

Unraveling Governance and Equity in Indonesia's Robusta Coffee Value Chains: Insights from Malang Regency, Indonesia

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ABSTRACT

Despite the coffee sector's importance to Indonesia's agricultural economy, many of its smallholder farmers remain economically precarious. This study investigates the governance dynamics within the Robusta coffee value chain in Malang Regency, Indonesia, highlighting its predominantly market-based governance structure. Using Gereffi's governance framework, this study employs a mixed-method approach, combining quantitative surveys with 72 key farmer informants (farmer group leaders) and qualitative in-depth interviews with 26 traders. The research reveals that despite farmers capturing approximately 86% of value-added, their economic security remains precarious due to price volatility and limited bargaining power, a situation reported by the key informants. A key methodological finding is the empirical inseparability of the 'Information Codifiability' and 'Supplier Capability' constructs, which underscores the risk of implementing formal standards without holistically addressing farmer capacity. To address these findings, this study recommends strategic interventions, such as strengthening farmer cooperatives to enhance collective negotiation and establishing long-term buyer relationships to mitigate market instability. These findings offer practical insights for policymakers aiming to address governance and capacity gaps in Robusta coffee value chains, ensuring more equitable outcomes for smallholders and providing a model applicable to similar contexts globally.

Key words: Robusta coffee; market governance; smallholder farmers; transaction complexity; supplier capability.

1 INTRODUCTION

As a cornerstone of Indonesia's agricultural economy, the coffee sector provides a livelihood for millions of smallholder farmers and generated US\$ 929 million from green coffee exports in 2023 (Ministry of Agriculture, 2023). However, despite the sector's importance, many of these smallholders remain trapped in a cycle of economic precarity, often facing limited bargaining power and asymmetric power relationships within the value chain (Trienekens, 2011). Malang is the third-largest coffee-producing regency in East Java, with an output of about 14.3 thousand tons in 2023, grown by smallholder farmers who manage 98% of the Malang's coffee plantations (Statistics of Malang Regency, 2024). Given the dominance of smallholder cultivation, it is important to consider the challenges they face in the value chain. Understanding the governance of the coffee value chain is therefore crucial for ensuring economic efficiency, sustainability, and social equity within this vital industry.

Governance structures influence how coffee is produced, traded, and marketed, shaping the competitiveness of local and global value chains (Mulyati & Indrawan, 2021). Strong governance frameworks enhance transparency, attract investments, and enable fair trade practices that ensure producers receive just compensation (Bro & Clay, 2017). Additionally, governance plays a vital role in promoting sustainability by encouraging environmentally responsible farming and securing premium markets through certifications

(Grabs, 2021). Socially, governance empowers smallholder farmers by fostering cooperative models that amplify their bargaining power and reduce market vulnerabilities (Sengere et al., 2019). Given the dynamic nature of the global coffee market, effective governance allows industry stakeholders to adapt to shifting consumer demands and regulatory changes, ensuring long-term viability (Grabs & Ponte, 2019).

Recognizing the importance of governance in the coffee value chain is key to fostering an equitable, resilient, and sustainable industry. Despite Indonesia's pivotal role in global coffee trade, smallholders face persistent vulnerabilities including limited bargaining power, price volatility, and asymmetric relationships with intermediaries (Grabs & Ponte, 2019; Trienekens, 2011). While governance structures, defined as the rules coordinating value chain actors, are critical for enhancing equity and upgrading opportunities (Gereffi et al., 2006), existing research exhibits significant gaps. First, studies have focused predominantly on Arabica value chains, revealing modular governance in Bondowoso (Mulyati & Indrawan, 2021), or relational models in Enrekang (Vicol et al., 2018), yet neglect Robusta systems responsible for >70% of exports (Permana et al., 2024). This oversight is significant, as the value chain governance, market structure, and socio-economic challenges within the Robusta sector are fundamentally different from those of the high-value Arabica market, directly affecting most Indonesia's coffee producers. Second, prior work suffers from geographic mismatches, analyzing non-production hubs like Bogor (Suryana et

al., 2023) and oversimplified typologies that ignore inter-variable dynamics (Ikhwana, 2018; Suryana et al., 2023). Third, the “governance paradox”, where farmers capture high value-added shares (e.g., 86%) yet remain economically vulnerable, remains unresolved theoretically (Grabs & Ponte, 2019).

This study addresses these gaps by examining the Robusta value chain in Malang Regency, a major production hub. Therefore, the specific objectives of this research are to: (1) map the value chain structure and identify the roles of its primary actors; (2) quantify the distribution of value-added among these actors; (3) determine the dominant governance typology using Gereffi’s framework; and (4) examine the empirical interrelationships and distinctiveness of the governance variables. By integrating a detailed analysis of these governance variables with grounded field data, this study offers practical insights for designing governance-sensitive policies and identifying opportunities for transitioning toward more structured and inclusive value chain arrangements. The findings from this study reveal how market governance, along with a significant divide between formal standards and supplier capability, perpetuates inequity, offering a replicable model for global Robusta regions. It also contributes to the broader discourse on agricultural governance in developing economies and offer a model for replicable diagnostics in other robusta-producing regions. In turn, this can inform policy and industry interventions.

2 MATERIAL AND METHODS

The study was conducted in Malang Regency, located in East Java, Indonesia, one of the province’s major coffee-producing regions. Geographically, Malang Regency is situated between 7°57’S latitude and 112°37’E longitude, with elevations ranging from 400 to 1,700 meters above sea level, making it a suitable region for high-quality coffee production. The total area dedicated to coffee plantations in the region is approximately 20,574 hectares, with Robusta accounting for 89%. Data collection was conducted over an eight-month period, from February 2024 to October 2024, a timeframe intentionally chosen to encompass the complete cycle of cultivation, harvest, post-harvest processing, and distribution activities.

The sample for the quantitative governance analysis was selected using a three-stage purposive sampling technique. The process began with the purposive selection of six major Robusta-producing districts. In the second stage, 24 active farmer groups were randomly selected as clusters. These 24 groups have a total combined membership of 2,122 farmers, which represents the population of the selected clusters. For the final stage, three key informants (farmer group leaders) were purposively chosen from each group to be the respondents, based on their in-depth knowledge of the group’s activities. As seen in Table 1, this method yielded a final sample of $n=72$ key informants, from whom the quantitative data for the governance analysis were collected.

Table 1: Sample distribution of coffee farmers.

District	Farmer groups	Key Informants (n) ^[*]	Farmer Group Member
Tirtoyudo	4	12	346
Ampelgading	4	12	348
Dampit	4	12	361
Sumbermanjing	4	12	359
Ngantang	4	12	350
Wonosari	4	12	358
Total	24	72	2.122

[*] 4 groups × 3 admins = 12 key informants/district.

In addition to sampling coffee farmers, sample actors were selected from various stages of the coffee value chain. A purposive sampling technique was used to select 26 key market actors, including local collectors, processors, and retailers, as presented in Table 2. This non-probability method was chosen to ensure that all critical roles and functional nodes within the value chain were represented in the sample, thereby allowing for a comprehensive mapping of the chain’s structure and activities.

To address the first research question (mapping the value chain structure and actor roles), a qualitative value chain analysis approach was employed, guided by the Global Value Chain (GVC) framework. This framework focuses on identifying the sequence of actors and the functions performed at each stage of the chain, rather than the internal, firm-level

Table 2: Sample distribution of coffee traders.

Types of traders	District					
	Dampit	Tirtoyudo	Ampelgading	Sumbermanjing	Wonosari	Ngantang
Local collectors	2	2	2	2	2	2
Exporter	1	-	-	-	-	-
Processors	2	2	1	1	1	-
Retailers	1	1	1	1	1	1

logistics of a value chain management model. The data for this mapping were primarily derived from the semi-structured, in-depth interviews conducted with the 26 purposively selected traders. This method allowed for a detailed identification of the primary actors, their functions, the various product flow pathways, and the supporting service environment, which are visually synthesized in Figure 1.

To quantify the distribution of value and profitability along the coffee value chain, data on selling prices, purchase costs, input expenses, labor wages, and margins were collected from farmers, collectors, and exporters through semi-structured, in-depth interview. Value-added at each stage was calculated as the difference between output selling price and input costs (including direct production costs and transaction expenses). Labor income was estimated based on reported wages or imputed family labor costs. Profit was computed by subtracting labor costs and other expenses from the value-added. These calculations were expressed in US Dollar (USD) per kilogram of green coffee bean equivalent. This approach enabled the assessment of economic performance and profit shares among key actors in the robusta coffee value chain.

To determine value chain governance, the study developed a structured questionnaire for farmers that adopted the Gereffi's framework (Gereffi et al., 2006), which identifies governance typologies based on three core variables: transaction complexity, information codifiability, and supplier capability.

- Transaction Complexity (4 items), refers to the intricacy of the information and knowledge required to complete a transaction, particularly concerning product and process specifications. High complexity arises when specifications are customized, difficult to articulate, and require specialized investments.
- Information Codifiability (4 items), relates to the extent to which this complex information can be standardized and communicated efficiently and unambiguously between actors. Information is highly codifiable when it can be translated into universal standards, metrics, or formal language, reducing the need for face-to-face interaction.
- Supplier Capability (4 items) refers to the ability of the supply base (in this case, the farmers) to meet the buyer's requirements. This includes not only their technical skills and equipment but also their financial capacity and access to knowledge needed to comply with complex and codified standards.

Likert-scale responses were coded from 1 (most negative or lowest capability/clarity) to 4 (most positive or highest capability/clarity). A four-point scale was intentionally chosen over a five-point scale to avoid the neutral midpoint, thereby preventing central tendency bias and compelling respondents to choose a definitive stance on each item.

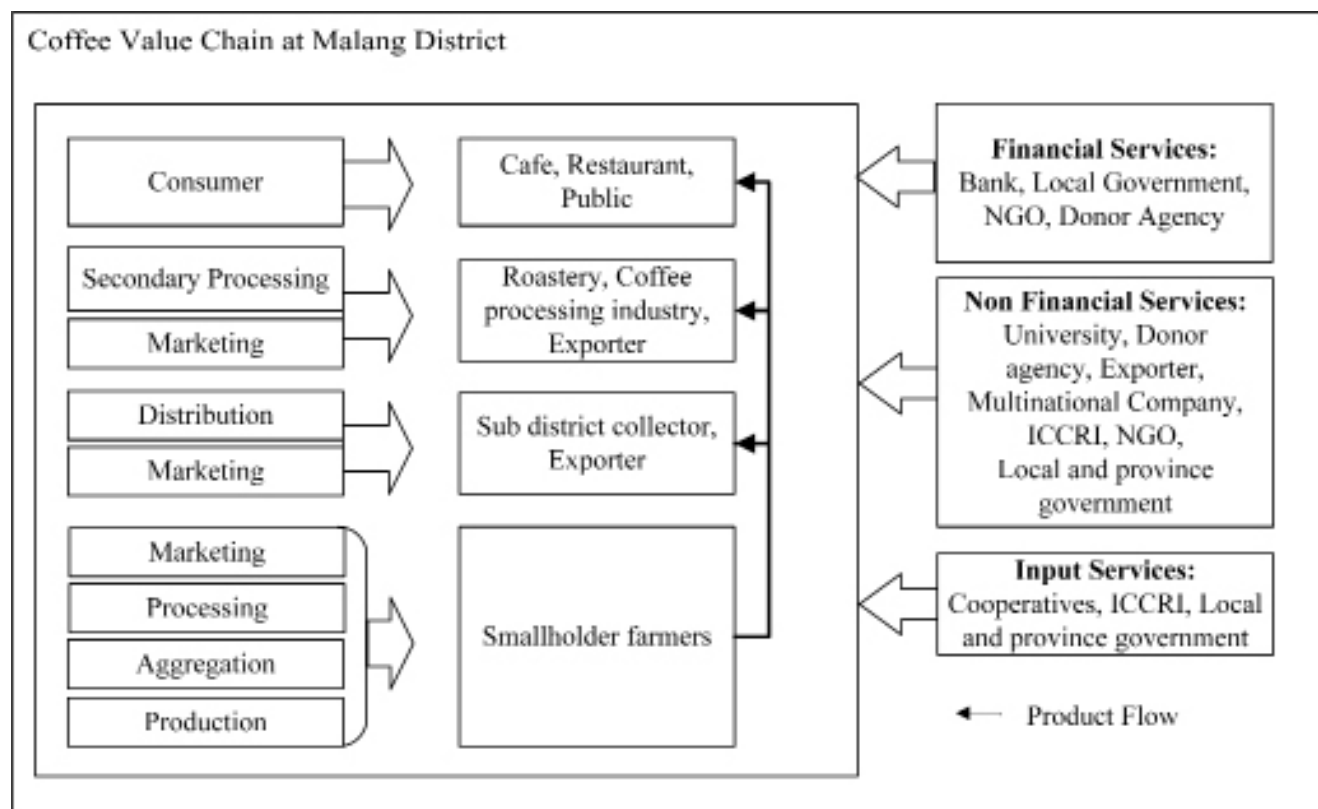


Figure 1: Robusta Coffee value chain in Malang Regency.

To quantify each governance dimension, a mean index, representing the average Likert score (Malhotra et al., 2020), was calculated for each dimension. As shown in Equation 1, the Mean Index is obtained by dividing the sum of the products of the number of respondents and their respective Likert scores by the total number of items.

$$\text{Mean Index} = \frac{\sum (\text{Number of Respondents} \times \text{Likert Score})}{\text{Number of Items}} \quad (1)$$

According to the global value chain governance framework, variables are typically classified into low and high levels based on relative scores or indices within a given measurement range and data context. Scores below 2 may be considered low. And scores above 3 are generally regarded as high. However, when scores fall between 2 and 3, they typically represent a moderate level. This index was then averaged to generate an overall governance index per dimension, providing a structured assessment of governance characteristics in the coffee value chain. After determining the relative level of each variable, the most suitable governance type can be identified by comparing these values with the reference, which summarized at Table 3.

After verifying reverse-coding (wherein items were checked and re-scored to align with their intended direction), we treated IC and SC as composite indices rather than reflective

scales and refrained from interpreting them as distinct latent constructs. This outcome reflects our methodological finding that codifiability and capability are empirically inseparable in this smallholder context.

To test the reliability and validity of the measurement constructs, a series of statistical tests were performed. The Transaction Complexity (TC) scale showed strong reliability (Cronbach's $\alpha = 0.855$), but the Information Codifiability (IC) and Supplier Capability (SC) scales yielded negative Cronbach's Alpha values ($\alpha = -0.234$ and $\alpha = -0.104$, respectively), indicating a severe lack of internal consistency. Furthermore, an Exploratory Factor Analysis (EFA) was conducted to test for construct validity. The data was found suitable for analysis (KMO = 0.582, Bartlett's Test $p < 0.001$), but the analysis did not produce a clean three-factor solution corresponding to the theoretical constructs. Given the negative α values for IC (-0.234) and SC (-0.104) and the results from the EFA, we refrain from treating IC and SC as distinct reflective constructs. Instead, we treat them as composite indices for descriptive diagnosis, interpreting their empirical inseparability as a methodological finding in this smallholder context. This finding is significant and will be discussed in more detail later. The factor loading matrix from the EFA analysis is provided in Table 4. All descriptive statistics and factor analyses were performed using Python 3.11 (pandas, factor_analyzer, and statsmodels).

Table 3: Reference for determining governance type (Gereffi et al., 2006).

Complexity	Codifiability	Supplier Capability	Governance Type	General Characteristic
Low	High	High	Market	Simple, independent suppliers
High	High	High	Modular	Complex but can be codified
High	Low	High	Relational	Close interaction, need for trust
High	High	Low	Captive	Dominant buyers, dependent suppliers
High	Low	Low	Hierarchy	Internal production, full coordination

Table 4: Exploratory Factor Analysis (EFA) factor loadings.

Item	Factor 1	Factor 2	Factor 3
TC1	0.949	0.109	0.040
TC2	0.701	-0.153	-0.022
TC3	0.670	0.111	0.111
TC4	0.720	0.016	-0.036
IC1	-0.083	0.979	-0.102
IC2	0.273	-0.068	-0.029
IC3	-0.063	0.051	0.885
IC4	-0.432	-0.032	0.005
SC1	-0.435	0.029	0.044
SC2	-0.021	-0.110	-0.047
SC3	-0.099	0.971	-0.058
SC4	0.001	0.002	0.998

The quantitative analysis of governance was based on a purposive sample of 72 key informants (farmer group leaders), not a large-scale random sample of individual farmers. While these leaders provide knowledgeable and rich insights, the findings may not be statistically generalizable to the entire population of over 2,000 farmers in the selected groups. This key informant approach provides a deep diagnostic of the governance structure, but future research could complement these findings with a broader survey to validate the results across the wider farmer population.

3 RESULTS

3.1 Value Chain Structure and Actor Roles

Figure 1 presents a comprehensive map of the Robusta coffee value chain in Malang Regency, illustrating the relationships between the main actors, the key functions performed, and the supporting services. The analysis reveals a clear division of functions across the chain's primary actors. At the base of the chain, smallholder farmers perform the foundational functions. This includes production (cultivation and harvesting), initial on-farm processing (such as drying cherries into green beans), aggregation of their own crops, and farm-gate marketing to the next actor in the chain. At the intermediary and export levels, sub-district collectors and exporters take on the crucial functions of large-scale aggregation, distribution, and marketing. They act as key nodes that channel the product towards different end markets. At the processing and retail levels, actors such as roasteries, the coffee processing industry, cafes, and restaurants conduct secondary processing (e.g., roasting, grinding, and packaging) and manage the final marketing and distribution to consumers.

Within this structure, the product does not follow a single path but moves through a network of at least five distinct product flow pathways:

1. Farmer → Local Collector → Processor → Domestic Consumer: This represents the most dominant domestic channel, where farmers sell cherries or dried beans to local collectors, who then supply larger processors for the national market.
2. Farmer → Local Collector → Domestic Consumer: A shorter variation where collectors, after some primary processing, sell green beans directly to local end consumers or small-scale roasters.
3. Farmer → Local Collector → Exporter → Foreign Consumer: This is the primary export-oriented channel. Collectors aggregate beans from numerous farmers and sell them in bulk to exporters, who handle the grading and shipping to foreign buyers.
4. Farmer → Processor → Domestic Consumer: In this channel, some farmers with better capacity or location bypass collectors and sell directly to domestic processors.
5. Farmer → Exporter → Foreign Consumer: Similarly, a small number of farmers engage in direct sales to exporters, although this channel is the least common. This multi-channel structure, underpinned by specific actor functions, highlights the complexity of market interactions and the various roles that farmers and intermediaries play in both domestic and global value chains.

Following the value chain map, Table 5 provides a detailed breakdown of the primary actors identified. The table elaborates on the specific roles and functions each actor performs within the chain, as well as their main outputs, from on-farm primary processing by farmers to the final distribution by retailers.

Table 5: Primary Actor and their role in robusta value chain.

Actor	Role/Function in Chain	Main Outputs
Farmers (smallholders)	Cultivate robusta coffee trees; harvest and primary processing (drying) coffee cherries.	Fresh coffee cherries; partially dried cherries (<i>gelondong</i>) or dried beans (<i>ose</i> /green bean) at farm-gate.
District Collectors	Aggregate coffee from farmers in a local area (village or sub-district);	Dried coffee beans (<i>ose</i> /green beans)
Exporters	Purchase bulk coffee from collectors or farmers; perform grading, quality sorting, and packaging; coordinate larger shipments for export or sale to industrial roasters. Act as export agents or have direct export operations.	Graded green coffee beans (bulk). Beans are prepared to export quality standards (moisture content, defect count).
Processors (Roasters & Coffee Industry)	Roast coffee beans and process into final products. This category includes local roasteries (producing roasted beans or ground coffee for domestic consumers), instant coffee manufacturers, and other value-adding processors. Some are small-scale (roasting SMEs), others are large companies.	Roasted coffee beans, ground coffee (powder), packaged coffee products, instant coffee.
Retailers & Cafés	Distribute and sell coffee products to end consumers. This includes coffee shops, cafés, hotels/restaurants serving coffee, as well as retailers selling packaged coffee (supermarkets, local markets).	Brewed coffee for consumption on-site (in cafés), and packaged coffee products for home consumers.
Consumers	End consumers who purchase and consume coffee in various forms (brew, instant, etc). They drive demand and have preferences affecting quality requirements upstream.	Final consumption of coffee (no output beyond consumption).

3.2 Value Addition and Economic Performance of Actors

To quantify the distribution of value and answer the second research question, a value-added analysis was conducted for the key actors in the chain. Table 6 presents the results of this analysis, detailing the economic performance of farmers, collectors, and exporters. To facilitate international comparison, all financial values are expressed in US Dollars (USD) per kilogram of green bean equivalent, based on market data from 2024.

The table reveals a central finding of this study: a significant governance-performance paradox. Smallholder farmers, as primary producers, capture the vast majority of the total value-added in the chain, approximately 86% (USD 3.94 of USD 4.57) of total value added. In stark contrast,

intermediaries such as collectors and exporters operate on much smaller value-added margins of only 5% (\$0.24) and 7% (\$0.39), respectively. While this high value-added share for farmers appears beneficial on the surface, the subsequent discussion will elaborate on how this figure masks underlying economic vulnerabilities, such as limited bargaining power and exposure to price volatility, which are inherent in the region's market-based governance system.

3.3 Governance Typology: Gereffi Framework Application

Table 7 presented the aggregated results, showing how different aspects of governance manifest in the Malang robusta coffee chain.

Table 6: Value addition and margins for key actors in Malang's robusta coffee chain (per kg, 2024 values).

Item / Indicator (Unit)	Farmer	Collector	Exporter
Selling price (USD/kg)	4.24	4.48	4.94
Purchase cost of raw product (USD/kg)	N/A [a]	4.24	4.48
Other input costs (USD/kg) [b]	0.3	0.01	0.06
Value Added (USD/kg) [c]	3.94	0.24	0.39
Value Added Share (%)	86	5	9
Labor income (USD/kg)	0.39	<0.01	0.01
Profit (USD/kg) [d]	3.36	0.24	0.33
Profit as % of output price (%)	79	5	7
Profit share of value added (%)	83	97	83

[a] Purchase cost is not applicable for farmers as they cultivate their own coffee cherries.

[b] Other input costs include farm inputs (e.g., fertilizer), imputed family labor for on-farm processing for farmers, and operational costs (e.g., handling, transport, sorting) for traders.

[c] Value Added is calculated as (Selling price) - (Purchase cost) - (Other input costs).

[d] USD values use the average 2024 IDR→USD exchange rate of Rp15,763.40 per USD; source: Bank Indonesia.

Table 7: Classification of Governance Variables in the Malang Robusta Coffee Chain.

Variable	Item	Average Mean Index	Class
Transaction Complexity	1	1.79	Low
	2	1.87	Low
	3	1.78	Low
	4	1.62	Low
	Overall Mean Index	1.77	Low
Information Codifiability	5	2.23	Moderate
	6	1.17	Low
	7	3.23	High
	8	3.77	High
	Overall Mean Index	2.6	Moderate
Supplier Capability	9	3.77	High
	10	3.1	High
	11	2.2	Moderate
	12	3.17	High
	Overall Mean Index	3.06	High

Transaction complexity was low, as buyers primarily require clean, dry beans with minimal defects. The analysis of the survey data indicates that 86.7% of the surveyed key informants (n=72) reported that farmers in their groups consistently meet buyer standards, indicating that demands remain within their capability. Typical specifications include moisture content around 12% and defect removal, which are standardized rather than customized.

Information codification was moderate to high, with industry metrics like moisture percentage, bean grading, and defect count providing clear assessment criteria. However, transparency issues persist, as 78.3% of farmers reported unclear price and quality information. While standards like Grade 1 vs Grade 2 are codifiable, farmers lack formal documentation, relying on verbal, last-minute communication. Information codifiability was found to be moderate, with an Overall Mean Index of 2.60 as shown in Table 6. This score reflects that while some standards exist, they are often basic and inconsistently documented. This aligns with market governance, where transactions are structured yet lack detailed contractual agreements. SNI grading could enhance codification, but current practices favor informal exchanges over documented specifications.

Supplier capability in the region was determined to be high. This finding is primarily evidenced by survey results, where 86.7% of the 72 key informants affirmed that their group members consistently meet the quality specifications demanded by buyers. This quantitative data is reinforced by the qualitative findings that rejections based on quality are infrequent. This demonstrates a robust, inherent capacity among farmers to operate with significant autonomy, successfully managing on-farm processing to satisfy current market demands without needing formal interventions from buyers. Farmers understand drying and storage techniques to prevent defects, demonstrating strong adaptive capability. Overall, supplier capability was high, achieving an Overall Mean Index of 3.06, as detailed in the summary row of Table 6. This high score reinforces the finding that farmers possess the necessary skills to meet current buyer requirements and can operate with significant autonomy. While production skills are strong, marketing capability remains limited, particularly in price negotiation and market access due to information asymmetry. This high supplier capability aligns with market and modular governance, where producers operate autonomously without direct oversight.

4 DISCUSSION

4.1 Value Chain Structure and the Governance-Performance Paradox (RQ1 & RQ2)

The analysis of the value chain structure (RQ1) conclusively points to the dominance of market governance

in Malang's Robusta coffee sector. As detailed in Table 6, the chain is characterized by a combination of Low Transaction Complexity (Overall Mean Index: 1.77), Moderate-to-High Information Codifiability (Overall Mean Index: 2.60), and High Supplier Capability (Overall Mean Index: 3.06). According to the theoretical framework by Gereffi et al. (2006), summarized in Table 3, this specific configuration corresponds directly to a 'Market' governance typology. The prevalence of this model means that transactions are typically simple, based on standardized product specifications, and involve minimal direct coordination between buyers and suppliers, with spot market interactions prevailing over structured partnerships.

This market-based structure is central to understanding the economic performance of its actors (RQ2), revealing a significant governance-performance paradox. The data shows that while farmers achieve high gross value capture—capturing approximately 86% of the total value-added—this fails to translate into net income security. Their income remains precarious due to price volatility and extremely limited bargaining power, with only 20% of key informants reporting that farmers in their groups engage in price negotiations. This vulnerability is exploited by intermediaries, particularly collectors, who exhibit hyper-efficiency by securing a 97% profit share from their own value-added, a figure driven primarily by spatial arbitrage rather than genuine value creation. It is important to note that this high 86% share reflects the gross value added up to the farm-gate for green bean equivalent, incorporating the significant value farmers contribute through on-farm primary processing (drying). It does not represent their final net income security and differs from analyses focused solely on cherry prices or the full chain to consumers.

Furthermore, the structural weakness of farmers within this system is compounded by the notable absence of strong, formal farmer cooperatives that could serve as a vehicle for collective action. While informal farmer groups exist, our observations indicate they rarely engage in coordinated marketing, leaving individual farmers to face buyers on their own. Thus, the value chain's structure, characterized by market governance and a lack of collective organization, directly creates the paradoxical outcome where farmers, despite being the primary value creators, remain the most economically vulnerable actors.

4.2 The Inseparability of Constructs: A Methodological Finding (RQ3 & RQ4)

A critical finding emerged during the methodological validation process, directly addressing the interrelationships between governance variables (RQ4). An Exploratory Factor Analysis (EFA) results indicated that the constructs of codifiability (IC) and supplier capability (SC) did not exhibit distinctiveness based on the factor loadings, with negative

Cronbach's α for both dimensions. Given the negative α for IC (-0.234) and SC (-0.104) and the EFA pattern, we refrain from treating IC and SC as distinct reflective constructs. These measurement results answer RQ4, indicating that codifiability and capability are not empirically distinct in this sample. After verifying reverse-coding, this study treats them as composite indices for descriptive diagnosis.

This result is a more nuanced discovery than a simple correlation. It suggests that for the key farmer informants surveyed, these concepts are deeply intertwined: a farmer's 'capability' is perceived as being directly dependent on the clarity of 'codified' information, and vice versa. This finding offers a powerful critique on the direct application of the GVC framework's variables in a smallholder context, revealing that theoretical distinctions can collapse in practice. It underscores that any policy aimed at increasing formalization (codifiability) must be fundamentally integrated with capacity-building (capability), as practitioners on the ground do not see them as separate issues.

This statistical inseparability is clearly visible in the Malang context. The analysis of the governance variables (RQ3) shows that while farmers currently possess high capability (Overall Mean Index: 3.06), this capability is tailored to the existing market with low transaction complexity (Index: 1.77). The key informants reported that while farmers can meet basic product standards, they lack the infrastructure, formal knowledge, and financial resources required to comply with higher, more rigidly codified standards. Furthermore, even with existing codifiable standards like grading, significant information asymmetry persists; 78.3% of informants reported that farmers in their groups face unclear price and quality information, preventing them from leveraging these standards to improve their market position. This statistical inseparability reflects the field realities in Malang. With formal cooperatives playing a minimal role in knowledge transfer, farmers predominantly rely on informal peer networks and direct interactions with buyers/collectors for learning and acquiring information. In such an environment, understanding market requirements (Codifiability, however informal) and developing the practical skills to meet them (Capability) become deeply intertwined processes. Capability is often demonstrated and learned through successfully navigating these specific, often unwritten, relational exchanges, blurring the theoretical distinction between the two concepts in the farmers' operational context.

This situation, where top-down formalization is disconnected from local realities, supports findings from Vicol et al. (2018) which demonstrate that such interventions can reinforce structural inequities rather than fostering inclusive upgrading. The core challenge for policymakers is therefore not simply to introduce more standards, but to bridge the gap

between formalization and capability. Any intervention must prioritize context-sensitive approaches, such as participatory standard-setting and integrated capacity-building, to ensure that governance structures enhance, rather than erode, smallholder resilience.

4.3 Pathways to Upgrading: Hybrid Governance and Policy Implications

Given the limitations of a pure market-based system and the risks of top-down formalization, a shift toward hybrid governance models offers the most pragmatic pathway for upgrading the value chain. These models integrate the transactional efficiency of market governance with the relational trust of more coordinated frameworks, which has been shown to empower smallholders by enhancing their bargaining power and access to premium markets (Gerard et al., 2023). This can be achieved through three key mechanisms: (1) positioning farmer cooperatives as "codification bridges" to internalize quality standards and negotiate collectively; (2) implementing phased formalization to build farmer readiness without creating an excessive compliance burden; and (3) fostering buyer-led relational channels to create stable market niches that reward quality. However, the implementation of such models is not without challenges, including the risk of creating new dependencies on buyers and the need to overcome potential internal governance issues within cooperatives (Vicol et al., 2018).

Successfully navigating these challenges and fostering a hybrid system requires targeted policy support that moves beyond a singular focus on certification. Based on our findings, we propose three key policy levers to address structural governance failures. First, to counter information asymmetry, policy should support the digital democratization of market data. The use of digital pricing tools has been shown to increase smallholder negotiation power significantly in other contexts (Latynskiy & Berger, 2017). Second, to enable farmers to capture more value downstream, a focus on cooperative capitalization is needed, mirroring successful models in regions like Ethiopia where cooperative investments have substantially increased farm-gate prices (Bekere & Megersa, 2021). Third, given the risks of imposing rigid compliance standards, policy should promote differentiation over compliance by supporting geographic branding initiatives, aligning with the call for "place-based sustainability" (Grabs, 2021).

Ultimately, a multi-dimensional policy approach that integrates these levers offers a more sustainable and scalable solution. By shifting the focus from compliance-driven certification to empowerment-based governance, policymakers can address structural inequities and ensure that smallholder farmers benefit from long-term economic stability and more equitable value chain participation.

4.4 Research Frontiers: Expanding the Understanding of Governance Dynamics

This study contributes to the understanding of governance dynamics in the Robusta coffee value chain, yet its findings, particularly the empirical inseparability of key theoretical constructs, open several critical areas for future exploration.

First, the finding that Information Codifiability and Supplier Capability are intertwined for key informants calls for a deeper, more critical examination of the GVC framework in smallholder contexts. Future qualitative research, perhaps using ethnographic methods, could explore *how* farmers perceive and experience these concepts, providing a richer understanding that moves beyond quantitative scales. Second, while this study provides a deep diagnostic based on a purposive sample of key informants, its findings are not statistically generalizable. Therefore, future research should aim to validate these results across a larger, randomly selected sample of individual farmers. Such a study could also employ longitudinal panel studies to investigate the long-term effects of capacity-building initiatives, assessing whether interventions lead to sustained improvements in both governance structures and farmer incomes.

Finally, to build a more globally relevant understanding, comparative case studies are needed. Comparing the market-based governance found in Malang with more relational or cooperative-led models in other Robusta-producing regions, such as in Brazil (e.g., Rondônia) or Colombia, could yield valuable insights into the enabling conditions for successful hybrid governance. Furthermore, the impact of specific policy interventions, such as digital traceability tools, could be rigorously tested using randomized controlled trials (RCTs) to provide robust evidence for policymakers. By addressing these frontiers, future studies can deepen the understanding of governance transitions and ensure the development of more inclusive and effective value chains.

5 CONCLUSION

This study revealed that while farmers capture 86% of the value-added, their economic vulnerability persists due to price volatility and limited bargaining power. The governance typology is primarily market-based, underscoring a system where fragmented interactions prioritize efficiency over long-term equity. Policy interventions aimed at increasing formalization are bound to fail if not fundamentally integrated with capacity-building. The study recommends hybrid governance models to empower farmers through cooperatives and capacity-building, addressing the identified vulnerabilities.

6 AUTHOR CONTRIBUTIONS

Conceptual Idea: Hadi, Y; Dania, W.A.P.; Soemarno, S.; Astuti, R; Methodology design: Hadi, Y; Dania, W.A.P.;

Data collection: Hadi, Y; Data analysis and interpretation: Hadi, Y; Soemarno, S.; Writing and editing: Hadi, Y; Dania, W.A.P.; Astuti, R.

7 DATA AVAILABILITY STATEMENT

Data available upon request to authors.

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