



The Role of Rural Production Systems in the Transformation of Rural Areas in Kediri Regency

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Abstract

Rural transformation involves comprehensive changes at the community level, including shifts from agriculture to non-agricultural sectors, infrastructure development, and socio-cultural transitions toward urbanization. The organization of rural production serves both as a driver and a reflection of these transformative processes. Kediri Regency in East Java is currently undergoing such changes, with 29 villages reclassified as urban between 2000 and 2010. While a shift toward non-agricultural sectors is evident, the agricultural sector in several areas remains vibrant and adaptive. This study analyzes rural production systems in the context of this transformation, focusing on three villages with varying proximity to Kediri City (a primary city) and Pare (a secondary city). Employing a quantitative method and descriptive statistical analysis, the study finds that rural production systems play a vital role in maintaining the relevance of agriculture during transformation. Significant progress is observed in physical assets, natural resource utilization, and social capital—manifested through increased use of modern tools, crop diversification, and strengthened social networks. Local production systems are gradually modernizing, with improved coordination and emerging innovation, even though collective farming practices remain prevalent. Productivity, income generation, and market linkages are improving, especially in villages located closer to urban centers. These areas display faster adaptation due to spatial advantages and more robust asset portfolios. The findings highlight the need to include rural production systems in rural development strategies to foster agricultural innovation, expand market and institutional linkages, and reinforce social and economic resilience in the face of transformation.

Keywords: agrarian transition; agriculture; rural production systems; rural transformation; spatial proximity

1. Introduction

Urbanization in Indonesia is progressing rapidly, reshaping spatial and functional relationships between cities and their rural hinterlands. By 2035, it is projected that nearly 70% of Indonesia's population will reside in urban areas (United Nations, 2018). This demographic shift not only transforms urban cores but also extends into peripheral rural landscapes, triggering the emergence of hybrid rural-urban zones. In Java, this process manifests most clearly through *desakota* formations areas where agricultural livelihoods coexist with non-agricultural employment, informal trade, and increased mobility (McGee, 2021; Firman, 2019; Handayani & Sihotang, 2022). These areas exemplify a complex spatial dynamic in which rural life increasingly adopts urban characteristics without entirely relinquishing its agrarian base.

This *desakota* phenomenon is not unique to Kediri. It has also emerged in peri-urban regions surrounding Yogyakarta, Bandung, and Greater Jakarta (Jabodetabek), where the intensity of rural-urban

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interactions has led to new forms of land use, labor reorganization, and spatial identity. These areas are no longer strictly rural in function but are not fully urban either, exhibiting a patchwork of rice fields, residential clusters, roadside markets, and informal service economies. The socio-spatial hybridity of such spaces poses both challenges and opportunities for planners and policymakers, especially in managing land use conflicts, infrastructure distribution, and livelihood resilience (McGee, 2021; Firman, 2019).

Within this evolving context, the concept of rural transformation has gained prominence in development and planning discourse. It refers to the broad and multidimensional transition of rural areas, involving shifts in economic structures, labor patterns, infrastructure, land use, and socio-cultural dynamics (Chigbu et al., 2019; World Bank, 2022). While often associated with deagrarianization, a process marked by the declining importance of agriculture in rural livelihoods recent scholarship challenges the assumption that agriculture is necessarily displaced. Instead, it highlights the reconfiguration of agricultural systems into more specialized, commercially oriented, or multifunctional forms (Rigg & Salamanca, 2019; Hazell & Rahman, 2020; FAO, 2021). In Southeast Asia, this includes transformations in Thailand's contract farming, Vietnam's peri-urban vegetable zones, and Indonesia's own horticultural clusters that integrate smallholders with value chains. These developments point to a shift not from agriculture to industry, but from traditional to adaptive agrarian systems.

From a global perspective, rural transformation is now also situated within the broader agenda of the Sustainable Development Goals (SDGs), particularly Goal 2 (Zero Hunger) and Goal 11 (Sustainable Cities and Communities). As emphasized by the FAO and OECD, transforming rural spaces in inclusive, productive, and sustainable ways is critical for long-term national development.

Kediri Regency in East Java illustrates this phenomenon in a compelling way. Located within an urbanizing corridor, Kediri has undergone extensive spatial reclassification, with 29 villages shifting from rural to urban status between 2000 and 2010 (BPS, 2022). This change is driven not only by demographic shifts but also by infrastructure investments and regional development projects most notably the construction of Dhoho Airport and the urban expansion of Kediri City (as a primary center) and Pare (as a secondary hub). Kediri's location within the Brantas River basin, coupled with its role as a horticultural distribution node, has made it a target for logistic and agricultural modernization. These spatial forces have intensified the integration of rural villages into regional economic networks, leading to land-use changes, increased connectivity, and economic diversification (Bappeda Kediri, 2023).

Prior to these changes, Kediri had been known for its intensive rice production and long-standing farmer groups, particularly in the southern areas. Pare, in particular, has functioned as a semi-urban marketplace and agricultural training center for decades. This historical role sets a distinctive context for observing how villages evolve under the influence of new infrastructure and reclassification. In recent years, Kediri has also experienced in-migration from nearby regencies, adding to the pressure on land and services.

Yet, despite these urbanizing pressures, Kediri's rural economy remains agrarian in character. Agriculture continues to employ over 30% of the local labor force, and agricultural GDP and productivity indicators have remained stable or even improved over the past five years. For example, although the total area of agricultural land declined from 101,588 hectares in 2017 to 90,408 hectares in 2021, rice and horticultural productivity increased, and farm-based incomes remained competitive (BPS Kediri, 2022). Key crops in the region include rice, corn, chili, and shallots, which are increasingly produced through improved cultivation methods. These findings suggest a complex agrarian transition, where agriculture persists not as a remnant of the past, but as a sector undergoing adaptation through new forms of production and institutional restructuring.

To understand this dynamic, it is crucial to examine rural production systems the constellation of resources, relationships, and institutions that underpin rural livelihoods. These include tangible assets such as land, equipment, and infrastructure; intangible assets like social networks and knowledge; and the institutional arrangements that mediate access to markets, credit, and public services (Scoones, 2015; Wiggins & Keats, 2020). Rural production systems are inherently spatial and dynamic: they are shaped by their proximity to urban centers, availability of infrastructure, and engagement with markets and governance networks. They also reflect path dependencies where historical practices, land tenure, and cooperative structures affect the ability to innovate and adapt.

Recent studies emphasize that rural transformation cannot be fully understood without engaging with the spatial dimension. Proximity to urban areas plays a pivotal role in shaping these systems. Villages nearer to cities often benefit from better access to transportation, services, and off-farm employment, enabling more diversified livelihood strategies. Conversely, more remote villages may remain dependent on subsistence agriculture and informal institutions, with limited access to innovation and external networks (Reardon et al., 2021; Tacoli, 2020). Indicators such as road access, irrigation availability, digital connectivity, and institutional density vary greatly even within a single regency. These spatial variations result in divergent transformation trajectories, making it essential to analyze rural transformation in context-specific ways.

This study seeks to analyze how rural production systems operate and adapt within the context of rural transformation in Kediri Regency. It focuses on three key dimensions: (1) rural household assets—including physical, natural, financial, and social capital; (2) local production arrangements and institutional linkages; and (3) agricultural production models and their evolution. The empirical analysis is based on a comparative study of three villages: Petok, Gempolan, and Bringin which represent different typologies based on their spatial proximity to Kediri City and Pare.

By investigating these dimensions, the study aims to answer the research question: *How do rural production systems function and adapt in the context of spatially differentiated rural transformation in Kediri*

Regency? In doing so, this research contributes to the broader understanding of agrarian change and offers practical insights for designing rural development strategies that are context-sensitive, spatially responsive, and grounded in local production realities. Moreover, it addresses a notable gap in the Indonesian literature, where spatial analysis of rural production systems remains underexplored despite their critical role in shaping equitable rural development.

Furthermore, the study fills a gap in the Indonesian literature on rural change by offering grounded analysis of village-level production dynamics in a regency that reflects broader rural-urban transitions occurring across Java. Its spatially comparative design strengthens the relevance of its findings to similar peri-urban districts facing pressure from urban expansion and infrastructural development.

2. Research Method

2.1. Study Area and Case Selection

This study was conducted in Kediri Regency, East Java Province, a region undergoing significant rural transformation. According to Statistics Indonesia (BPS), 29 rural villages in Kediri were reclassified as urban areas between 2000 and 2010, indicating widespread changes in land use, population density, and spatial functions. The regency lies within the influence of Kediri City, a primary urban center, and Pare, a secondary urban growth node. These cities play a crucial role in accelerating regional transformation through economic integration, infrastructure expansion, and service delivery.

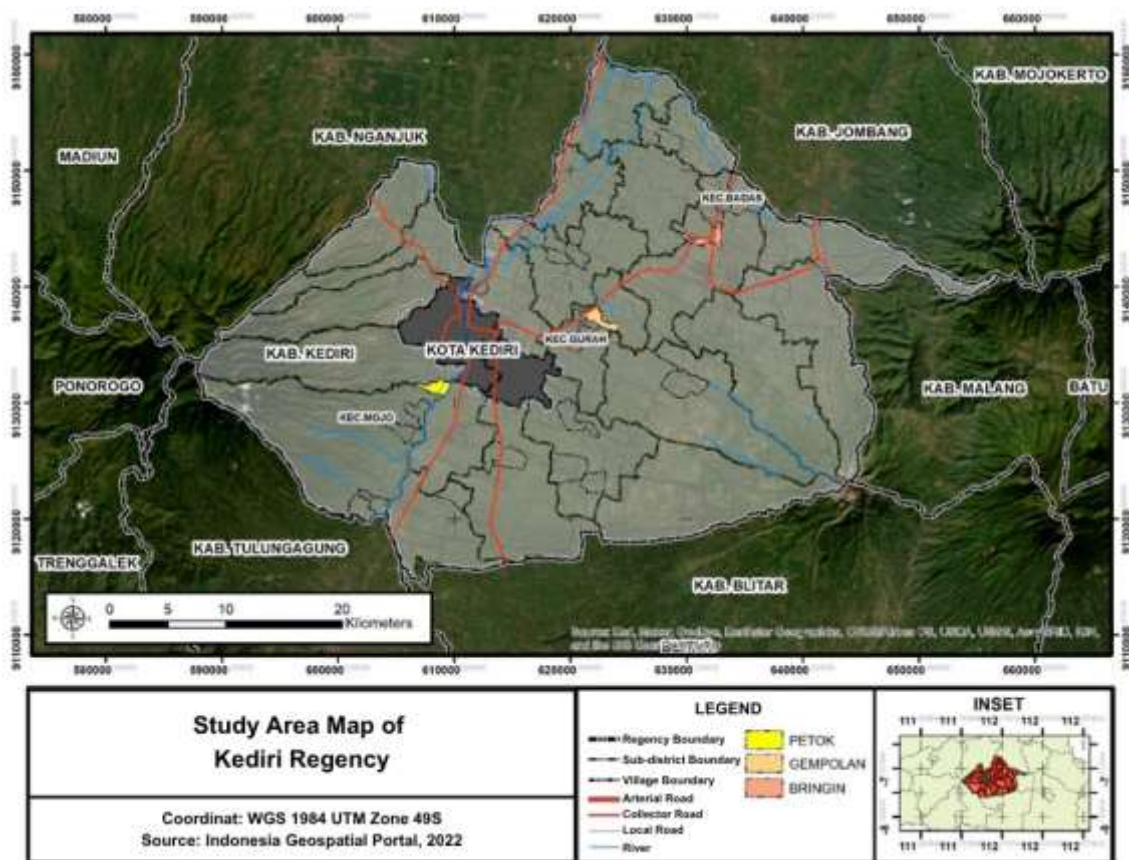


Figure 1 Study Area of Kediri Regency

To capture the spatial diversity of transformation trajectories, three villages were selected for in-depth study: Petok, Gempolan, and Bringin. Each village represents a unique spatial typology based on its proximity to Kediri City and Pare. Petok is located approximately five kilometers from Kediri City and twenty kilometers from Pare; Gempolan is situated roughly ten kilometers from both urban centers; and Bringin is twenty kilometers from Kediri City but only five kilometers from Pare. These variations provide an analytical basis for understanding how urban proximity influences rural production systems. Furthermore, the selected villages differ in population growth rates, agricultural activity intensity, and infrastructure access, making them ideal for comparative spatial analysis.

2.2. Data Collection and Analytical Methods

The research applied a quantitative-descriptive approach, complemented by field observations and semi-structured interviews to validate and enrich the quantitative findings. Primary data were collected through a structured questionnaire administered to 102 farming households, comprising 34 respondents from each of the three villages. A multistage sampling strategy was used to identify respondents. In the first stage, area sampling was employed to select the three case study villages based on spatial criteria. In the second stage, snowball sampling was used to reach active farming households, defined as households with

at least one productive-age member (between 15 and 64 years) engaged in agricultural work. This sampling method was particularly suitable given the absence of detailed administrative data on farming households in village-level records.

The questionnaire covered three dimensions of rural production systems: household assets, local production organization, and agricultural production models. It included questions on physical assets such as farming equipment and infrastructure; natural assets including land tenure and cropping patterns; financial resources such as savings, credit access, and agricultural insurance; and social capital components like trust, shared norms, group membership, and participation in village institutions. Additional questions explored operational aspects of production systems, including cooperation mechanisms, land ownership structures, crop choice behavior, input strategies, post-harvest practices, and access to local and regional markets.

Secondary data were collected from official government reports, village spatial planning documents, and statistical records provided by BPS and regional development agencies. These documents were used to contextualize the primary findings and triangulate the household-level data. The data collection process took place over a three-month fieldwork period in early 2023. Questionnaires were distributed manually using door-to-door visits and responses were digitized and managed through an online platform.

For data analysis, descriptive statistics were used to identify patterns across the three case study villages. These included frequency distributions, cross-tabulations, and comparative summaries of variables across village typologies. Quantitative findings were supported by field observations that documented the physical condition of agricultural tools, irrigation facilities, cropping systems, and local infrastructure. Additionally, insights from interviews with village heads, local cooperative members, and key informants were used to deepen the interpretation of household strategies, institutional support mechanisms, and adaptation processes. These mixed-method approaches allowed for a comprehensive understanding of how rural production systems function and evolve amid the pressures of rural transformation.

The analytical framework was guided by concepts from sustainable livelihoods theory and territorial rural development. In particular, the work of Scoones (2015) on asset-based livelihood strategies and the sustainable use of rural resources provided the theoretical backbone for evaluating household conditions. Meanwhile, insights from Tacoli (2020) and Reardon et al. (2021) on rural-urban linkages informed the spatial interpretation of village-level differences. This framework enabled the research to account for both internal village dynamics and external urban influences in analyzing rural transformation processes.

The conceptual framework guiding this study is visualized in Figure 2. It outlines the core components of the rural production system analyzed: household assets, local production arrangements, and agricultural production models, all situated within a spatial transformation context.

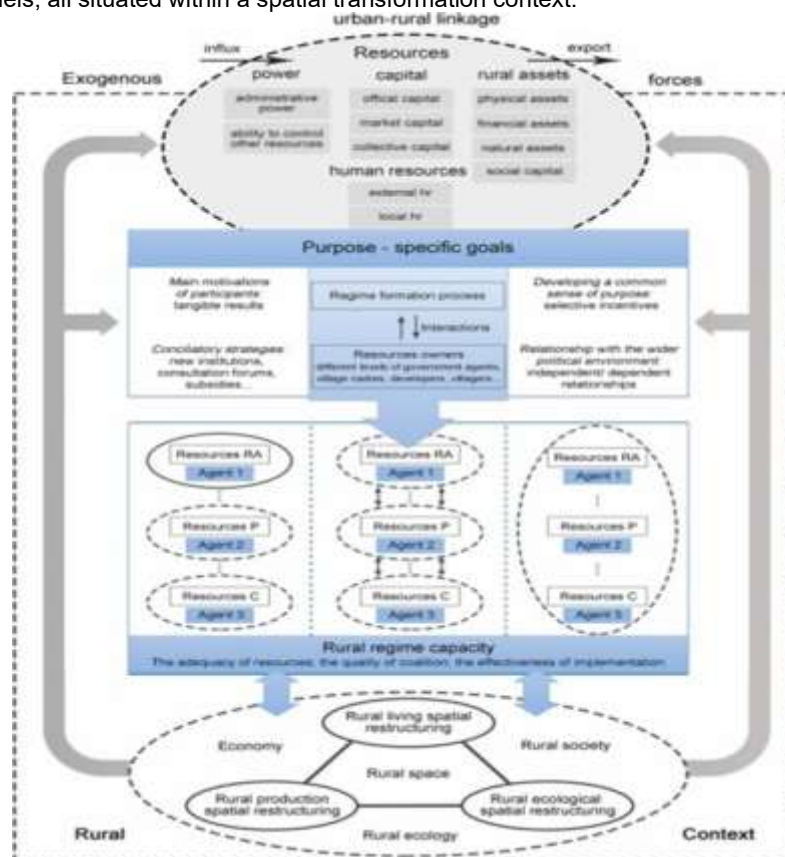


Figure 2 Diagram of Rural Production System

3. Result and Discussion

3.1. Rural Assets and Transformation Capacity

Rural assets in Kediri Regency exhibit dynamic transformation potential that shapes local capacity for rural adaptation. Across Petok, Gempolan and Bringin, household assets reflect a transition from subsistence to more adaptive and semi-commercial systems, especially in physical, natural, and social domains. The increasing use of machinery tractors, threshers, and irrigation pumps, demonstrates growing mechanization, with notable concentrations in Bringin and Gempolan where asset diversity is highest. While Petok also display mechanization, its physical capital remains less varied, reflecting limited connectivity and institutional access.

In Bringin, some farmers reported the shared use of mechanized tools such as rice threshers and water pumps, which were either collectively purchased through farmer groups or loaned from nearby cooperatives. This arrangement lowers capital barriers and reflects early signs of resource pooling among smallholders. Figure 3 presents a comparative view of production-related household assets across the three villages, highlighting variation in physical and natural capital.

In Petok, where formal equipment ownership remains low, some farmers rely on rotational labor groups locally known as *tandak*. These informal arrangements help households share labor during peak planting and harvest periods, reducing costs and enhancing social cohesion. Respondents explained that such practices have persisted for decades and provide an essential safety net, particularly for older or less-resourced farmers. Meanwhile, in Bringin, shared ownership of equipment like threshers or irrigation pumps is often organized through informal farmer groups, enabling access without full capital outlay. One Bringin farmer described, "We take turns using the machine, and everyone contributes to maintenance it's like a family system but between farms." These practices highlight how physical and social assets interact to strengthen production capacity and resilience.

In addition to mechanization, farmers in Bringin and Gempolan have gradually adopted water-saving practices such as limited irrigation schedules and organic mulch application. These small-scale efforts signal increasing environmental awareness and resilience thinking at the farm level. Informants also reported increased collaboration in sharing irrigation responsibilities, particularly during the dry season, which enhances collective efficiency.

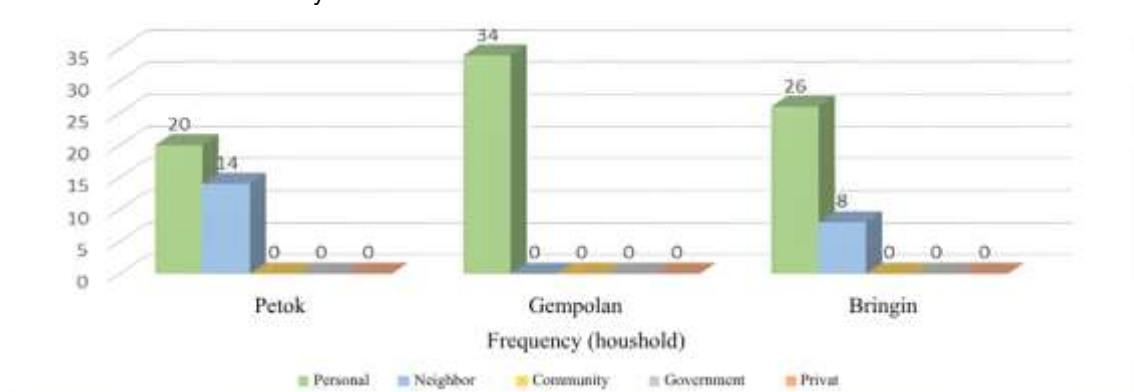


Figure 3. Chart: Household Asset Ownership Comparison

Natural assets remain constrained by shrinking agricultural land due to conversion, yet farmers respond through crop diversification. Bringin and Gempolan households adopt intercropping systems combining rice, shallots, and corn to stabilize income and optimize land use. This shift reflects broader strategies endorsed by FAO (2021), which underscores diversification as a fundamental rural resilience approach.

In terms of financial capital, a few households in Gempolan and Bringin accessed informal savings schemes or cooperative-based microcredit to purchase seeds and fertilizer. However, no respondents reported access to formal agricultural insurance, indicating a gap in institutional risk management.

Social capital, while uniformly present, differs in depth and external linkage. In all three villages, farmers engage in mutual labor exchanges and informal support systems. However, Bringin shows stronger linking social capital through ties with agro-industry actors such as Aura Seed and BISI, providing not only employment but also access to product information and market channels. This contrasts with Petok, where cooperation tends to remain localized and less institutionally integrated. According to Chirwa & Dorward (2021), external linkages are vital in enhancing learning, innovation diffusion, and collective bargaining power in rural production contexts.

Infrastructure an essential extension of physical capital also differentiates the three villages. While all three use surface and diesel-based irrigation systems, Bringin and Gempolan have adapted more consistently to decline river flows by investing in diesel pumps and, in Gempolan's case, bore wells. These adaptations align with Prayitno & Arsyad (2009), who argue that adaptive use of production infrastructure correlates strongly with agrarian productivity under changing environmental conditions.

3.2. Local Production Systems and Organizational Resilience

Local production systems in Kediri are defined by family labor, seasonal cooperation, and gradual institutional structuring. While traditional norms remain dominant, emerging organizational forms suggest a shift towards semi-modern coordination. In Petok, cooperative groups facilitate seasonal procurement and irrigation scheduling, particularly in water-scarce months. Bringin, more innovatively, has instituted a collective fund for input subsidies, mimicking financial services within producer cooperatives a model similar to Hellin et al., (2019)'s findings on grassroots-led agricultural innovation.

Gempolan, however, shows minimal institutional dynamism. While several farmer groups exist, participation is sporadic and largely centered on elite farmers with prior market exposure. Informal information diffusion through respected elders or farmer-leaders dominates knowledge transfer. This reflects broader literature that warns against exclusionary dynamics within rural producer groups when they fail to engage less-connected households (Wiggins & Keats, 2020).

Interviews with key informants in Gempolan revealed that leadership within farmer groups tends to remain unchanged over several cycles, which discourages the participation of younger and more dynamic farmers. This stagnation reduces opportunities for innovation diffusion and limits intergenerational knowledge exchange.

Land tenure and plot fragmentation continue to influence production scale. Bringin, with more consolidated holdings, facilitates better mechanization and scale-based decision-making. In contrast, land leasing and fragmented ownership are common in Petok and Gempolan, limiting long-term planning and reducing capacity for intensive investment. Hazell & Rahman (2020) emphasize that land consolidation is foundational to enhancing smallholder productivity under rural transformation.

Moreover, spatial dynamics significantly shape organizational resilience. Bringin and Gempolan's proximity to both Kediri City and Pare ensures stronger access to services, infrastructure, and institutional actors. These villages lie within regional arterial corridors-linking to markets and agro-industrial firms, thus benefiting from what Douglass (1998) described as spatial multiplicity: layered rural-urban interactions that reinforce systemic adaptation.

Interviews also revealed generational barriers in farmer group leadership. In Gempolan, many farmers groups are led by elder males who have retained positions for multiple cycles. While their experiences are respected, this limits engagement from younger, more educated farmers many of whom expressed reluctance to join decision-making due to a perceived lack of voice. One youth respondent commented, "I would attend, but the group never changes; it's the same ideas and leaders." Conversely, Bringin has begun involving younger members in group tasks like fertilizer procurement and equipment coordination. Though informal, these efforts suggest potential for greater inclusivity and long-term institutional sustainability, especially when combined with local cooperative support.

In addition, informal women's savings groups in Bringin also support agricultural activities such as joint seed purchases or shared post-harvest labor. These groups, although not formally recognized as farmer institutions, fill an important coordination gap and provide alternative platforms for economic collaboration. Their contribution to risk-sharing and production efficiency remains underrepresented in policy design, but field evidence suggests their growing role in organizing flexible labor and financial strategies at the neighborhood level.

3.3. Agricultural Production Models and Spatial Variation

Agricultural production systems across the three case villages illustrate a continuum from monoculture and traditional input use to diversified, knowledge-driven practices. Petok remains reliant on rice and corn monoculture, with limited intercropping and value-addition. Most inputs are purchased individually, and irrigation remains dependent on both seasonal river flows and diesel pumps, adapted to the temporal rhythm of rainfall. Labor shortages and aging farmer demographics further constrain innovation capacity. Figure 4 illustrate the diversity of cropping models and input use, reflecting spatially differentiated agricultural strategies.

Table 1. Cropping Patterns and Models per Village

Objective	Variable	Desa Petok	Desa Gempolan	Desa Bringin
Rural Agricultural Production System Model	Cropping System Choices	<ul style="list-style-type: none"> No intercropping Increased production and cost minimization 	<ul style="list-style-type: none"> 23,5% intercropping Time efficiency and reduced labor 	<ul style="list-style-type: none"> 8,8% intercropping Time efficiency and profit
	Cropping System Management Decisions	<ul style="list-style-type: none"> Rice variety Inpari 32 and sweet corn Herbicide, insecticide, rodenticide Urea fertilizer and POSKA River irrigation and diesel pumps Average farmers: <5 people/hectare Dominant age: 50-54 years Balanced gender proportion 	<ul style="list-style-type: none"> Rice variety Inpari 32, sweet corn, and some chili Insecticide, fungicide, rodenticide Urea fertilizer, NPK, POSKA More frequent use of diesel irrigation Average farmers: <5 people/hectare Dominant age: 45-49 years Balanced gender proportion 	<ul style="list-style-type: none"> Rice variety Inpari 32, sweet corn, red onion, vegetables Insecticide, rodenticide, herbicide Urea fertilizer and POSKA More frequent use of diesel irrigation Average farmers: 5-10 people/hectare Dominant age: 45-49 years Balanced gender proportion
	Harvest Outcomes and	<ul style="list-style-type: none"> Average production: 5-10 quintals/harvest 	<ul style="list-style-type: none"> Average production: 5-10 quintals/harvest 	<ul style="list-style-type: none"> Average production: 5-10 quintals/harvest

Objective	Variable	Desa Petok	Desa Gempolan	Desa Bringin
Failure Phenomena	• 41,2% processing (corn)	• 55,9% processing (corn)	• 26,5% processing (corn and shallots)	
	• Crop failure is rare	• Crop failure is rare	• Crop failure is rare	
	• Market access: Kembaran and Gringging Market (Grogol)	• Market access: Tengger Lor Market, Menang (Pagu), and Pare Central Market	• Market access: Pare Market, Tulungagung Central Market, Blitar	

In contrast, Gempolan and Bringin show growing use of intercropping techniques and input integration. Farmers in these villages increasingly adopt rotational planting, organic inputs, and integrated pest management. Younger farmers are particularly active in this regard, reflecting both generational and educational effects. This transition mirrors FAO's (2021) view of rural transformation as a platform for agricultural innovation rather than abandonment.

Quantitative survey data further underscore these differences. In Bringin, 65% of households practiced intercropping, particularly combining rice with shallots or secondary legumes. In Gempolan, the rate was slightly lower at 52% while Petok lagged behind at just 26%. The adoption of organic inputs and rotational planting systems was also significantly higher in Bringin, which benefits from consistent extension services from nearby Pare. In contrast, Petok residents cited distance and limited digital access as barriers to receiving up-to-date technical advice. These disparities show how geographic proximity to secondary cities not only enhances market access but also facilitates innovation in everyday farming practices.

Post-harvest handling and market integration show the clearest divergence. While Petok primarily sells unprocessed crops locally, Bringin and Gempolan households have begun engaging in on-site drying, packaging, and even basic processing. Bringin, in particular, benefits from direct access to Pare's central market and the logistics route connecting Kediri, Ngasem, and Tulungagung. Households market their produce through both direct sales and intermediary agents (*tengkulak*), increasing their bargaining flexibility. Figure 5 provides a simplified flow of post-harvest handling and market distribution, particularly in Bringin and Gempolan.

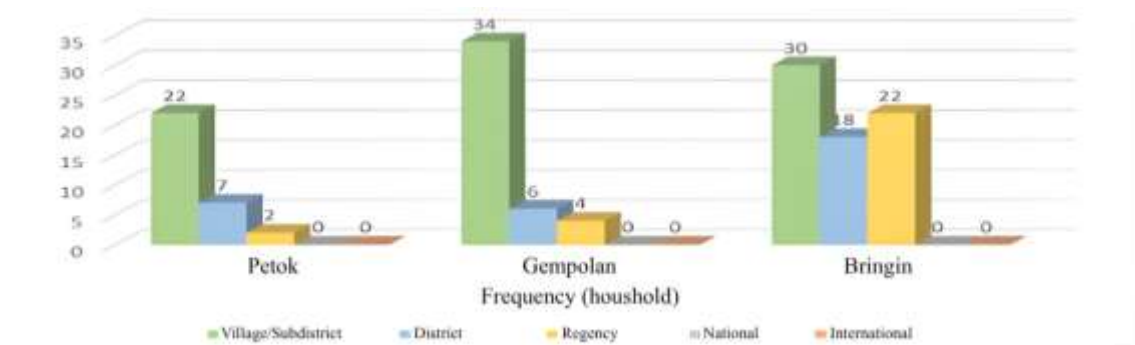


Figure 5. Market Access and Post-Harvest Channels

In Bringin, several farmers noted the use of WhatsApp groups to coordinate harvest schedules and buyer deliveries, particularly for horticultural products sold in the Pare market. Although not widespread, such practices signal emerging digital integration in rural marketing channels.

Some farmers in Bringin have initiated small-scale packaging and labeling of their dried shallots and chili powder, targeting local kiosks and market stall in Pare and Kediri. While still informal, these efforts mark a transition toward value-added agribusiness, suggesting that rural production is beginning to diversify beyond raw crop sales. These innovations are typically led by younger farmers, who are more familiar with market demands and customer preferences. Additionally, a few farmers have begun experimenting with online platforms, although poor digital connectivity in Petok and parts of Gempolan remains a challenge.

These practices reflect what Tacoli (2020) terms locational leverage, where spatial positioning determines integration into food systems and value chains. The presence of market roads and regional infrastructure amplifies this leverage, enabling peripheral rural areas like Bringin to compete more effectively in agricultural commercialization.

Yet, systemic constraints persist. Subsidized fertilizer access is limited and erratic; households must often purchase expensive commercial fertilizers at high cost, placing financial pressure on smaller operators. In Gempolan, vulnerability is further amplified by limited water access and historical susceptibility to seasonal flooding, which affects planting reliability and restricts equipment use.

Moreover, while technology adoption is increasing, it is not uniform. Machinery such as rotavators, rice seeders, and drying units are concentrated in Gempolan, where production challenges have necessitated greater adaptation. In Petok and Bringin, these tools remain scarce or centralized among better-resourced households.

Ultimately, spatial variation shapes not only resource access and productivity but also the willingness to innovate. Villages embedded within active rural-urban corridors are more likely to evolve adaptive models, while spatially isolated communities lag behind. In addition, younger farmers and women are increasingly participating in post-harvest activities such as drying, sorting, and selling, through their involvement in upstream production decisions remains limited. Gender and age therefore intersect with spatial and institutional factors in shaping production roles. These patterns affirm the arguments of Woods (2021), who identifies spatial asymmetries as central to contemporary rural change.

4. Conclusion

This study has examined the dynamics of rural production systems in Kediri Regency and their role in shaping and responding to processes of rural transformation. By focusing on three representative villages: Petok, Gempolan, and Bringin. This research demonstrates that while structural pressures such as urban expansion, land conversion, and economic reclassification are present, agriculture remains a resilient and adaptive sector. Rural transformation in Kediri is not defined by deagrarianization, but rather by the emergence of hybrid production systems that blend traditional practices with modern strategies, contingent upon spatial context, institutional capacity, and asset endowments.

Three key insights emerge from the analysis. First, rural assets, especially physical infrastructure, natural resources, and social capital are central to shaping household capacity to adapt and innovate. Villages with higher connectivity to urban centers and markets, such as Bringin and Gempolan, tend to exhibit stronger asset portfolios and greater responsiveness to changing production demands. Second, local production systems are evolving, albeit unevenly. While family-based labor and land tenure structures remain foundational, there are early signs of semi-formal coordination, particularly through farmer groups and informal financial mechanisms. These systems, when inclusive and well-organized, offer the potential to facilitate input access, knowledge sharing, and production efficiency.

Third, spatial variation plays a decisive role in shaping agricultural production models. The proximity of Bringin to market infrastructure has enabled households to diversify cropping systems and participate more actively in post-harvest value chains. Conversely, Gempolan's weaker institutional integration and physical constraints such as water scarcity and flooding—limit production flexibility and resilience. These findings echo broader debates in rural studies that underscore the importance of spatial asymmetries and place-specific strategies in understanding agrarian transition.

Based on these insights, several policy implications are evident. First, rural development programs should adopt a spatially differentiated approach, recognizing that villages positioned closer to urban centers or along market corridors may require different interventions than those in more peripheral or resource-constrained areas. For instance, support for market linkages, agro-processing units, and infrastructure in areas like Bringin can consolidate emerging production advantages. Meanwhile, in villages like Gempolan, policies should prioritize basic infrastructure investments, such as irrigation reliability and land rehabilitation, to enhance production stability.

Second, policies should strengthen local institutional capacities, particularly farmer organizations, to facilitate inclusive coordination. Encouraging the formation and revitalization of producer cooperatives with transparent leadership, accessible financial services, and embedded knowledge-sharing platforms can improve input access, support innovation, and reduce vulnerability to market volatility.

Third, there is a clear need to support asset-based rural transformation. Programs that enhance access to productive assets mechanization tools, land security, and water infrastructure will directly improve adaptive capacity. This is especially relevant as climate variability and input price fluctuations intensify pressure on smallholders.

Lastly, policymakers should resist treating rural transformation as synonymous with urbanization or non-agricultural expansion. Instead, agriculture should be seen as a strategic sector capable of transformation in its own right through commercialization, diversification, innovation, and rural entrepreneurship. Supporting this form of agrarian modernization can contribute not only to rural resilience but also to inclusive regional development that bridges the rural-urban divide.

The study also contributes methodologically by integrating spatial typologies into the analysis of rural production systems. While many rural development studies focus on sectoral change or macro indicators, this research highlights the importance of micro-spatial variation in shaping rural responses. By situating production systems within different spatial configurations of Kediri Regency, the analysis captures how everyday decisions are shaped not only by household capacity but also by physical distance to markets, access to infrastructure, and historical institutional exposure. Future research should continue exploring these multi-scalar interactions, particularly in districts undergoing rapid reclassification and infrastructure-driven growth.

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