



Original Article

Supply Chain Identification of Indonesian Specialty Coffee: A Case Study of Kayumas Coffee Using the FSCN Framework

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Abstrak:

Downstream policy formulation in Indonesia's specialty coffee sector remains constrained by fragmented data systems that fail to integrate production, processing, and market dimensions, particularly for smallholder-based supply chains. This study aims to identify and analyze the supply chain configuration of Kayumas specialty coffee from Situbondo, East Java, using Vorst's Food Supply Chain Networks (FSCN) framework. A qualitative case study design was applied, with data collected through in-depth interviews using snowball sampling involving farmers, farmer group leaders, roastery owners, distributors, café owners, and consumers. Secondary data were obtained from documents and literature to support triangulation. Data were analyzed thematically across four FSCN dimensions: supply chain structure, management, resources, and business processes. The findings indicate that the Kayumas coffee supply chain is characterized by a smallholder-driven, trust-based governance structure operating through a hybrid push-pull system. While farmer groups play a central coordinating role in post-harvest processing and market access, the chain remains constrained by limited capital, weak digital infrastructure, informal contracting, and fragmented information flows. These constraints limit scalability, traceability, and performance measurement, thereby weakening adaptive downstream policy design. This study concludes that strengthening data integration, formal coordination mechanisms, and digital traceability systems is essential to enhance value creation, investment consistency, and smallholder participation in Indonesia's specialty coffee economy. The findings provide empirical evidence to support more coherent, data-driven downstream policy formulation and supply chain development strategies.

Keywords: Specialty Coffee, Supply Chain, Smallholder Farmers, FSCN Framework, Indonesia.

Introduction

Specialty coffee has emerged as a different segment within the global coffee industry, characterized by quality standards, traceability, and flavor profiles that command premium market value (Tieghi et al., 2024; Traore et al., 2018). In practice, a coffee is classified as specialty when it achieves a minimum cupping score of 80 out of 100 under the Specialty Coffee Association (SCA) protocol, exhibits very low or no primary defects in green beans, demonstrates clean cup characteristics, and presents a distinctive, balanced, and positive flavor profile (Servín-Juárez et al., 2021). These standards emphasize not only product quality but also the integrity of production, processing, and delivery systems (Loppies et al., 2024). Kayumas coffee from Situbondo Regency, East Java, represents a geographically specific specialty coffee with agroecological conditions, cultivation traditions, and post-harvest handling practices contribute to its sensory attributes and potential positioning in premium markets.

Most of specialty coffee producer in Indonesia is smallholder farmer that owned 1-2 ha land. The ideal specialty coffee supply chain for smallholder producers is structured around collaborative, transparent, and inclusive governance arrangements that strengthen farmers' economic and technological capacities (Wahyudi et al., 2020). Key characteristics include cross-sector collaboration that centers farmers' voices in decision-making processes, transparent interactions among producers, buyers, processors, and roasters, and cooperative strategies that enhance economic resilience. Such systems ensure access to critical inputs, finance, knowledge, and market technologies, while simultaneously addressing structural challenges such as climate change, pest pressures, and market access barriers (Smith et al., 2022). Collectively, these features enable the transition from transactional exchanges to value-based, sustainable partnerships that support long-term smallholder economic development (Hartono et al., 2023).

Empirically, the Indonesian specialty coffee sector operates under fragmented institutional arrangements and dispersed data systems (Wahyudi et al., 2026). Information related to production capacity, quality performance, research outputs, and market access remains siloed across ministries, agencies, and industry actors, limiting the ability to construct an integrated national perspective (Ashardiono & Trihartono, 2024). Most specialty coffee producers, including those cultivating Kayumas coffee, are smallholder farmers who face structural constraints, particularly limited access to capital, technology, and market information.

Study on Kayumas coffee has dominantly focused on historical development, consumer behavior, and value-added approach, with limited attention to systematic supply chain analysis. Historically, Arabica coffee cultivation in Kayumas from Dutch colonial plantations in 1883 to the formation of eight farmer groups and 410 farmers by 2018 (Izzah et al., 2023). Other research on consumer behavior specifically in consumer attitude and purchase intention is affected by marketing mix (Setiawati et al., 2025). Analysis on value adding process stated that there is three process that add value to raw material of Kayumas coffee that is fullwash process and natural process (Puryantoro, 2021). The limited research on the supply chain topic failed to provide systematic framework that connects production, research, industrial processing, and market dimensions in case of specialty coffee.

This study is important because it seeks to generate structured, integrated evidence on the specialty coffee supply chain of Kayumas coffee as a basis for more coherent and measurable downstream policy formulation in Indonesia. The main objectives of this

study are to identify the configuration of the Kayumas coffee supply chain using food supply chain framework (FSCN) and provide insights to support the development of adaptive, evidence-based downstream strategies that enhance value creation, investment consistency, and smallholder participation in the specialty coffee economy.

Methods

This study adopts a qualitative case study design to systematically identify and analyze the configuration specialty coffee supply chain of Kayumas coffee from Situbondo, East Java. This framework enables systematic examination of network structure, business processes, and governance mechanisms across the specialty coffee supply chain. Sampling method using snowball sampling which is useful for finding, identifying, selecting and taking samples in a network or chain of relationships (Nurdiani, 2014). Research participants include coffee farmers belonging to farmer groups, owner of coffee processing firm (roastery), distributor, business consumers (café owners), and individual consumers totaling 10 people.

Primary data were collected through in-depth interviews to capture actors' roles, relationships, operational practices, and constraints. Secondary data were obtained through document analysis and literature review to support contextual interpretation and analytical triangulation. Study primarily conducted at one of Kayumas Village's farmer groups as focal company. Data were analyzed thematically in accordance with the FSCN framework by Vorst (2006) includes following dimensions: (1) supply chain structure, which identifies key actors, their roles, network configuration, and institutional arrangements aligned with supply chain objectives; (2) supply chain management, which examines coordination mechanisms and management structures that enable process execution; (3) supply chain resources, which include transformation resources such as human capital, machinery, finance, and information and communication technologies; and (4) supply chain business processes, defined as structured and measurable activities encompassing planning, operations, distribution, ordering, marketing, product development, customer relations, and finance.

Results

Supply chain structure

The supply chain structure consists of interconnected actors who perform specific roles and maintain relationships to facilitate the flow of goods from producers to consumers. These flows include the flow of products, financial transactions, and information. Actors of the Kayumas coffee supply chain include farmers, farmer groups, distributors, roastery, cafés, and consumers. Farmers in Kayumas Village supply coffee cherries cultivated under organic farming standards on smallholder plots ranging from 0.5 to 3 hectares. Harvested cherries are processed by farmer groups that act as post-harvest processing facilities processing coffee berries into green beans using full-washed, natural, and anaerobic methods. Farmers group also make whole roasted coffee beans and ground coffee to be sold directly to cafés and individual consumers or go through distributors. Roastery buy green beans from farmer groups to produce ground coffee and coffee blend according to consumers demand.

There is only one roastery in Situbondo specifically using Kayumas coffee as main products operate in both B2B and B2C markets via cafés, online marketplaces, and direct sales. Cafes buy whole roasted coffee beans or ground coffee from farmer groups or roasteries to make coffee drinks. Individual consumer is end-user that consumes

Kayumas coffee in different shape such as, whole roasted beans, ground coffees and coffee drinks.

The Kayumas coffee supply chain involves three interrelated flows: material, financial, and information flows. Material flow begins with farmers cultivating and harvesting Arabica coffee cherries, which are delivered to farmer groups for processing into green beans, roasted beans, and ground coffee. These products are subsequently distributed to distributor, roastery, and cafés, which either resell the products or further process them into beverages for final consumers. Financial flows move in the opposite direction, from consumers to producers, with payments typically conducted directly via cash or bank transfer; companies pay farmers upon delivery of harvests to the processing unit, and consumers pay upon receipt of products. Information flows bidirectionally across the supply chain and includes price information, order quantities, delivery schedules, and market trends.

Supply chain management

Supply chain management in the Kayumas coffee network is implemented through partnership relationships and transaction systems that facilitate coordination among actors. Partnership arrangements are primarily trust-based and largely informal, particularly between farmer groups and farmers, as well as packaging suppliers, with no written contracts. Farmers sell harvested coffee cherries directly to the farmer group, with quantities varying annually. Relationships with resellers are also based on trust, with routine deliveries conducted at least once per week and ad hoc orders permitted, and product prices discounted by approximately 20% from retail levels. Partnerships with local roasteries, including those owned by farmer group members, operate informally, while collaborations with external roasteries and cafés are governed by formal agreements (Memoranda of Understanding), including advance payments of 30% and discounted prices ranging from 15% to 20% below retail.

Transaction systems are predominantly cash-based and conducted through direct sales, e-commerce platforms, and digital communication channels. Farmers are paid immediately upon delivery of coffee cherries to the processing unit, with prices ranging from IDR 15,000 to IDR 15,500 per kilogram, determined by market conditions and mutual agreement. Consumer transactions occur through direct purchases at Kayumas Village, online platforms such as Tokopedia, and WhatsApp-based orders, with deliveries made via courier services or private vehicles. Through collaborative relationships with farmers, resellers, roasteries, and cafés, the farmer group coordinates production, processing, and distribution activities to enhance value creation and expand market reach within the specialty coffee supply chain.

Supply chain resources

Resources in the Kayumas coffee supply chain consist of physical, human, and technological assets that support production and distribution. Physical resources include coffee farmland owned by farmer members (ranging from 0.5 to 3 hectares per farmer), production and storage facilities, processing machinery, and transportation. The production facility is equipped with washing tanks, pulper, washer, drying beds, huller, sorting machines, roasting, grinding, and sealing equipment, enabling processing from harvested cherries to green beans, roasted beans, and ground coffee. Storage and processing buildings are located at the farmer group leader's residence in Kayumas Village, while transportation is supported by two privately owned vehicles used for

product distribution.

Human resources comprise 19 farmer members (15 men and 4 women) managing a total of approximately 54 hectares, supported by nine permanent processing workers, one part-time driver, and seasonal laborers for post-harvest handling and manual bean sorting, primarily local women paid based on output. Technological resources include processing methods such as natural, full-washed, and anaerobic fermentation, supported by basic processing machinery and dry hulling to produce market-ready green beans. Information technology is limited to mobile phones and messaging applications (e.g., WhatsApp) for coordination, while a website developed with university support became inactive in early 2023, reflecting constraints in digital infrastructure and technological capacity.

Supply chain process

The business processes in the Kayumas coffee supply chain follow a push–pull system, where activities are driven either by demand forecasts (push) or direct customer orders (pull) (Chopra & Meindl, 2013). At the farm level, processes are predominantly push-based, as farmers cultivate coffee in anticipation of future processing needs. This stage includes procurement (inputs and equipment), cultivation, harvesting, and order fulfillment through the sale of coffee cherries to the farmer group.

At the farmer group level, both push and pull processes operate. Procurement and post-harvest processing (natural, full-washed, and anaerobic methods) are conducted based on available harvest volumes and stored as green beans, reflecting a push approach. Further processing into roasted or ground coffee, as well as order fulfillment, occurs only after receiving customer orders, reflecting a pull approach. Distributor activities are primarily pull-based, involving procurement from the farmer group, product processing or repackaging according to consumer demand, and order fulfillment. Consumers place orders directly through distributors, processing firms (roasteries or cafés), or the farmer group, using in-person transactions, messaging applications, or online platforms, with nationwide delivery facilitated by logistics services.

Discussion

This study reveals that the Kayumas coffee supply chain operates as a predominantly smallholder-driven, trust-based network with limited formalization but strong relational governance. This finding aligns with prior research on agri-food supply chains in developing countries, where informal contracts and social capital substitute for formal institutions (Karyani et al., 2019; Nuraisyah et al., 2025; Umaman et al., 2022). While such arrangements reduce transaction costs and foster long-term cooperation, they may also constrain scalability, access to formal finance, and integration into higher-value global markets. For decision makers, this highlights the importance of designing policies and support programs that strengthen institutional capacity without undermining existing social trust mechanisms.

The push–pull configuration identified across different stages of the supply chain reflects adaptive operational strategies. Production and post-harvest activities follow a push logic driven by seasonal harvest cycles, while roasting, packaging, and distribution are demand-driven (pull). This hybrid model is consistent with supply chain management theory, which suggests that decoupling points are essential for managing uncertainty in agri-food systems (Chopra & Meindl, 2013).

However, the lack of forecasting tools, inventory management systems, and real-time demand data may limit the efficiency of this configuration. Enhancing information flows through digital platforms and market intelligence systems could improve responsiveness, reduce waste, and optimize resource allocation. The study further demonstrates that value addition is concentrated at the cooperative and downstream processing levels, particularly through post-harvest processing, roasting, packaging, and branding. This supports the upgrading literature, which emphasizes functional upgrading as a pathway for smallholders to capture greater value (Kartika et al., 2025). Nevertheless, farmers remain primarily positioned as raw material suppliers with limited direct participation in higher-value market segments. Strengthening farmer inclusion in downstream activities—such as collective branding, direct trade arrangements, and quality-based pricing—could enhance income distribution and reduce vulnerability to price volatility.

Another critical discussion point concerns data fragmentation and limited traceability across the supply chain. The absence of integrated data systems weakens performance monitoring, policy formulation, and benchmarking against national or global standards. This finding input broader challenges in Indonesia's agricultural governance, where the lack of interoperable databases undermines evidence-based policymaking. Implementing digital traceability systems and standardized data reporting could improve transparency, facilitate certification processes, and support market differentiation strategies for Kayumas coffee.

Conclusion

This study finds that the supply chain of Kayumas coffee is characterized by a smallholder-based, trust-driven network coordinated by farmer groups, operating through a hybrid push–pull system, but constrained by limited capital, fragmented information flows, and the absence of standardized performance indicators. These conditions directly explain why downstream policy formulation in Indonesia remains administrative rather than adaptive, as decision makers lack integrated, supply chain–level data linking production capacity, processing, market demand, and research outcomes.

Suggestion

Future research should examine the economic feasibility and impact of introducing formal contractual arrangements, cooperative financing mechanisms, and digital traceability systems on smallholder income stability, investment access, and supply chain transparency. Longitudinal studies are needed to assess how climate variability, processing innovations (e.g., anaerobic fermentation), and market fluctuations affect quality consistency and production capacity over time. Additionally, comparative studies between Kayumas coffee and other Indonesian specialty coffee regions would support benchmarking and contribute to the development of a national specialty coffee performance dashboard. Finally, future research should explore the integration of research institutions, extension services, and private sector actors to evaluate how coordinated knowledge transfer can strengthen downstream policy implementation and value creation.

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