

MANAGING AGRIBUSINESS SYSTEMS IN TROPICAL REGIONS: SUSTAINABILITY, INNOVATION, AND SOCIOECOLOGICAL TRADE-OFFS

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Abstract

Background: Tropical agribusiness systems operate in regions where agricultural production is closely linked to biodiversity, climate variability, land-use change, and rural livelihoods. Unlike agribusiness in more controlled or temperate settings, tropical agribusiness often develops in landscapes where productivity goals intersect with forest conservation, smallholder welfare, infrastructure gaps, and community-based resource management. These conditions make management decisions more complex because economic gains may also have ecological and social consequences.

Purpose: This study reviews and synthesizes the current literature on the management of agribusiness systems in tropical regions, with specific attention to sustainability integration, innovation and digital transformation, value chain coordination, and socio-ecological trade-offs.

Design/methodology/approach: A systematic literature review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 framework. Searches were performed in Scopus and Web of Science for peer-reviewed publications published between 2000 and 2026. Initially, 262 records were identified. After duplicate removal, title and abstract screening, and full-text assessment, 33 eligible articles were included in the final synthesis. The studies were analyzed thematically across four areas: sustainability measurement, innovation and digitalization, value chain coordination, and socio-ecological governance.

Findings/Results: The review shows that sustainability assessment has become an important entry point for managerial decision-making in tropical agribusiness, especially in relation to infrastructure, financing, technology use, and environmental risk. Innovation and digital tools can improve productivity and coordination; however, their benefits depend on local capacity, institutional support, and access to basic infrastructure. Evidence also shows that value chain coordination matters because farmers, cooperatives, firms, financial institutions, and public agencies often work under fragmented arrangements. Socio-ecological trade-offs are most visible in land use, conservation, technology access, and the recognition of local knowledge. Across the reviewed studies, weak institutions, unequal access to technology, poor actor coordination, and limited community participation are recurring barriers.

Conclusion: Sustainable tropical agribusiness cannot rely solely on technology or productivity improvement. This requires management approaches that connect sustainability metrics, innovation capacity, value chain coordination, and participatory governance. The review suggests that tropical agribusiness systems become more resilient when ecological safeguards, local knowledge, and institutional support are considered together in management decisions.

Originality/value (State of the art): This review offers a focused synthesis of tropical agribusiness literature by connecting sustainability assessment, innovation practices, value chain governance, and socioecological trade-off management. This study contributes to future research agendas for building resilient, inclusive, and sustainable agribusiness systems in tropical regions.

Keywords: tropical agribusiness, sustainability, innovation, socio-ecological systems, governance

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INTRODUCTION

Agribusiness systems in tropical regions play a central role in ensuring food security, rural livelihoods, and long-term economic development. Unlike agribusiness systems in temperate or highly controlled production environments, tropical agribusinesses operate in landscapes shaped by high rainfall variability, rich biodiversity, climate uncertainty, forest conversion, infrastructure gaps, and vulnerable rural communities. These conditions make tropical agribusiness a socio-ecological system in which managerial decisions are closely connected to environmental dynamics, economic pressures, and social structures (Leite-Filho et al. 2021; Levers et al. 2024). Consequently, management in tropical agribusiness cannot be understood only in terms of efficiency, scale, and market competitiveness. It must also consider how production, land use, ecosystem resilience, community welfare, and institutional capacity interact within the same landscape.

From this perspective, tropical agribusiness systems face a complex set of interrelated challenges. They are expected to increase productivity and market participation while protecting ecosystems, reducing vulnerability, and supporting social inclusion. For example, in the Brazilian Amazon, deforestation has altered rainfall patterns and reduced agricultural yields, creating direct consequences for rural livelihoods (Leite-Filho et al. 2021). Similar pressures are intensified by weak regulatory enforcement, fragmented land governance, limited support for sustainable practices, biodiversity loss, and marginalization of forest-dependent communities (Levers et al. 2021; Ferreira et al. 2022; Oliveira & Meyfroidt, 2021). These conditions show that productivity, conservation, and equity cannot be treated as separate management objectives. In tropical regions, they are interdependent dimensions of long-term agribusiness performance.

The importance of tropical agribusiness extends beyond primary production. These systems generate employment, support rural infrastructure, improve market access, and sustain smallholder-driven value chains, particularly in low-income tropical countries, where agribusiness serves as both a source of income and a pathway for poverty reduction (Santika et al. 2020; Marshall et al. 2024). Simultaneously, resilience depends on the ability to respond to climate change, price volatility, policy uncertainty, and other

socioeconomic pressures. This dual function makes tropical agribusiness a critical field for understanding how management practices can strengthen food security while reducing environmental and social vulnerability. Tropical agribusinesses also play a significant global role. Across Latin America, Africa, Asia, and the Caribbean, it supplies major traded commodities, such as palm oil, cocoa, coffee, rubber, sugarcane, rice, tropical fruits, livestock products, and forest-based agricultural outputs. These commodity systems connect rural producers to national and international markets, but they are often located in ecological frontiers where expansion can reshape forests, savannas, peatlands, watersheds, and coastal communities. This position as both a driver of economic opportunity and a source of socioecological pressure makes tropical agribusiness analytically distinct from other agribusiness typologies and highlights the need for management approaches that integrate sustainability, innovation, governance, and local livelihood.

Sustainability and innovation have become central themes in tropical agribusiness research in recent years. Approaches such as climate-smart agriculture, agroecology, circular economy practices, agro-industrial waste reuse, alternative protein development, and biopesticides are increasingly being discussed as ways to address environmental pressure and improve resource efficiency (Begna & Wakweya, 2025; Cherdthong, 2025; Andreatta et al. 2025; Carrillo-Rodriguez et al. 2025). Recent reviews have also shown that agroecological practices can strengthen ecological resilience while supporting productivity in tropical contexts (Chandra, 2025). This indicates that sustainability in tropical agribusiness is not limited to environmental protection. It now includes technological adaptation, institutional coordination, market access, and social inclusion.

The literature can be divided into four connected streams. The first concerns sustainability assessment through multidimensional indicators, life-cycle assessment, and decision-support tools for evaluating economic, ecological, and social performance. The second focuses on innovation and digital transformation, including climate-smart practices, agroecology, bio-inputs, circular use of agro-industrial waste, and digital platforms. The third examines value chain coordination, particularly how infrastructure, finance, market access, and institutional arrangements shape the performance of agribusinesses. The fourth

addresses socio-ecological governance, including land-use change, local knowledge, conservation pressure, and community participation. Taken together, these streams show that the problem is not the absence of research but the limited integration of sustainability assessment, innovation, coordination, and governance. Despite this progress, there are still significant gaps. Many studies still emphasize technology adoption without sufficiently examining the sociopolitical conditions that determine implementation outcomes. Governance quality, institutional arrangements, and power relations are often underrepresented, even though they strongly influence the success or failure of sustainability initiatives (Akbar et al. 2025; Nurjati & Adityawati, 2024). Empirical work that integrates agroecology with modern biotechnology remains limited, as does research on feedback mechanisms between socioeconomic conditions and sustainability outcomes (Bueno et al. 2021). Consequently, previous studies have not fully explained how managerial strategies, innovation processes, value chain coordination, and socio-ecological governance interact within tropical agribusiness systems.

This gap raises specific management questions. The issue is not only whether tropical agribusiness can become more sustainable, but also how managers, cooperatives, governments, and local actors coordinate decisions when sustainability tools, innovation choices, market incentives, and ecological limits do not always point in the same direction. The novelty of this review lies in its management-oriented synthesis of the literature. Rather than treating sustainability, innovation, value chain coordination, and governance as separate themes, this study integrates them into a single analytical framework. This is important because agribusiness decisions in tropical regions often generate trade-offs between productivity, equity, conservation, and resilience. By clarifying these interconnections, this review positions tropical agribusiness as both an economic system and a socioecological management challenge.

Therefore, the contribution of this review is specific rather than overly broad. It does not claim to solve all sustainability problems in tropical countries. Instead, it organizes existing evidence to make the managerial connections between assessment, innovation, coordination, and governance more visible. This synthesis is useful because many tropical agribusiness interventions fail not simply because a

single technology is absent, but because infrastructure, finance, local knowledge, market coordination, and land-use governance are handled separately.

Addressing these challenges requires integrated agribusiness strategies that combine technological innovations with local ecological knowledge. Climate-resilient and agroecological practices can enhance biodiversity, maintain soil fertility, and strengthen food security when adapted to local conditions (Hernandez & Bonilla-Landaverri, 2025; Cote et al. 2022; Vogel et al. 2023; Wezel et al. 2020). In addition, tropical communities often have knowledge systems that guide land-use decisions, optimize resource use, and reduce climate-related risks (Leakey et al. 2021). Therefore, problem-solving in tropical agribusiness requires an integrative approach that connects scientific evidence, managerial decision-making, stakeholder participation, and ecological understanding.

This framing also addresses a practical problem. In many tropical agribusiness settings, sustainability efforts remain fragmented across technology, infrastructure, finance, local knowledge, market systems, and land-use governance. A systematic synthesis is needed to identify where these elements reinforce one another, where they create trade-offs, and how managers and policymakers can respond more effectively.

Accordingly, this systematic literature review synthesizes how agribusiness systems in tropical regions are managed to achieve sustainability, innovation, and socio-ecological balance. It examines managerial strategies, governance mechanisms, and innovation processes, while identifying methodological patterns and evidence gaps. This review covers peer-reviewed literature published from 2000 to 2026 in tropical regions, including Latin America, Africa, Asia, and the Caribbean. The synthesis focuses on sustainability metrics, innovation adoption, value chain coordination, and environmental governance to clarify the current knowledge, reveal limitations, and support future research directions.

This study aims to review and synthesize the current scientific literature on the management of agribusiness systems in tropical regions, particularly in relation to sustainability, innovation, and socioecological trade-offs. This review addresses the following research questions: How are agribusiness systems in tropical regions managed to integrate sustainability, innovation,

and socioecological trade-offs?; What managerial levers shape sustainability and performance outcomes in tropical agribusiness?; What gaps and limitations exist in the current literature, and how can future research address these?.

These questions maintain a focus on management: how decisions are organized, which levers are important, and where the existing literature remains incomplete. This study provides a management-oriented synthesis that contributes to the theoretical debate on socio-ecological systems and offers practical insights into developing resilient, inclusive, and sustainable agribusiness systems in the tropics.

METHODS

This study employed a systematic literature review (SLR) of peer-reviewed articles indexed in Scopus and Web of Science from 2000 to 2026. These databases were selected for their multidisciplinary coverage of agribusiness management, sustainability, innovation, governance, and socioecological systems. The review focused on tropical regions, including Latin America, Africa, Asia, and the Caribbean, and treated each article as a unit of analysis. To ensure a clear and repeatable boundary, tropical agribusiness was defined as literature addressing agribusiness systems, value chains, governance, innovation, sustainability assessment, infrastructure, market access, or

socioecological management in tropical or humid tropical contexts. Studies limited to crop production or agronomy without a clear management, value chain, sustainability, or governance contribution were not prioritized for synthesis.

Data were collected through a structured Boolean search in Scopus and Web of Science using four conceptual blocks: tropical context, agribusiness, management, and sustainability-oriented focus. The search string combined the terms (“tropical” OR “tropics” OR “humid tropical” OR “neotropics”) AND (“agribusiness” OR “agro-industry” OR “agricultural value chain” OR “food supply chain”) AND (“management” OR “strategy” OR “governance” OR “coordination” OR “capabilities” OR “performance”) AND (“sustainability” OR “resilience” OR “innovation” OR “digital” OR “trade-off” OR “socio-ecological”). Search filters were applied to include only English-language journal articles and scholarly book chapters published between 2000 and 2026. All records were exported with complete metadata, including the title, abstract, author, keywords, publication year, journal, and DOI. Duplicates were removed, titles and abstracts were screened using predefined criteria, and potentially relevant articles were assessed through full-text review, following the PRISMA 2020 framework (Page et al. 2021). The inclusion and exclusion criteria used to guide the screening and eligibility processes are presented in Table 1.

Table 1. Inclusion and exclusion criteria for the systematic literature review on tropical agribusiness management, sustainability, innovation, and socio-ecological governance

Criterion	Inclusion	Exclusion
Period	2000–2026	Before 2000
Source/type	Peer-reviewed articles and scholarly book chapters indexed in Scopus or Web of Science	Editorials, opinion papers, reports, abstracts, and non-reviewed documents
Language	English	Non-English
Geography	Tropical, humid tropical, neotropical, or comparable tropical contexts	Non-tropical contexts without relevant comparison
Topic	Agribusiness, value chains, sustainability, innovation, governance, coordination, resilience, or socio-ecological trade-offs	Pure agronomy or biological studies without management relevance
Evidence	Sufficient conceptual, methodological, or empirical detail	Insufficient information for synthesis
Full text	Available for assessment	Not accessible or not assessable

As shown in Figure 1, the selection process identified 262 records, comprising 162 from Scopus and 100 from Web of Science. After removing 49 duplicates, 213 records were screened by title and abstract, of which 180 were excluded because they did not meet the eligibility criteria or were not directly relevant to the tropical agribusiness management. These exclusions mainly involved studies on general agriculture, non-tropical contexts, technical production issues without management or sustainability relevance, insufficient methodological detail, or topics outside the scope of the review. The remaining 33 studies underwent full-text assessment, met all eligibility requirements, and were included in the final synthesis.

The data were analyzed using thematic synthesis, supported by a quality appraisal. Each selected article was reviewed to extract information on its objectives, geographical context, agribusiness sector, sustainability dimensions, innovation types, governance mechanisms, value chain issues, methodology, and key findings. The extracted data were then coded into four thematic areas: sustainability measurement and strategic management, innovation and digital transformation, value chain coordination and market access, and socioecological trade-offs and governance. The synthesis compared findings across methods, regions, commodities, and managerial themes to identify recurring mechanisms,

dominant patterns, contradictions, and research gaps. Because this study is a systematic literature review, it did not formulate statistical hypotheses; instead, the analysis was guided by the research questions and the proposition that effective tropical agribusiness management depends on the integration of sustainability assessment, innovation adoption, value chain coordination, and adaptive socioecological governance.

To strengthen methodological rigor, each included article was assessed using a structured quality appraisal approach. The appraisal considered the clarity of the research objectives and context, appropriateness of the research design and sampling, transparency of data collection and analysis, relevance to tropical agribusiness management, and strength of the reported evidence. The appraisal criteria were structured to accommodate the methodological diversity of the included studies and focused on research clarity, design appropriateness, sampling, transparency of data collection and analysis, relevance, and strength of evidence. Studies with strong methodological transparency and direct relevance were given greater interpretive weight, whereas conceptually useful but methodologically limited studies were retained and interpreted with caution.

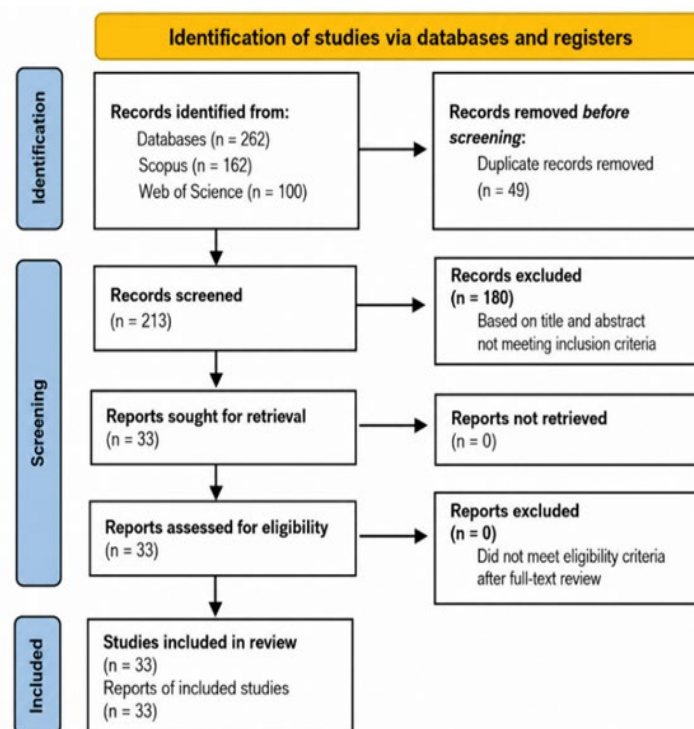


Figure 1. Flow diagram of article identification, screening, eligibility assessment, and final inclusion in the systematic literature review on tropical agribusiness management

The framework of this study positions tropical agribusiness as a socio-ecological system shaped by ecological, institutional, economic, and social pressures. Using the PRISMA 2020 framework, the review identifies and synthesizes studies from Scopus and Web of Science into four analytical themes: sustainability measurement, innovation and digital transformation, value chain coordination, and socioecological governance. These themes guide the interpretation of managerial strategies, research gaps, and future directions for sustainable tropical agribusiness management.

RESULTS

The results are presented as a thematic synthesis rather than as a descriptive list of articles. Across the 33 reviewed studies, the analysis identified recurring patterns, differences across regions and methods, tensions among findings, and the managerial meaning of those patterns. This section therefore keeps the four original themes, but treats them as connected mechanisms: how sustainability is measured and used, how innovation depends on local capacity, how value chains translate resources into outcomes, and how governance shapes socio-ecological trade-offs.

Sustainability Measurement and Strategic Management in Tropical Agribusiness

Table 2 synthesizes ten studies on how sustainability assessment supports strategic management in tropical agribusiness systems in Indonesia, Brazil, Somalia, Thailand, the Argentine Chaco, and Colombia. Sustainability is commonly assessed through ecological, economic, social, technological, and institutional dimensions. The reviewed studies show that different tools serve different managerial purposes: MDS and RAP-based approaches identify multidimensional sustainability gaps; AHP and SEM clarify priorities and relationships among factors; LCA and cost-benefit analysis trace environmental and economic consequences along the value chain; and participatory indicators incorporate local priorities into assessment processes.

Evidence from Munarso et al. (2025) and Febrianto et al. (2025) shows how MDS-based tools can guide infrastructure upgrading, recovery planning, risk mitigation, and technology-oriented interventions. Piquer-Rodríguez et al. (2024) and Jaroenkietkajorn et al. (2024) emphasized participatory and integrated assessments for agricultural frontiers and bio-circular-green value chains. At the firm and cooperative levels, Agripino et al. (2023) and Ali et al. (2025) demonstrate the role of AHP and SEM in prioritizing sustainability strategies and linking agribusiness performance with livelihood resilience, whereas Pinheiro et al. (2022) and Medina (2022) highlight the need to account for land-use governance, incentive alignment, and conservation outcomes. Overall, the evidence suggests that sustainability assessment should not function only as a reporting tool but as a strategic management interface that helps managers, cooperatives, and policymakers identify intervention priorities, allocate resources, anticipate risks, and balance productivity, equity, and environmental conservation.

Innovation and Digital Transformation in Tropical Agribusiness Management

As summarized in Table 3, innovation and digital transformation in tropical agribusiness operate through three main pathways: digital coordination, bio-based resource efficiency, and organizational or supply chain upgrading. Digital platforms, open data, precision agriculture, and decision-support tools improve information flow and managerial decision-making, whereas bio-inputs, fermented residues, by-product utilization, and crop modeling help reduce input dependency and improve the use of local resources. Simultaneously, quality management systems, green supply chain coordination, and entrepreneurial innovation reshape how firms, producers, and institutions work together. These pathways differ in their requirements and effects, indicating that innovation does not follow a single, linear pattern across tropical agribusiness systems.

Table 2. Sustainability measurement and strategic management in tropical agribusiness systems

Reference	Context	Dimensions	Method/Tool	Managerial Insight
Munarso et al. (2025)	Rural agribusiness infrastructure, Indonesia	Economic, social, environmental, technological, institutional	MDS + SWOT	Identifying leverage points for infrastructure upgrading, finance, digitalization, and emissions control.
Febrianto et al. (2025)	Smallholder dairy farming post-FMD, Indonesia	Ecological, economic, socio-cultural, technological, institutional, information	RAPDairy/MDS	Supporting recovery planning, risk mitigation, and targeted managerial interventions.
Piquer-Rodríguez et al. (2024)	Agricultural frontiers, Argentine Chaco	Socio-economic, environmental, governance	Co-produced indicators	Aligning agribusiness decisions with local sustainability priorities.
Jaroenkietkajorn et al. (2024)	Tropical value chains, Thailand	Environmental, social, economic	LCA, S-LCA, cost-benefit analysis	Evaluating bio-circular-green value chains for strategic sustainability decision-making.
Alvarez-Ochoa et al. (2024)	Agribusiness firms, global/tropical	Economic, environmental, social, governance	Bibliometric and systematic synthesis	Identifying sustainability orientations in CSR, standards, innovation, and governance.
Agripino et al. (2023)	Farm-level agribusiness, Brazil	Environmental, economic, stakeholder	AHP	Prioritizing sustainability strategies in agribusiness planning.
Bannor & Arthur (2024)	Emerging tropical markets, Africa and Asia	Economic, social, institutional, technological	SLR and bibliometrics	Revealing gaps in skills, innovation, and governance.
Ali et al. (2025)	Fragile agricultural value chains, Somalia	Livelihood, economic, social, natural capital	SEM with value chain and SLF frameworks	Linking agribusiness performance with sustainability and livelihood resilience.
Pinheiro et al. (2022)	Cooperative agribusiness, Eastern Amazon	Conservation, economic viability	Survey-based assessment	Showing incentive misalignment and governance challenges.
Medina (2022)	Soybean agribusiness, Brazil	Economic, institutional, developmental	Value-chain analysis	Framing sustainability as a governance and policy issue.

Table 3. Innovation and digital transformation for tropical agribusiness management

Reference	Innovation Type	Context	Enablers/Barriers	Management & Sustainability Outcome
Romani et al. (2023)	Digital platform and data integration	Agribusiness ecosystem, Brazil	Support: institutions, open data; Barriers: interoperability, scalability	Improving data-driven decision-making, coordination, and SDG alignment.
Smihunova et al. (2024)	Quality management systems	Agribusiness firms	Support: regulation, market demand; Barriers: certification costs, readiness	Enhancing efficiency, product quality, and environmental performance.
Nguyen et al. (2024)	Green supply chain coordination	Coffee exports, Vietnam	Support: management commitment, institutional pressure; Barrier: coordination complexity	Strengthening market, financial, and sustainability performance.
Pongsub et al. (2024)	Fermented agro-industry residues	Livestock systems, Thailand	Support: local feed resources; Barriers: technical skills, adoption risk	Reducing feed costs and improving resource efficiency.

Table 3. Innovation and digital transformation for tropical agribusiness management (continue)

Reference	Innovation Type	Context	Enablers/Barriers	Management & Sustainability Outcome
de Oliveira et al. (2024)	Agro-industry by-product use	Silvopastoral livestock, Amazon Brazil	Support: co-product availability; Barrier: supply consistency	Supporting cost efficiency and sustainable livestock management.
Dias et al. (2020)	Crop modeling and varietal innovation	Sugarcane, Brazil	Support: research capacity, data; Barrier: model transferability	Guiding variety selection and management optimization.
Favero et al. (2021)	Bio-input and microbiome innovation	Legume systems, Brazil	Support: microbial diversity, R&D; Barrier: scaling deployment	Reducing fertilizer dependence and supports sustainable intensification.
Basso et al. (2024)	Genomics, precision agriculture, digital tools	Agribusiness systems, Brazil	Support: R&D investment; Barriers: unequal access, skills gaps	Supporting productivity growth with a lower environmental impact.
Ali et al. (2025)	Value chain and livelihood innovation	Fragile systems, Somalia	Support: coordinated investment, institutions; Barriers: fragility, climate risk	Linking agribusiness performance with livelihood resilience.
Ikuemonisan (2024)	Entrepreneurial and organizational innovation	Agribusiness SMEs, Nigeria	Support: public-private collaboration; Barriers: infrastructure, skills	Identifying policy and managerial innovation needs for sustainable growth.

The reviewed studies show that digital and data-driven technologies can strengthen coordination and sustainability alignment, as seen in Romani et al. (2023) and Basso et al. (2024), although unequal access and technical skill gaps remain barriers. Bio-based and resource-use innovations also support sustainable intensification, as demonstrated by Favero et al. (2021), Pongsub et al. (2024), de Oliveira et al. (2024), and Dias et al. (2020). Beyond technical innovation, Nguyen et al. (2024), Smihunova et al. (2024), Ikuemonisan (2024), and Ali et al. (2025) emphasized the importance of institutional support, managerial capacity, public-private collaboration, and value chain integration. Overall, innovation becomes effective when it is matched with skills, financing, infrastructure, institutional readiness, and market access; without these conditions, it may remain fragmented or widen the gaps between better-resourced firms and vulnerable producers.

Value Chain Coordination, Infrastructure, and Market Access in Tropical Agribusiness

As shown in Table 4, value chain coordination, infrastructure, financing, and market access are central to tropical agribusiness performance in Sub-

Saharan Africa, Southeast Asia, the Amazon, and Latin America. The reviewed studies show that coordination acts as a bridge between resources and sustainability outcomes: infrastructure improves performance only when producers can access and use it, finance supports resilience when connected to viable markets, and cooperative arrangements work when supported by governance, trust, and collective action. Thus, value chain coordination is not merely a logistical issue but a managerial mechanism that links technology, capital, market information, and institutional support.

The evidence highlights multi-stakeholder coordination as a key response to systemic inefficiency. Munarso et al. (2025) show that sub-terminal infrastructure, fintech access, and strategic planning can reduce post-harvest losses in Indonesian rural agribusiness, while Ali et al. (2025) demonstrate that coordinated investment in irrigation, infrastructure, and microfinance improves income, food security, and resilience in fragile contexts. Medina (2022) emphasizes the role of state-market coordination, storage, transport, and agro-industrial capacity in Brazil's soybean system, whereas Bannor and Arthur (2024) identify weak institutional coordination and policy implementation as major barriers in emerging tropical markets.

Table 4. Synthesis of value chain coordination, infrastructure, and market access in tropical agribusiness systems

Reference	Focus	Coordination/ Governance	Infrastructure/Finance	Key Outcome
Oberholster et al. (2015)	Agricultural finance, South Africa	Value chain integration and partnering	Value chain finance, risk services	Improving competitiveness and production sustainability.
Nguyen et al. (2024)	Coffee exports, Vietnam	Green supply chain coordination	Export logistics, market linkages	Enhancing financial, market, and sustainability performance.
Munarso et al. (2025)	Rural distribution systems, Indonesia	Multi-stakeholder governance and planning	Sub-terminal infrastructure, fintech	Reducing post-harvest losses and supporting sustainability.
Ali et al. (2025)	Fragile value chains, Somalia	Integrated value chain–livelihood governance	Irrigation, rural infrastructure, microfinance	Improving income, food security, and resilience.
Medina (2022)	Soybean agribusiness, Brazil	State–market and policy coordination	Storage, transport, agro-industrial capacity	Shaping the value distribution and development opportunities.
Yepes-Jiménez et al. (2023)	Agribusiness firms, Colombia	Strategic implementation and control	Organizational and logistics infrastructure	Showing that weak execution limits performance.
Leitão et al. (2024)	Agribusiness capabilities	Capability-based firm coordination	Knowledge, learning, relational assets	Supporting sustained value chain performance.
Bannor & Arthur (2024)	Emerging market agribusiness	Institutional coordination and policy support	Market systems, information flows	Identifying coordination and institutional gaps.
Pinheiro et al. (2022)	Cooperative agribusiness, Eastern Amazon	Cooperative governance	Processing facilities, market access	Showing coordination limits in sustainable subsidy use.
Herrán-Aguirre et al. (2023)	Livestock systems, Mexican tropics	Diversification-based coordination	On-farm infrastructure, mixed systems	Enhancing resilience and market stability.

At the firm and network levels, coordination capacity shapes competitiveness and sustainability. Nguyen et al. (2024) show that green supply chain coordination improves market and financial performance in Vietnam’s coffee exports, while Yepes-Jiménez et al. (2023) note that weak strategy implementation can limit firm performance, even when infrastructure exists. Pinheiro et al. (2022), Leitão et al. (2024), Oberholster et al. (2015), and Herrán-Aguirre et al. (2023) indicate that cooperative governance, relational assets, financing mechanisms, learning capabilities, and diversification strategies help reduce risk and strengthen sustainability. Overall, the evidence suggests that tropical agribusiness requires coordinated upgrading rather than isolated interventions because weaknesses in one part of the chain can reduce the benefits of improvements elsewhere.

Socioecological Trade-offs and Governance in Tropical Agribusiness

As summarized in Table 5, tropical agribusiness systems often operate in ecologically sensitive and socially contested landscapes, where expansion and intensification create trade-offs among productivity, conservation, and community welfare. These trade-offs emerge from land-use change, pesticide-intensive production, fragile value chain integration, market expansion, and shifts from diversified to specialized agricultural systems. They appear in concrete managerial choices, such as productivity versus conservation, market integration versus livelihood security, technology adoption versus unequal access, commodity expansion versus community rights, and specialization versus resilience. This explains why a practice that improves output in one context may generate ecological or social costs in another context.

Table 5. Synthesis of socioecological trade-offs, land-use change, and governance in tropical agribusiness systems

Reference	Trade-off Domain	Key Actors Involved	Mechanism Generating Trade-offs	Governance / Management Responses
van Grieken et al. (2013)	Water quality vs. regional livelihoods	Farmers, mills, policymakers	Environmental regulation affecting land-use practices	Integrating social–economic impact assessment to avoid underestimating regional welfare losses.
Pinheiro et al. (2022)	Environmental conservation vs. income generation	Cooperatives, associations, state	Expansion of agribusiness into tropical forests	Highlighting need for incentive alignment and continuous governance programs.
Gaboardi et al. (2023)	Productivity vs. environmental & health safety	Agribusiness firms, government, communities	Pesticide-intensive production models	Calling for stronger regulation and alternative management pathways to reduce socio-environmental injustice.
Mandujano & Alves (2018)	Territorial rights vs. agribusiness expansion	Peasants, agroextractivists, agribusiness firms	Land grabbing and capital-driven expansion	Showing role of local resistance strategies and socio-political governance.
Faingerch et al. (2025)	Deforestation vs. agricultural profitability	Diverse land-use agents	Heterogeneous land-use strategies	Advocating actor-specific governance through archetype-based management.
Ferreira et al. (2022)	Biodiversity conservation vs. market integration	Indigenous communities, agribusiness	Replacement of traditional management	Demonstrating the value of indigenous governance for resilient tropical systems.
Ali et al. (2025)	Market integration vs. livelihood vulnerability	Smallholders, exporters, institutions	Fragile value-chain integration	Emphasizing inclusive governance and asset-based management.
Bannor & Arthur (2024)	Global competitiveness vs. local capacity	Governments, youth, SMEs	Skills and innovation gaps	Identifying policy and institutional reforms to mitigate socio-economic trade-offs.
Herrán-Aguirre et al. (2023)	Specialization vs. resilience	Livestock producers	Transition from diversified to conventional systems	Showing diversification as a governance strategy to enhance resilience.

A recurring pattern in the literature is the tension between agricultural development and environmental protection. Faingerch et al. (2025) showed that deforestation pressures require actor-specific governance because land-use agents differ in their strategies and motivations. Van Grieken et al. (2013) demonstrated that environmental regulations can create unintended social costs when regional livelihoods are not adequately considered. Similar tensions exist in relation to territorial rights and traditional livelihood systems. Mandujano and Alves (2018) highlighted conflicts between peasants, agroextractivist groups, and capital-intensive agribusiness in the Brazilian Cerrado, while Ferreira et al. (2022) showed that the erosion of indigenous land management can weaken biodiversity conservation and traditional governance capacity.

Evidence also shows that socio-ecological trade-offs become more severe when market integration and competitiveness are not supported by institutional capacity, inclusive governance, and social protection. Ali et al. (2025) link fragile value chain integration with livelihood vulnerability, while Bannor and Arthur (2024) identify human capital and institutional gaps as barriers to balancing global competitiveness with local capacity. Pinheiro et al. (2022) and Gaboardi et al. (2023) further show that misaligned subsidies, weak cooperative coordination, pesticide-intensive production, and limited regulations can undermine conservation and public welfare. Overall, synthesis positions governance as the main arena for negotiating trade-offs. Technology may reduce some pressures, but more effective responses combine regulation, incentive alignment, community participation, and coordination across markets and institutions.

This review advances the understanding of tropical agribusiness as a socio-ecological management system by synthesizing evidence from 33 studies on sustainability, innovation, value chain coordination, and governance. The findings show that tropical agribusiness cannot be managed only through productivity and market efficiency perspectives because ecological feedback, social equity, institutional capacity, and local knowledge strongly shape long-term performance. Studies by Ferreira et al. (2022), Pinheiro et al. (2022), and Faingerch et al. (2025) indicate that ignoring ecological dynamics may weaken productivity and resilience, whereas biodiversity protection and indigenous or community-based management can strengthen sustainability outcomes. Thus, tropical agribusiness management should be understood as an adaptive process that links ecological integrity, economic performance, and social inclusion.

Regarding the first research question, the evidence suggests that sustainability, innovation, and governance become meaningful when connected within the same decision space. Sustainability indicators are useful not only as measurement tools but also as inputs for land-use decisions, infrastructure priorities, technology adoption, and producer incentives. This extends socio-ecological systems thinking by positioning tropical agribusiness as a management system in which a single decision may simultaneously affect yield, forest pressure, household income, and local governance legitimacy.

Innovation emerges as a strategic enabler, but its effectiveness depends on institutional and contextual preparedness. Digital platforms, microbiome technologies, supply chain coordination tools, and bio-based innovations can support productivity and environmental goals when embedded in governance systems (Romani et al. 2023; Favero et al. 2021; Nguyen et al. 2024). However, innovation may increase vulnerability when introduced without adequate infrastructure, skills, financing, and institutional support, especially in fragile agribusiness contexts (Ali et al. 2025; Ikuemonisan, 2024). Participatory and stakeholder-based governance is therefore essential because local actors, cooperatives, indigenous communities, and public-private collaborations shape sustainability outcomes (Mandujano & Alves, 2018; Piquer-Rodríguez et al. 2024).

Regarding the second research question, the main managerial levers include infrastructure, financial access, cooperative governance, institutional rules, technological access, and market coordination. These levers shape whether sustainability and innovation translate into actual performance improvement. Digital platforms, green supply chain tools, and bio-based innovations work better when farmers and firms have connectivity, technical support, working capital, and market access. Without these conditions, innovation may remain concentrated among better-resourced actors, leaving smallholders or remote communities behind. This explains why the findings differ across regions and commodities: in some contexts, innovation improves productivity; in others, it supports coordination, traceability, or input efficiency.

The review also shows that tropical agribusiness requires coordination among infrastructure, finance, technology, market incentives, and local knowledge. Governance may appear as a formal land-use regulation, but in community-based systems, it may also involve customary rules, collective monitoring, and cooperative decision-making. If these elements are handled separately, sustainability outcomes weaken. Therefore, the managerial implication is not simply to adopt more technology or stronger regulations but to align interventions across value chains, landscapes, and institutions.

However, the literature still has methodological limitations. Some studies rely on self-reported data, which may create recall or response bias, while others focus on accessible or better-resourced farming systems and underrepresent marginalized tropical regions (Pinheiro et al. 2022; Yepes-Jiménez et al. 2023). Inconsistencies in mixed-method applications and misalignment between research design and statistical techniques indicate the need for stronger methodological rigor (Nuarié et al. 2024). Future studies should integrate resilience and sustainability theories, examine gender and equity dimensions, and apply multi-scale approaches that connect local agribusiness systems to national and global policy frameworks (Clément et al. 2023; Fernández-Giménez et al. 2022).

Regarding the third research question, the main gaps concern fragmentation, uneven regional coverage, and limited longitudinal evidence. Many studies still examine sustainability metrics, innovation, value chain

coordination, and governance separately, while fewer explain how these domains interact within the same agribusiness system. Remote islands, forest margins, conflict-affected areas, and smallholder-dominated supply chains remain underrepresented. Future research should use comparative and longitudinal designs to examine how managerial capabilities, land-use rules, community participation, market incentives, traceability systems, infrastructure investment, digital tools, gender, and equity shape tropical agribusiness transformation over time.

Managerial Implications

The findings have practical implications for managers, policymakers, cooperatives, and development institutions in tropical agribusiness systems. First, sustainability assessment should be embedded in strategic planning rather than being treated as a compliance activity. Multidimensional tools, life-cycle analysis, participatory indicators, and strategic planning frameworks can help identify leverage points in production, infrastructure, finance, technology, governance, land-use risk, supplier compliance, and community impact. Thus, sustainability measurement becomes a decision-making interface for resource allocation, risk management, traceability, and long-term agribusiness performance.

Second, innovation strategies should be adapted to local capacity, infrastructure conditions, and ecological realities. Digital platforms, precision agriculture, bio-inputs, agro-industrial waste utilization, and green supply chain practices can improve productivity and sustainability when supported by skills, financing, digital connectivity, market access, and institutional coordination. For cooperatives and smallholder value chains, innovation should also be linked to supplier coordination, post-harvest facilities, working capital, training, and collective certifications. Without this support, standards and digital systems may become barriers rather than opportunities.

Third, tropical agribusiness actors need stronger value chain coordination and adaptive governance to manage socioecological trade-offs. Cooperative governance, public-private partnerships, contract farming, digital market platforms, and integrated logistics can improve coordination among producers, processors, traders, financial institutions, and policymakers. At the policy level, infrastructure, land governance, innovation

support, financing, and conservation incentives should be designed as interconnected programs. This coordination is necessary so that productivity gains do not accelerate ecological pressure or weaken community welfare but instead support resilience, equity, and environmental sustainability.

CONCLUSION AND RECOMMENDATIONS

Conclusions

This review demonstrates that tropical agribusiness should be understood as a socio-ecological management system, not merely as a productivity- or profitability-oriented sector. Based on the synthesis of 33 studies, sustainable tropical agribusiness depends on the integration of sustainability assessment, innovation, value chain coordination, and governance. Sustainability assessment is most useful when it informs strategic decisions regarding infrastructure, finance, technology, land use, and environmental risk. Innovation contributes to sustainability when it fits the local capacity, infrastructure conditions, and institutional support. Value chain coordination links producers, cooperatives, firms, financiers, and public agencies, whereas governance provides the mechanism for negotiating trade-offs among productivity, conservation, livelihoods, and community rights.

The findings also show that sustainability outcomes are weakened by fragmented coordination, poorly aligned incentives, limited infrastructure, weak governance, and insufficient community participation. In contrast, more resilient agribusiness systems combine local knowledge, adaptive institutions, inclusive innovation, and evidence-based decision making. Theoretically, this review contributes to the literature by showing that tropical agribusiness requires a socio-ecological lens to explain why similar technologies, assessment tools, or value-chain models produce different outcomes across tropical contexts. Practically, managers, cooperatives, firms, governments, and development agencies must connect sustainability metrics with technology choices, infrastructure planning, supplier coordination, and participatory land-use governance. Future research should address the methodological limitations in the literature by using stronger mixed-method, comparative, and interdisciplinary designs while giving greater attention to policy impacts, gender, equity, and multi-scale governance.

Recommendations

Future agribusiness development in tropical regions should prioritize integrated sustainable governance that connects strategic planning, multi-criteria assessment, infrastructure investment, digitalization, inclusive financing, and cross-actor coordination. Policymakers need to strengthen institutional coherence to reduce bottlenecks across value chains, while managers should apply mixed-method sustainability assessments that combine quantitative analyses with stakeholder engagement for context-specific decision-making. Development programs should also move beyond firm-centered interventions by building collaborative platforms among public, private, and civil society actors. Future research should use longitudinal, comparative, and mixed-method designs to examine how sustainability assessment influences managerial decisions over time; why innovation and governance models succeed in some tropical commodity systems but fail in others; and how power relations, local knowledge, gender, equity, firm-level strategy, and landscape-level governance shape agribusiness upgrading and long-term sustainability.

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