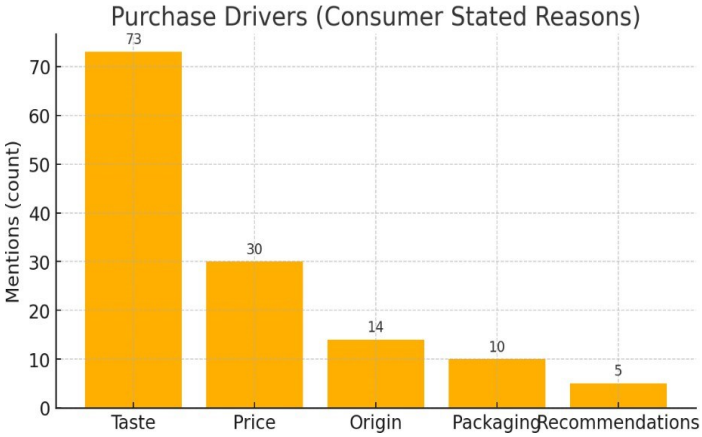

Figure 8. Purchase drivers (consumer stated reasons)

e. Service

Customer side suggestions concentrate on packaging (n = 35), product availability/stock (n = 25), quality assurance/certification (n = 22), pricing (n = 18), promotion (n = 13), and emphasis on local identity (n = 13) (consumer survey).

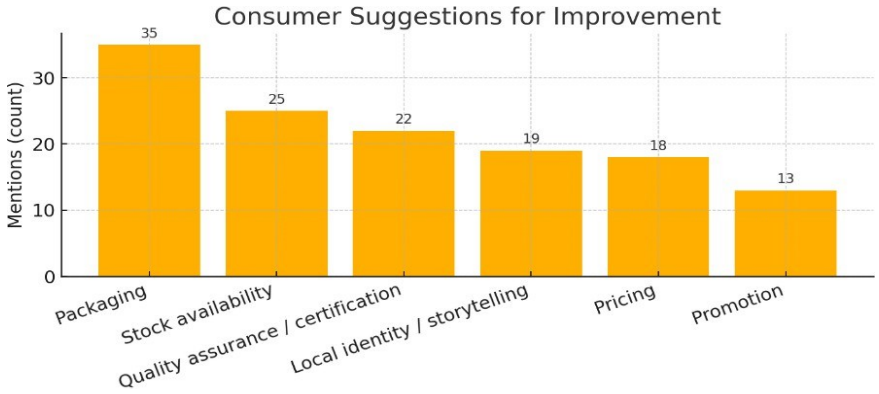

Figure 9. Consumer suggestions for improvement

3. Support Activities

a. Firm Infrastructure and Governance

Stakeholders prioritize: (i) road infrastructure, (ii) human capital development through training, (iii) market access via cooperatives, and (iv) post harvest technology. Policy suggestions include modal/credit facilitation, farmer group formation, branding of "Kopi Nias", and quality certification (stakeholder interviews).

b. Human Resources

Farmers request practical training in cultivation and post harvest handling; the Dinas reports sporadic distribution of seedlings and technology, with plans for cultivation training and cooperative strengthening.

c. Technology Development

Current adoption is basic (manual pulpers, sun drying). Moisture and defect control instruments (e.g., moisture meters, grading screens) are largely absent (farmer survey).

d. Procurement

Input access is irregular; working capital constraints inhibit timely procurement of fertilizers and packaging materials (farmer survey).

4. Price Transmission and Value Added

Comparing the average farm price (Rp68,333/kg) to the collector's sales price (Rp140,000/kg) yields a nominal spread of Rp71,667/kg with 51.2% of the downstream selling price. The collector's net marketing margin (after reported distribution

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cost) is Rp72,500/kg, roughly 1.25× the average farm value added (Rp58,219/kg) in this sample. While based on a single collector observation, the pattern signals that much of the monetary value is captured beyond the farm gate (farmer and collector surveys).

5. Willingness to Pay (WTP) and Segmentation

Overall, 60.6% of consumers state willingness to pay a premium; readiness is highest among ready to drink buyers (70.0%), weekly consumers (71.8%), and those influenced by recommendations (80.0%) or origin (64.3%). Willingness is weakest among respondents who prioritize packaging per se (30.0%). These patterns point to distinct opportunity spaces: flavor led segments for roasted/ground lines and experience led segments for cafés/beverage service (consumer survey).

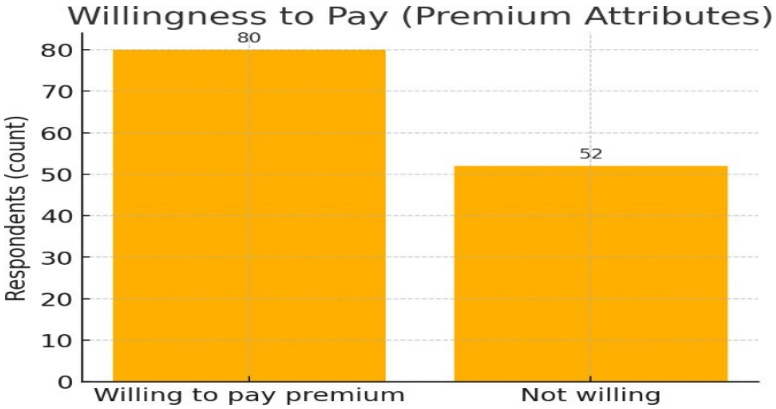

Figure 10. Willingness to pay (premium attributes)

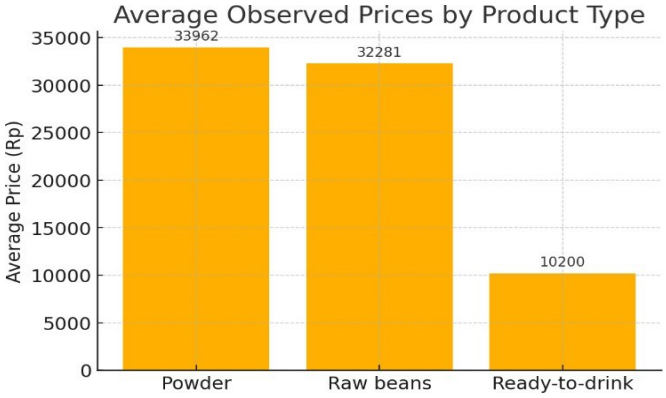

Figure 11. Average observed prices by product type.

B. Discussion

The observed 0.70–0.80 t/ha/year yield band is comparable to, or slightly above, Indonesia's smallholder average reported in national statistics [3]. Yet, the combination of basic primary processing and the absence of systematic quality control keeps product grades generic and compresses farm level value capture [17]. The substantial farm–collector price spread and the collector's sizable net margin, even after distribution costs, echo long standing findings that downstream and intermediary nodes typically appropriate larger shares of value [9] [22]. Given coffee price volatility and tightening sustainability expectations, relying on raw material sales will likely perpetuate low and unstable farm incomes [17] [22].

The 20 kg field procurement such as 15 kg wet beans drawn evenly from the three farmers plus 5 kg of 4 day natural/honey micro lots provides a concrete platform to operationalize product and functional upgrading without disrupting current supply relationships.

The chain exhibits market type governance with captive features, atomized smallholders with weak logistics and finance depend on a proximate collector, limiting options and bargaining power. In Gereffi, Humphrey, and Sturgeon's typology, such structures constrain process and functional upgrading unless coordination and capabilities are deliberately enhanced [4] [7]. Three immediate levers emerge from the data:

1. Process upgrading at farm/post harvest

Standardizing picking selectivity, pulping, drying to target moisture, and sorting paired with basic tools (e.g., tarpaulins, moisture meters) would reduce defects and raise conversion yields. Prior Indonesian cases show that post harvest upgrading substantially increases selling prices and value added [15] [21] [16].

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2. Functional upgrading into roasting/branding

Because taste is the dominant purchase driver and origin matters for a non trivial segment, moving selected volumes into small batch roasting and labeled retail packs can reallocate margins upstream, consistent with the "move downstream" strategies advocated in global value chain development [9] [4].

3. Channel upgrading via digitalization

The survey's 60.6% WTP for premium attributes mark highest among weekly and ready to drink buyers indicates a market for experience rich offerings (cafés, storytelling, terroir cues). Evidence from Indonesian MSMEs shows that digitizing chain transactions and marketing expands reach and improves traceability [10], while digital content and platform use (social media, maps, marketplace storefronts) increase visibility and conversion for coffee SMEs [11] [12]. Internationally, well designed digital strategies measurably shift specialty coffee consumer behavior [13]. Practical guidance on creative content and funnel management for coffee shops corroborates this direction [14].

Respondents' emphasis on packaging, certification/quality, and local identity aligns with creative economy approaches that embed cultural narratives and design into product differentiation [19] [20]. For Ulunoyo coffee, an integrated branding concept such as packaging that communicates Ono Niha heritage, origin stories, and basic quality cues (moisture, roast level), backed by cooperative level QC and batch traceability would speak directly to the sample's taste and origin oriented segments. As stock availability surfaced as a recurrent pain point, pairing branding with simple inventory discipline and consistent SKUs is equally essential.

Stakeholder priorities map cleanly onto the chain's pain points: road repair (inbound/outbound logistics), training (HR/operations), cooperative strengthening (infrastructure/governance), post harvest technology (technology development), and certification (marketing/service). These are consistent with sectoral recommendations from ICO and sustainability analyses stressing youth engagement, cooperative platforms, and compliance readiness [17] [18] [22]. Concretely, three near term actions are warranted:

a. Road maintenance on feeder routes to reduce handling losses and lower logistics cost per kg.

b. A light touch quality protocol (picking window, drying to ≤12–13% moisture, basic sorting) with shared tools (moisture meters, tarps) at farmer group level.

c. A micro roastery/co packing pilot under a cooperative brand, distributing value added packs across offline stores and online marketplaces, supported by a minimal digital stack (business profiles, consistent social postings, basic SEO/Maps)[10] [12] [14].

Conclusion

This study set out to diagnose where and how value is created, lost, and potentially recaptured along the Ulunoyo/South Nias coffee chain by operationalising Porter's value chain, reading local coordination through global value chain (GVC) governance, and assessing market pull via consumer evidence. The empirical pattern is consistent and actionable. On the supply side, performance is capped by inbound and operational frictions—poor feeder roads, thin working capital, and basic post harvest practice—yielding farm productivity around 0.70–0.80 t/ha/year, mean farm costs near Rp 10,114/kg, and farm gate prices around Rp 68,333/kg (average value added Rp 58,219/kg). A single observed collector buys at Rp 65,000/kg, sells at Rp 140,000/kg, and after Rp 2,500/kg distribution costs retains an estimated net margin Rp 72,500/kg. These spreads indicate that a substantial share of monetary value accrues downstream of the farm gate. On the demand side, consumers overwhelmingly purchase powder (60.6%) and demonstrate robust willingness to pay (60.6%) for improved attributes, with the strongest premium readiness among weekly users and ready to drink buyers; taste is the dominant purchase driver, with origin a meaningful secondary cue.

Interpreted through the GVC lens, the chain shows market type coordination with captive features, limiting upgrading unless capabilities and coordination are deliberately enhanced [7] [4]. Three complementary upgrading tracks follow directly from the evidence: (i) process upgrading (selective picking, moisture control to 12–13%, basic sorting and handling) to lift grades and conversion yields [3] [17] [16] [15] [21] (ii) functional upgrading via small batch roasting/branding to reallocate margins upstream [9] and (iii) channel upgrading through digitisation to extend reach, formalise traceability, and monetise origin narratives [10] [11] [12] [13] [14].

A concrete bridge from diagnosis to implementation is already present in the pilot procurement of 20 kg—15 kg wet beans (5 kg per farmer) plus 5 kg natural/honey micro lots (4 day drying)—which can be used to establish light touch quality protocols, document moisture/defect trajectories, generate limited SKUs, and test premium pricing with WTP positive segments. Strategically embedded in a cooperative anchored model and paired with creative economy branding that foregrounds Ono Niha identity, these steps provide a pragmatic, locally feasible route to shift value capture toward producers while building a credible origin presence in national markets [19] [20] [18] [17] Bermudez, Voora, & Larrea, 2022). The contribution of the article, therefore, lies in offering an integrated, evidence based upgrading pathway that connects farm level practice, mid chain coordination, and end market behaviour within one coherent framework for an under researched origin.

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