REVISTA INVECOM
ISSN en línea: 2739-0063

Sustainable development of farmers through production chains: theoretical approaches and territorial evidence

Desarrollo sostenible de agricultores mediante cadenas productivas: enfoques teóricos y evidencia territorial

Received: 10/06/2026 - **Accepted:** 13/08/2026

Guido Holguín Ferro
https://orcid.org/0000-0001-7235-4500
gholguin@unamad.edu.pe
Universidad Nacional Amazónica de Madre de Dios. Puerto Maldonado, Peru

Giovana Lira Jiménez
https://orcid.org/0000-0002-1242-3727
giovi.telme@gmail.com
Universidad Nacional Amazónica de Madre de Dios. Puerto Maldonado, Peru

Fátima Irene Balarezo Bustinza
https://orcid.org/0009-0005-8714-6348
025101970h@uandina.edu.pe
Universidad Andina del Cusco. Cusco, Peru

Abstract

The development of agricultural value chains is a strategic pathway to strengthen productivity, generate added value, enhance market integration, and promote territorial sustainability in Amazonian regions. This study aimed to analyze the importance of value chains for the economic development of farmers in the Tambopata province, Madre de Dios region, through a literature review and territorial analysis. Methodologically, a descriptive-analytical study with a qualitative approach was conducted, based on a narrative review of academic literature and official institutional sources on production, innovation, market integration, and forest conservation. The analysis incorporated theoretical frameworks on value chains, global governance, and sustainable development. The main findings demonstrate that the sector's constraints are not limited to primary production but also include limitations in infrastructure, financing, technical assistance, processing, traceability, and negotiation. Furthermore, specific opportunities were identified in the Brazil nut, cacao, cupuaçu, and forest conservation value chains. In March 2026, eight native communities and 22 small-scale producers projected sales of S/ 4.3 million with 418 tons of sustainable products. It is concluded that regional development policy must shift from a focus on primary production volume to a strategy based on integration, processing, innovation, and access to value-added markets.

Keywords: agriculture, economic development, sustainability.

Resumen

El desarrollo de las cadenas productivas agropecuarias constituye una vía estratégica para fortalecer la productividad, la generación de valor agregado, la articulación comercial y la sostenibilidad territorial en regiones amazónicas. El presente estudio tuvo como objetivo analizar la importancia de las cadenas productivas para el desarrollo económico de los agricultores de la provincia de Tambopata, región Madre de Dios, a partir de una revisión documental y un análisis territorial. Metodológicamente, se desarrolló una investigación descriptiva-analítica con enfoque cualitativo basada en una revisión narrativa de literatura académica y fuentes institucionales oficializadas sobre producción, innovación, articulación comercial y conservación de bosques. El análisis incorporó los enfoques teóricos de encadenamientos productivos, cadenas de valor, gobernanza global y desarrollo sostenible. Los hallazgos principales evidencian que las restricciones del sector no se limitan al ámbito primario, sino que involucran limitaciones de infraestructura, financiamiento, asistencia técnica, transformación, trazabilidad y negociación. Asimismo, se identificaron oportunidades concretas en las cadenas de castaña, cacao, copoazú y productos provenientes de bosques conservados. En marzo de 2026, ocho comunidades nativas y 22 pequeños

productores proyectaron ventas por S/ 4,3 millones con 418 toneladas de productos sostenibles. Se concluye que la política de desarrollo regional debe transitar de un enfoque centrado en el volumen primario hacia una estrategia basada en la articulación, transformación, innovación y acceso a mercados de valor agregado.

Palabras clave: agricultura, desarrollo económico, sostenibilidad.

Introduction

Agriculture serves a strategic economic, social, and environmental function across the rural territories of the Peruvian Amazon, where it bears directly on employment generation, household income, food security, and ecosystem conservation. Increasingly, however, the sector's economic contribution hinges less on isolated primary production and more on the ability of local actors to coordinate with one another, add value to their goods, meet international standards, access timely information, and connect with dynamic markets.

In the province of Tambopata, Madre de Dios region, the challenge of agricultural development is far from straightforward. A farming system may post acceptable yields per hectare and still leave rural households with meager earnings whenever postharvest losses remain high, bargaining power is weak, value addition is minimal, logistics costs are steep, and access to differentiated markets is limited. Addressing this problem matters precisely because the Amazon must reconcile economic growth and poverty reduction with environmental conservation and climate change mitigation.

The conceptual framework underpinning this study draws on production-chain theory together with the contemporary value chain approach. Porter (1985) first proposed the value chain as a tool for examining how interconnected activities generate competitive advantage. Gereffi et al. (2005) later extended this analysis to Global Value Chains (GVCs), arguing that chain governance is shaped by the complexity of transactions, the codifiability of information, and supplier capabilities. From a sustainability standpoint, Altieri et al. (2017) contend that agroecological approaches foster resilient farming systems, while the Food and Agriculture Organization of the United Nations (FAO, n.d.) stresses that building sustainable agrifood chains requires connecting smallholders with resources, technology, and information. Karatepe and Scherrer (2024), for their part, caution that participation in value chains does not by itself guarantee socioeconomic gains unless it is accompanied by collective action and supportive public policy.

Prior research and sector-level diagnostics in the region point to meaningful institutional progress. CITEproductivo Madre de Dios, for instance, has prioritized intervention lines in the Brazil nut, cupuaçu, and cacao agroindustries (Instituto Tecnológico de la Producción [ITP], 2026). The Economic Commission for Latin America and the Caribbean (CEPAL, 2024) likewise reported advances within the Amazonian Brazil nut cluster through traceability initiatives, water and carbon footprint measurement, and linkages to specialty markets. Diaz (2024) further substantiated the technological development prospects of cupuaçu through fermentation and agroindustrial processing techniques.

Against this backdrop, the present study contributes to the existing body of work by updating the regional productive diagnosis with recent institutional evidence through 2026 and by proposing a strategic matrix linked to territorial governance. The study is set in the province of Tambopata, an area marked by high biodiversity, mounting pressure on land use, and a productive landscape in transition toward sustainability. Accordingly, the overall objective of this research is to examine the importance of production chains for the sustainable economic development of farmers in the province of Tambopata, drawing on a review of theoretical approaches and updated territorial evidence.

Methodology

This study followed a qualitative, descriptive-analytical approach, built on a non-experimental, documentary design. The methodological strategy consisted of a systematized narrative review of the scientific literature together with official statistical and institutional information on the agricultural production chains of the province of Tambopata, Madre de Dios.

The unit of analysis comprised the leading agricultural and non-timber forest chains of the province of Tambopata, spanning the links of input supply, primary production, collection, agroindustrial processing, marketing, and consumption. The documentary population included indexed academic publications, institutional technical reports, and public statistical series. Inclusion criteria were: (a) scientific articles addressing value chains, governance, and sustainable development; (b) official publications issued by state agencies and international bodies between 2024 and 2026; and (c) studies with a territorial focus on the Peruvian Amazon and Madre de Dios. Informal outreach materials and sources containing unverifiable data were excluded.

Data collection relied on documentary review and content analysis. Supporting instruments included bibliographic record sheets and thematic systematization matrices organized by production link, constraint, and market opportunity. Official information was drawn from the National Institute of Statistics and Informatics (INEI, 2025), the Ministry of the Environment (MINAM, 2026), CEPAL (2024), ITP (2026), and the National Amazonian University of Madre de Dios (UNAMAD).

Information analysis proceeded through theoretical and conceptual triangulation, contrasting the analytical categories (governance, value addition, associativity, and sustainability) against secondary empirical evidence. On ethical grounds, scientific rigor, thematic fidelity, and full respect for intellectual property were ensured through precise citation of all consulted sources following APA seventh-edition guidelines. Among the study's limitations is its reliance on secondary data; accordingly, the figures reported for commercial events should be read as market intentions rather than primary field data.

Results and discussion

This section presents the central findings on production chains in Tambopata, organized around two axes: (i) the evolving territorial diagnosis and the sector's structural constraints, and (ii) commercial integration and technological innovation as enabling factors for sustainable development. Drawing on the documentary review and updated territorial evidence, the discussion then turns to what these results imply for value capture and the economic sustainability of the province's farmers.

Evolving territorial diagnosis and constraints in Tambopata

The documentary analysis shows that the constraints facing Tambopata's productive sector have shifted over time, moving away from purely agronomic shortcomings toward structural bottlenecks in processing and marketing. The statistics of INEI (2025) confirm that primary production volumes have held steady; even so, producers continue to face financing gaps, a shortage of specialized technical assistance, and unresolved land tenure issues. This shift mirrors a pattern documented in other agrifood chains, where field-level productivity ceases to be the binding constraint once basic thresholds are met, and competitiveness instead comes to depend on the capacity to add value, meet quality standards, and reach formal markets.

Table 1 sets out the area's main production chains, their potential for value addition, the opportunities identified as of 2026, and the priority gaps that call for attention. Identifying these gaps makes it possible to prioritize interventions that go beyond raising yields, instead strengthening critical links such as primary processing, marketing logistics, and engagement with institutional and private buyers.

Table 1

Main production chains and current opportunities in Tambopata

Chain / Activity	Value potential	Current opportunities	Priority gaps
Brazil nut	High potential for processing and differentiation	Traceability, environmental footprint, derivative products, specialty markets	Quality, financing, logistics, governance, and value capture
Cacao	Processing into paste, chocolate, and other derivatives	Quality, certification, local processing, market integration	Productivity, postharvest handling, technical assistance, and market access
Cupuaçu	Agroindustrial diversification	Pulp, chocolate, beverages, and other derivatives; technological development	Scale, standardization, markets, and business capabilities
Products from conserved forests	Differentiation through sustainability and origin	Brazil nut oil, cacao, cupuaçu, huicungo, and other products	Traceability, volume, logistics, and commercial continuity
Aquaculture	Regional supply and value addition	Production and technological innovation	Infrastructure, health standards, market access, and management

Note. Adapted from ITP (2026), CEPAL (2024), MINAM (2026), and Diaz (2024).

Market integration and technological innovation

The findings indicate that market integration is a key driver of sustainable economic development for Tambopata's farmers. As MINAM (2026) reported, a business roundtable held in Puerto Maldonado in March 2026 brought together eight native communities and 22 smallholders from Madre de Dios, who projected sales exceeding S/ 4.3 million on an offering of 418 tons of sustainable products. Brazil nut derivatives accounted for the largest share of purchase intentions at that event, totaling S/ 3.3 million, followed by cacao, cupuaçu pulp, and huicungo oil. These results point to consolidated demand for Amazonian products carrying sustainability attributes, provided that volume, quality, and traceability can be guaranteed.

On the technological front, Diaz (2024) demonstrates that cupuaçu cultivation holds considerable potential for producing butter, liqueur, and chocolates with a distinct territorial identity, provided that the fermentation and drying stages are standardized. This evidence aligns with the findings of CEPAL (2024), which highlight the Brazil nut cluster's work in measuring water and carbon footprints to position Amazonian products within high-value international niches. Together, innovation in postharvest processes and the adoption of environmental sustainability indicators allow Tambopata's products to stand out in markets that prize not only sensory quality but also the socio-environmental performance of the chains behind them.

Table 2 systematizes the sector's constraints and possible solutions through a matrix of problems, opportunities, and suggested indicators. This matrix functions as a planning tool that links the territorial diagnosis to concrete lines of action, thereby facilitating coordination among public, private, and community actors.

Table 2

Matrix of problems, opportunities, and development indicators

Problem / Gap	Effect on the chain	Intervention opportunity	Suggested indicator
Low processing capacity	Reduced value capture	Processing centers and product development	% of processed production
Weak market integration	Dependence on intermediaries	Business roundtables and responsible contracts	No. of sustainable trade agreements
Limited traceability	Impedes access to differentiated markets	Digital traceability systems	% of traceable batches
Insufficient financing	Constrains investment and scaling	Agricultural finance and guarantee mechanisms	Productive credit amount / producer
Technological deficit	Low productivity and quality	CITE centers, universities, and technology extension	No. of producers receiving technological assistance
Environmental risk	Loss of resources and reputation	Agroforestry and conservation-compatible production	Hectares under sustainable management
Weak associative management	Low bargaining power	Organizational strengthening	Margin / collective bargaining capacity

Note. Authors' own elaboration based on the documentary review.

Implications for value capture and sustainability

The results confirm that Tambopata's sustainable economic development calls for moving beyond the assistentialist paradigm of simply raising harvest volume per hectare, an approach that has proven inadequate for structurally improving smallholder incomes. Persisting with a model centered exclusively on primary productivity fails to address power asymmetries or the barriers that block access to more lucrative markets, thereby perpetuating dependence on intermediaries and exposure to price volatility. As Gereffi et al. (2005) argue, value capture within a chain hinges on the type of governance in place and on suppliers' ability to meet complex specifications for quality, volume, traceability, and sustainability, requirements that reach well beyond raw production alone.

For Tambopata, this means that interventions ought to prioritize building capacity for primary and secondary processing, covering fermentation, drying, and transformation techniques that yield derivatives with a territorial identity, alongside the standardization of postharvest processes and certification of differentiating attributes such as organic status, fair trade, or carbon footprint. So long as Tambopata's farmers continue selling only unprocessed raw materials, profitability will remain marginal regardless of the volumes produced, given the intense competition in commodity markets and farmers' weak bargaining position vis-à-vis intermediaries who control access to distribution channels. The 2026 business roundtable, where Brazil nut derivatives accounted for the bulk of purchase intentions at over S/ 3.3 million, illustrates that buyers are willing to pay *premium* prices for products with sustainability attributes and a clear territorial origin, provided that supply consistency, standardized quality, and verifiable traceability are in place. This suggests that public policy and productive development programs in the province should be redirected toward supporting local processing, building collective brands rooted in Amazonian identity, and forging direct links with market niches that value not only sensory quality but also the chains' socio-environmental performance.

These findings likewise echo Karatepe and Scherrer (2024), who argue that integrating smallholders into value chains demands robust collective action alongside supportive public institutions capable of coordinating across links and lowering the transaction costs tied to commercialization. Collective action, channeled through cooperatives, producer associations, and marketing networks, allows small farmers to achieve economies of scale, pool volume to fulfill large orders, standardize quality to buyer specifications, and negotiate on more even footing with actors that have traditionally concentrated market power. In Madre de Dios, multi-stakeholder engagement among CITEproductivo, MINAM, universities, and cooperatives is essential if the purchase intentions projected at commercial events are to translate into stable, equitable income, since no single organization holds the resources, expertise, and convening capacity needed to coordinate entire chains on its own. This multi-stakeholder articulation is consistent with the territorial approach to agrifood chains, which underscores the need to build local innovation ecosystems and shared governance arrangements in which public, private, and community actors jointly define investment priorities, quality standards, and benefit-sharing mechanisms.

Viewed this way, the State’s role goes beyond dispensing subsidies or one-off technical assistance; it also entails facilitating dialogue platforms that surface shared bottlenecks, investing in critical infrastructure such as collection centers, processing plants, and access roads, and establishing regulatory frameworks that encourage formalization, environmental sustainability, and the inclusion of smallholders in formal chains. Universities and research centers, for their part, contribute technical knowledge for improving production processes, developing new higher-value products, and measuring sustainability indicators such as water and carbon footprints, capabilities that are essential for reaching demanding international markets that require verifiable evidence of environmental performance. Cooperatives and producer associations, meanwhile, act as intermediaries that consolidate volume, standardize quality to buyer specifications, manage commercial relationships with markets, and redistribute income among their members, thereby reducing individual farmers’ exposure to price volatility and abusive intermediary practices.

Chain governance in Tambopata must therefore evolve away from fragmented, intermediary-dependent models toward vertical and horizontal coordination schemes that engage every link, from production through consumption, in setting quality standards, sharing the risks tied to production and marketing, and distributing the benefits generated along the chain more equitably. This calls for transparency mechanisms that let producers see market prices and marketing margins, fair contracts that spell out clear terms of purchase and payment, and traceability systems that enable end consumers to recognize, and pay for, the socio-environmental value embedded in Tambopata's products. The Brazil nut cluster's experience in measuring water and carbon footprints to position Amazonian products in high-value international niches shows that sustainability-based competitive advantages are achievable wherever actors coordinate and commit to continuous improvement.

Finally, in line with Altieri et al. (2017) and the FAO (n.d.), forest conservation in Tambopata is not a constraint on development but rather its chief source of commercial differentiation once paired with environmental certification and traceability systems that verifiably convey the sustainable origin of the products involved. The results suggest that sustainable economic development strategies in the province should treat the environmental dimension explicitly as a value component that justifies *premium* pricing and opens access to specialized markets, rather than as an added cost that erodes profitability, consistent with the principles of environmentally sustainable agriculture that place system resilience, biodiversity, and product quality above short-term yield maximization. Evidence from the Brazil nut cluster's work on water and carbon footprint measurement shows that environmental attributes can become competitive advantages when effectively communicated to markets willing to pay for verified sustainability, particularly amid growing global demand for low-carbon, deforestation-free products with a positive social footprint.

Given this scenario, Tambopata's farmers have an opportunity to position their production chains as models of Amazonian bioeconomy that combine income generation with forest conservation, provided they succeed in bringing together environmental certification, traceability systems, and collective brands with a territorial identity that convert sustainability into additional income. This requires that productive development policy in the province be coherently aligned with conservation and land-use planning policy, avoiding the contradiction between production incentives and environmental restrictions that generates uncertainty and discourages long-term investment.

Beyond this, weaving the environmental dimension into production chains bolsters resilience against climate and market shocks, since agroforestry systems and sustainable management practices lessen vulnerability to drought, pests, and price swings by diversifying income sources and strengthening the natural resource base on which producers depend. Sustainability, then, is neither a luxury nor an obstacle to Tambopata's economic development; it is a necessary condition for the long-term competitiveness of its production chains amid climate change, the shift toward low-carbon economies, and consumers' rising demand for products that are not only high in quality but also ethically and environmentally responsible.

Conclusions

Taken together, these findings support the conclusion that strengthening production chains is a decisive factor for the sustainable economic development of Tambopata's farmers, since this approach helps overcome smallholder fragmentation, integrate local agroindustrial processing, and improve market entry into highly competitive environments where quality and sustainability are increasingly demanding selection criteria. This conclusion follows directly from evidence showing that the territory's priority constraints are no longer confined to the primary cultivation stage but instead concentrate in weak market integration, limited processing infrastructure, difficult access to credit, and scarce traceability of Amazonian products, factors that constrain farmers' ability to capture value beyond the sale of raw materials.

Within this context, chains such as Brazil nut, cacao, and cupuaçu display substantial competitive advantages grounded in sensory quality and the ecological value of their territorial origin, which positions them favorably against products from other regions unable to offer the same combination of Amazonian identity and verified sustainability. Recent events, most notably the March 2026 business roundtable in Puerto Maldonado, where projected sales exceeded S/ 4.3 million on an offering of 418 tons of sustainable products, demonstrate that concrete, growing demand exists for products originating from conserved forests, provided that volume, standardized quality, and traceability allowing buyers to verify origin and production conditions can be assured.

Bridging this market demand with local productive capacity, however, requires that environmental sustainability and production traceability be consolidated as core components of regional competitiveness rather than treated as ancillary features or bureaucratic requirements. In Tambopata, forest conservation and agroforestry should be positioned as economic assets that generate added value, capable of justifying premium prices in market niches that prize the Amazonian bioeconomy and are willing to pay for products that support forest conservation and the well-being of local communities. Productive development strategies in the province must therefore explicitly incorporate the environmental dimension as a source of commercial differentiation, in keeping with the principles of environmentally sustainable agriculture that place system resilience and product quality above short-term yield maximization.

Achieving this alignment between productive supply and sustainable market demand calls for a multi-stakeholder governance model that brings together public institutions, productive organizations, innovation centers such as CITEproductivo, and academia, with the aim of converting commercial projections into lasting contracts and genuine gains in rural income, preventing the purchase intentions voiced at one-off events from dissipating for lack of coordination, capacity, or the infrastructure needed to meet buyer requirements. Such a governance model should facilitate vertical and horizontal coordination across chain links, establish transparency mechanisms and fair contracts, and build traceability systems that allow end consumers to recognize the socio-environmental value of Tambopata's products, much as the Brazil nut cluster has already shown through its work measuring water and carbon footprints to position Amazonian products in high-value international niches.

Lastly, future research should take up the challenge of empirically evaluating the direct impact of business roundtables and environmental certifications on changes in net household income and farmers' standard of living, since current evidence rests largely on sales projections and case studies that fall short of establishing robust causal links between these interventions and long-term socioeconomic outcomes. Such evaluations would be essential for refining productive development policy in Tambopata, prioritizing the interventions that yield the greatest impact on farmer income, and ensuring that the shift toward more sustainable, higher-value production chains translates into tangible improvements in the living conditions of the province's rural families.

References

Altieri, M. A., Nicholls, C. I. & Montalba, R. (2017). Technological approaches to sustainable agriculture at a crossroads: An agroecological perspective. *Sustainability*, *9*(3), 349. https://doi.org/10.3390/su9030349

Comisión Económica para América Latina y el Caribe [CEPAL]. (23 de diciembre de 2024). *Innovación y tradición: Clúster de la Castaña Amazónica transforma la sostenibilidad en Madre de Dios*. CEPAL. https://www.cepal.org/es/notas/innovacion-tradicion-cluster-la-castana-amazonica-transforma-la-sostenibilidad-madre-dios

Diaz, J. E. (2024). *Perspectivas de desarrollo del copoazú en Madre de Dios*. Universidad Nacional Amazónica de Madre de Dios. https://repositorio.unamad.edu.pe/handle/20.500.14070/1200

Gereffi, G., Humphrey, J. & Sturgeon, T. (2005). The governance of global value chains. *Review of International Political Economy*, *12*(1), 78–104. https://doi.org/10.1080/09692290500049805

Instituto Nacional de Estadística e Informática [INEI]. (2025). *Avance económico departamental: Madre de Dios*. INEI. https://www.inei.gob.pe/media/MenuRecursivo/publicaciones_digitales/Est/Lib2028/madios.htm

Instituto Tecnológico de la Producción [ITP]. (2026). *Madre de Dios: Compendio estadístico 2025* [Informe]. Ministerio de la Producción. https://www.gob.pe/institucion/inei/informes-publicaciones/7654854-madre-de-dios-compendio-estadistico-2025

Karatepe, I. D. & Scherrer, C. (2024). Smallholder challenges of social and economic upgrading in agricultural value chains: A cross-country, cross-crop comparison. *Agrarian South: Journal of Political Economy*, *13*(3), 1–24. https://doi.org/10.1177/22779760241261445

Ministerio del Ambiente [MINAM]. (13 de marzo de 2026). *Madre de Dios: proyectan venta por más de S/ 4.3 millones de productos de bosques conservados*. Programa Nacional de Conservación de Bosques para la Mitigación del Cambio Climático. https://www.gob.pe/institucion/bosques/noticias/1366243-madre-de-dios-proyectan-venta-por-mas-de-s-4-3-millones-de-productos-de-bosques-conservados

Organización de las Naciones Unidas para la Alimentación y la Agricultura [FAO]. (s. f.). *Sustainable agribusiness and agrifood value chain development*. FAO. https://www.fao.org/agrifood-economics/areas-of-work/smart/sustainable-agribusiness-agrifood-value-chain/en/

Porter, M. E. (1985). *The competitive advantage: Creating and sustaining superior performance*. Free Press.

AUTHOR CONTRIBUTION

1. Conceptualization: Guido Holguín Ferro, Giovana Lira Jiménez, Fátima Irene Balarezo Bustinza.
2. Data curation: Guido Holguín Ferro, Giovana Lira Jiménez.
3. Formal analysis: Guido Holguín Ferro, Giovana Lira Jiménez, Fátima Irene Balarezo Bustinza.
4. Funding acquisition: Guido Holguín Ferro.
5. Research: Guido Holguín Ferro, Giovana Lira Jiménez, Fátima Irene Balarezo Bustinza.
6. Methodology: Guido Holguín Ferro, Giovana Lira Jiménez.
7. Project administration: Guido Holguín Ferro.
8. Resources: Guido Holguín Ferro, Giovana Lira Jiménez, Fátima Irene Balarezo Bustinza.
9. Software: Giovana Lira Jiménez.
10. Supervision: Guido Holguín Ferro.
11. Validation: Guido Holguín Ferro, Giovana Lira Jiménez, Fátima Irene Balarezo Bustinza.
12. Visualization: Giovana Lira Jiménez, Fátima Irene Balarezo Bustinza.
13. Writing – original draft: Guido Holguín Ferro, Giovana Lira Jiménez.
14. Writing – proofreading and editing: Guido Holguín Ferro, Giovana Lira Jiménez, Fátima Irene Balarezo Bustinza.