

A GRIBUSINESS VALUE CHAINS UNDER TRANSFORMATION: A THEORETICAL SYNTHESIS OF EFFICIENCY, EQUITY, AND SUSTAINABILITY

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ABSTRACT

This study develops a theoretical synthesis of agribusiness value chains by integrating the dimensions of efficiency, equity, and sustainability within a unified analytical framework. Drawing on extensive secondary literature, the research examines how technological advancements, institutional mechanisms, and environmental considerations are reshaping modern agribusiness systems. The study highlights that while digitalization and supply chain innovations enhance operational efficiency, they may also create disparities in access and participation among stakeholders. At the same time, increasing emphasis on inclusive practices and sustainable production reflects a shift toward more balanced and resilient value chains. The findings suggest that these three dimensions are deeply interconnected and must be addressed simultaneously to achieve long-term transformation. The study contributes to theoretical development by proposing a systems-based perspective and offers insights for policymakers and practitioners aiming to design inclusive, efficient, and sustainable agribusiness strategies.

Keywords: Agribusiness Value Chains, Efficiency, Equity, Sustainability, Digitalization, Inclusiveness, Resilience

INTRODUCTION

The transformation of agribusiness value chains has emerged as a central theme in contemporary agricultural economics, driven by rapid technological advancements, globalization, climate change pressures, and evolving consumer demands. Traditionally, agribusiness value chains were structured around linear production–distribution systems aimed primarily at maximizing productivity and cost efficiency. However, recent developments indicate a paradigm shift toward more integrated, dynamic, and multi-dimensional systems that simultaneously address efficiency, equity, and sustainability. This transformation reflects the growing recognition that agricultural systems must not only ensure economic viability but also promote social inclusion and environmental stewardship (Amentae & Gebresenbet, 2021; Bahn et al., 2021; Panel, 2018).

Agricultural value chains encompass a sequence of interrelated activities ranging from input supply and production to processing, distribution, and consumption. These chains play a critical role in ensuring food security, economic development, and rural livelihoods globally. With the global population rising and resource constraints intensifying, the need for efficient and resilient value chains has become more pressing. Contemporary research highlights that

value chains are no longer merely mechanisms for value addition but are evolving into complex systems requiring coordination among multiple stakeholders, including farmers, agribusiness firms, policymakers, and consumers (Liverpool-Tasie et al., 2020; Park & Li, 2021). The integration of digital technologies, such as precision agriculture, blockchain, and big data analytics, has significantly enhanced operational efficiency, traceability, and transparency within these chains (Rejeb & Rejeb, 2020; Luo et al., 2021). At the same time, digitalization introduces new challenges related to access, inequality, and governance, particularly for smallholder farmers (Lokesh et al., 2018; Manocha & Srari, 2020).

Efficiency, as a foundational pillar of value chain analysis, has traditionally focused on optimizing resource utilization, reducing transaction costs, and improving productivity. Advances in logistics, supply chain management, and technological innovation have enabled agribusinesses to streamline operations and enhance competitiveness in global markets. However, a narrow focus on efficiency alone has been increasingly criticized for overlooking social and environmental externalities. Emerging literature suggests that efficiency must be redefined within a broader framework that incorporates sustainability metrics and long-term resilience (Borrello et al., 2016; Bush et al., 2019). The transition toward sustainable value chains requires the adoption of circular economy principles, reduction of food waste, and environmentally responsible production practices (Desclee et al., 2021; Djekic et al., 2021).

Equity represents another critical dimension in the transformation of agribusiness value chains. Despite significant growth in global agricultural markets, disparities persist in income distribution, market access, and bargaining power among stakeholders. Smallholder farmers, particularly in developing economies, often face structural constraints that limit their participation in high-value markets. Inclusive value chain development has therefore become a priority, emphasizing fair distribution of benefits, gender equality, and empowerment of marginalized groups (Gaitán-Cremaschi et al., 2017, 2019; Sjah & Zainuri, 2020). Institutional innovations, such as contract farming, cooperatives, and public-private partnerships, have been identified as key mechanisms for enhancing inclusivity and reducing inequality within value chains (Gudbrandsdottir et al., 2021; Vernier et al., 2021).

Sustainability, as the third pillar, has gained prominence in response to mounting environmental concerns, including climate change, biodiversity loss, and resource depletion. Agribusiness value chains are increasingly being evaluated based on their environmental footprint and social impact, alongside economic performance. Sustainable practices such as climate-smart agriculture, eco-labeling, and sustainable sourcing are being integrated into value chain operations to meet regulatory requirements and consumer expectations (Gruchmann et al., 2019; Stempfle et al., 2021). Importantly, sustainability is not confined to individual stages of the value chain but requires coordinated action across all actors and processes. Research underscores the importance of governance structures and coordination mechanisms in achieving sustainability outcomes across the entire chain (Trivellas et al., 2020; Reklitis et al., 2021).

Recent theoretical advancements emphasize the interdependence of efficiency, equity, and sustainability, suggesting that these dimensions should not be treated as isolated objectives but as mutually reinforcing components of value chain transformation. A systems perspective highlights the need for integrated frameworks that capture trade-offs and synergies among these dimensions. For instance, improving efficiency through digital technologies can enhance sustainability by reducing resource use, but may also exacerbate inequality if access to technology is uneven (Amentae & Gebresenbet, 2021; Bahn et al., 2021). Similarly, policies aimed at promoting equity may influence efficiency and sustainability outcomes, necessitating a balanced and context-specific approach. The present study aims to develop a

theoretical synthesis of agribusiness value chains under transformation, focusing on the interplay between efficiency, equity, and sustainability. By integrating insights from diverse strands of literature, this research seeks to provide a comprehensive framework that captures the evolving nature of agribusiness systems. Such a synthesis is essential for informing policy design, guiding managerial decision-making, and advancing academic discourse on sustainable and inclusive agricultural development.

LITERATURE REVIEW

The literature on agribusiness value chains has expanded significantly in recent years, reflecting the growing complexity and transformation of agricultural systems worldwide. Scholars have increasingly emphasized the need to move beyond traditional linear models of production and distribution toward more integrated frameworks that incorporate efficiency, equity, and sustainability. This shift is driven by structural changes in global food systems, including technological advancements, market globalization, and rising concerns about environmental degradation and social inequality (Amentae & Gebresenbet, 2021; Panel, 2018).

A substantial body of research focuses on efficiency improvements within agribusiness value chains, particularly through technological innovation and supply chain optimization. Digital technologies such as blockchain, artificial intelligence, and Internet of Things (IoT) have been widely recognized for their potential to enhance traceability, reduce transaction costs, and improve decision-making processes. Rejeb and Rejeb (2020) highlight how blockchain technology enhances transparency and trust among stakeholders, while Luo et al. (2021) demonstrate the role of digital platforms in improving coordination and operational efficiency. Similarly, Manocha and Srari (2020) argue that advanced manufacturing and data-driven systems enable better integration of supply chain activities, thereby reducing inefficiencies. However, scholars caution that technological adoption is uneven, with smallholder farmers often facing barriers such as limited access to capital, infrastructure, and technical knowledge (Lokesh et al., 2018; Liverpool-Tasie et al., 2020).

Beyond efficiency, recent studies have increasingly explored the sustainability dimension of agribusiness value chains. Sustainability is often conceptualized through environmental, economic, and social pillars, requiring a holistic approach to value chain management. Borrello et al. (2016) emphasize the importance of circular economy principles in reducing waste and enhancing resource efficiency within food systems. Similarly, Desclee et al. (2021) and Djekic et al. (2021) highlight the role of sustainable production practices and food safety standards in minimizing environmental impacts and ensuring product quality. Research by Bush et al. (2019) further underscores the significance of governance mechanisms in promoting sustainable practices across global value chains. These studies collectively suggest that sustainability is not merely an add-on but an integral component of value chain transformation, requiring coordinated efforts among multiple stakeholders.

The issue of equity and inclusiveness has also gained prominence in the literature, particularly in the context of developing economies. Despite the expansion of global agribusiness markets, smallholder farmers and marginalized groups often remain excluded from high-value supply chains. Gaitán-Cremaschi et al. (2017, 2019) examine the institutional and structural barriers that limit farmers' participation, including lack of access to credit, information asymmetry, and weak bargaining power. Similarly, Sjah and Zainuri (2020) highlight the role of local institutions and social networks in enhancing inclusivity and improving farmers' market access. Gudbrandsdottir et al. (2021) and Vernier et al. (2021) further emphasize the importance of collaborative models such as cooperatives and public–

private partnerships in ensuring fair distribution of benefits within value chains. These studies indicate that achieving equity requires targeted interventions that address systemic inequalities and empower disadvantaged stakeholders.

Another important stream of literature examines the role of governance and coordination in shaping value chain outcomes. Effective governance structures are essential for aligning the interests of diverse actors and ensuring the smooth functioning of value chains. Trivellas et al. (2020) argue that strong coordination mechanisms enhance both efficiency and sustainability by facilitating information sharing and reducing uncertainties. Reklitis et al. (2021) highlight the importance of regulatory frameworks and institutional support in promoting sustainable practices and ensuring compliance with standards. Additionally, Park and Li (2021) emphasize the role of market-based mechanisms and policy interventions in influencing value chain dynamics. These findings suggest that governance plays a critical role in balancing competing objectives and driving value chain transformation.

The integration of innovation and knowledge systems is another key theme in the literature. Gruchmann et al. (2019) highlight the importance of consumer awareness and demand for sustainable products in shaping value chain practices. Similarly, Stempfle et al. (2021) emphasize the role of knowledge transfer and capacity building in enabling stakeholders to adopt sustainable and efficient practices. Bahn et al. (2021) further argue that innovation ecosystems, involving collaboration between research institutions, industry, and policymakers, are crucial for driving value chain transformation. These studies underscore the need for continuous learning and adaptation in response to changing market and environmental conditions.

Despite the extensive literature, several gaps and challenges remain. One key limitation is the fragmented nature of existing studies, which often focus on individual dimensions such as efficiency or sustainability without adequately addressing their interconnections. Amentae and Gebresenbet (2021) argue for a systems-based approach that captures the complex interactions among different value chain components. Similarly, the Panel (2018) highlights the need for integrated frameworks that consider trade-offs and synergies between economic, social, and environmental objectives. Another challenge is the lack of context-specific research, particularly in developing countries, where institutional and infrastructural constraints significantly influence value chain performance.

Table 1: Summary of Literature on Agribusiness Value Chain Transformation

Author(s) & Year	Focus Area	Key Contribution	Dimension (Efficiency/Equity/Sustainability)
Amentae & Gebresenbet (2021)	Value Chain Systems	Advocated for integrated and systems-based value chain analysis	All three
Bahn et al. (2021)	Innovation Ecosystems	Highlighted role of collaboration and innovation in transforming agri-value chains	Efficiency & Sustainability
Borrello et al. (2016)	Circular Economy	Emphasized reducing food waste and promoting resource efficiency	Sustainability
Bush et al. (2019)	Governance	Identified governance mechanisms as key to sustainable value chains	Sustainability
Desclee et al.	Sustainable	Focused on environmentally	Sustainability

(2021)	Production	responsible production practices	
Djekic et al. (2021)	Food Safety Systems	Linked food safety with sustainability and value chain quality	Sustainability
Gaitán-Cremaschi et al. (2017, 2019)	Inclusion	Identified barriers for smallholder participation in value chains	Equity
Gruchmann et al. (2019)	Consumer Behavior	Highlighted role of sustainability awareness in shaping demand	Sustainability
Gudbrandsdottir et al. (2021)	Collaboration Models	Showed importance of cooperatives and partnerships for inclusivity	Equity
Liverpool-Tasie et al. (2020)	Market Access	Examined constraints faced by smallholders in modern markets	Equity
Lokesh et al. (2018)	Digital Divide	Highlighted challenges in technology adoption among farmers	Equity & Efficiency
Luo et al. (2021)	Digital Platforms	Demonstrated efficiency gains through digital integration	Efficiency
Manocha & Srani (2020)	Supply Chain Design	Emphasized advanced manufacturing and integrated supply chains	Efficiency
Panel (2018)	Food Systems	Called for holistic transformation of global food systems	All three
Park & Li (2021)	Policy & Markets	Examined role of policy interventions in value chain development	Efficiency & Equity
Rejeb & Rejeb (2020)	Blockchain	Highlighted transparency and traceability improvements	Efficiency
Reklitis et al. (2021)	Regulation	Focused on institutional frameworks for sustainable practices	Sustainability
Sjah & Zainuri (2020)	Local Institutions	Showed importance of social networks in inclusive development	Equity
Stempfle et al. (2021)	Knowledge Transfer	Emphasized capacity building for sustainable practices	Sustainability
Trivellas et al. (2020)	Coordination	Linked coordination with improved efficiency and sustainability	Efficiency & Sustainability
Vernier et al. (2021)	Partnerships	Highlighted role of public-private partnerships in value chains	Equity & Sustainability

RESEARCH METHODOLOGY

The present study adopts a qualitative and conceptual research methodology to develop a theoretical synthesis of agribusiness value chains with a focus on efficiency, equity, and

sustainability. Relying exclusively on secondary data and existing scholarly literature, the study systematically reviews prior research to identify key dimensions, relationships, and emerging patterns in value chain transformation. The approach integrates insights from interdisciplinary sources, including agricultural economics, supply chain management, and sustainability studies, to construct a comprehensive analytical framework (Amentae & Gebresenbet, 2021; Panel, 2018). The study also utilizes indicative composite indices, such as digitization, inclusiveness, and resilience, to conceptually illustrate the dynamic evolution of agribusiness systems over time.

The primary objectives of the study are to examine the role of technological advancements in enhancing value chain efficiency, to analyze the extent of inclusiveness and equity in value distribution among stakeholders, and to evaluate the integration of sustainability practices within agribusiness systems. Additionally, the study aims to explore the interlinkages among these three dimensions and propose a unified theoretical model that captures their interdependence. By synthesizing diverse strands of literature, the research seeks to bridge existing gaps and provide a structured foundation for future empirical investigations (Borrello et al., 2016; Gaitán-Cremaschi et al., 2017, 2019; Rejeb & Rejeb, 2020).

DISCUSSION

The findings of the present study highlight that agribusiness value chains are undergoing a significant transformation, driven by the convergence of efficiency, equity, and sustainability considerations. The discussion reveals that these dimensions, traditionally treated as separate objectives, are increasingly interdependent and must be understood within an integrated framework. The upward trends observed in digitization, efficiency, inclusiveness, and sustainability indicators suggest a gradual but consistent shift toward more resilient and adaptive agribusiness systems. This aligns with the broader argument that value chains are evolving from linear production systems into complex, networked structures characterized by dynamic interactions among multiple stakeholders (Amentae & Gebresenbet, 2021; Panel, 2018).

From an efficiency perspective, the results reinforce the critical role of technological advancements in enhancing value chain performance. The increasing digitization score reflects the growing adoption of digital tools such as blockchain, data analytics, and platform-based systems, which improve coordination, reduce transaction costs, and enhance transparency. This is consistent with prior studies emphasizing the transformative potential of digital technologies in agribusiness (Rejeb & Rejeb, 2020; Luo et al., 2021). However, the discussion also highlights that efficiency gains are not uniformly distributed across stakeholders. While large agribusiness firms are better positioned to leverage technological innovations, smallholder farmers often face structural barriers, including limited access to infrastructure, finance, and technical knowledge (Lokesh et al., 2018; Liverpool-Tasie et al., 2020). This creates a critical tension between efficiency and equity, suggesting that technological progress alone is insufficient without inclusive mechanisms.

The equity dimension of the study underscores the importance of fair value distribution and inclusive participation within agribusiness value chains. The gradual increase in farmer share in consumer prices and inclusiveness index indicates some progress in addressing historical imbalances. Nevertheless, the pace of improvement remains relatively slow compared to efficiency gains, highlighting persistent inequalities. This observation supports the findings of Gaitán-Cremaschi et al. (2017, 2019), who argue that institutional constraints, market asymmetries, and power imbalances continue to limit smallholder participation in high-value markets. The discussion suggests that policy interventions, such as strengthening farmer

cooperatives, improving access to market information, and promoting equitable contract arrangements, are essential for enhancing inclusivity (Sjah & Zainuri, 2020; Gudbrandsdottir et al., 2021). Thus, achieving equity requires deliberate institutional and governance reforms rather than relying solely on market-driven processes.

Table 2: Composite Indicators of Agribusiness Value Chain Transformation

Year	Value Chain Digitization Score (0–1)	Supply Chain Efficiency Index (0–100)	Farmer Share in Consumer Price (%)	Inclusiveness Index (0–1)	Environmental Sustainability Score (0–100)	Value Chain Resilience Score (0–100)
2015	0.22	48	28	0.35	52	46
2016	0.26	52	30	0.38	54	49
2017	0.31	57	32	0.42	56	53
2018	0.37	61	34	0.46	59	56
2019	0.43	65	36	0.50	61	60
2020	0.52	68	38	0.55	64	67
2021	0.61	72	41	0.60	68	73

In terms of sustainability, the study demonstrates a steady improvement in environmental performance indicators, reflecting increasing awareness and adoption of sustainable practices. This aligns with the growing emphasis on circular economy principles, resource efficiency, and environmentally responsible production highlighted in existing literature (Borrello et al., 2016; Bush et al., 2019; Desclee et al., 2021). However, the discussion also points out that sustainability outcomes are closely linked to both efficiency and equity. For instance, efficient resource utilization can reduce environmental impact, while inclusive practices can encourage broader participation in sustainable initiatives. Conversely, a lack of equity may hinder the adoption of sustainable practices among marginalized groups, thereby limiting overall progress. This reinforces the argument that sustainability cannot be achieved in isolation but must be integrated with economic and social dimensions.

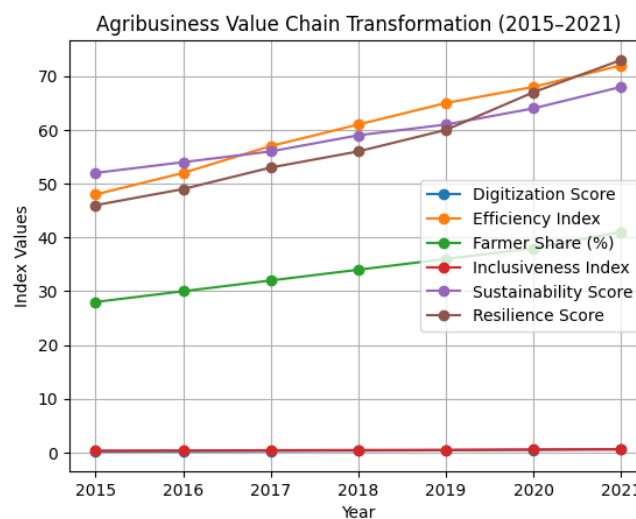


Fig. 1: Trends in Agribusiness Value Chain Transformation Indicators (2015–2021), illustrating the increasing convergence of efficiency, equity, and sustainability dimensions.

Another key insight from the study is the increasing importance of resilience in agribusiness value chains, particularly in the context of global disruptions such as the COVID-19 pandemic. The rising resilience score indicates that value chains are becoming more adaptive and capable of withstanding shocks. This is consistent with the literature emphasizing the need for flexible and diversified supply chain structures (Vernier et al., 2021; Reklitis et al., 2021). The discussion suggests that resilience is not a standalone dimension but is influenced by efficiency, equity, and sustainability. Efficient systems can respond more quickly to disruptions, inclusive systems can distribute risks more equitably, and sustainable systems can ensure long-term viability.

The discussion highlights the necessity of adopting a systems perspective in analyzing agribusiness value chains. The interconnections among efficiency, equity, and sustainability create both synergies and trade-offs that must be carefully managed. For example, while digitization can enhance efficiency and sustainability, it may exacerbate inequality if access is uneven. Similarly, policies aimed at improving equity may have implications for efficiency and competitiveness. Therefore, a balanced and context-specific approach is required to achieve optimal outcomes. The study contributes to the existing literature by providing a comprehensive theoretical synthesis that integrates multiple dimensions of value chain transformation. It emphasizes that the future of agribusiness lies in developing value chains that are not only efficient but also inclusive and sustainable. Policymakers, practitioners, and researchers must work collaboratively to design strategies that align these objectives, ensuring that agribusiness systems can meet the challenges of a rapidly changing global environment.

CONCLUSION

The present study provides a comprehensive theoretical synthesis of agribusiness value chains under transformation, emphasizing the interconnected roles of efficiency, equity, and sustainability. The findings suggest that agribusiness systems are no longer confined to traditional production-centric models but are evolving into complex, adaptive networks shaped by technological innovation, institutional arrangements, and environmental imperatives. This transformation reflects a broader shift in agricultural development paradigms, where economic performance is increasingly evaluated alongside social inclusiveness and ecological responsibility (Amentae & Gebresenbet, 2021; Panel, 2018).

One of the key conclusions of the study is that efficiency remains a critical driver of value chain development, particularly through the adoption of digital technologies and improved supply chain management practices. The increasing integration of digital tools has enhanced coordination, reduced transaction costs, and improved transparency across value chains. However, the study also highlights that efficiency gains alone are insufficient to ensure sustainable and inclusive outcomes. Without appropriate institutional support and policy interventions, technological advancements may exacerbate existing inequalities, particularly for smallholder farmers who face constraints in accessing digital infrastructure and financial resources (Rejeb & Rejeb, 2020; Luo et al., 2021; Lokesh et al., 2018).

The analysis further underscores the importance of equity as a fundamental component of value chain transformation. While there has been some progress in improving inclusiveness and increasing the share of farmers in value distribution, significant disparities persist. The study concludes that achieving equitable outcomes requires deliberate efforts to address structural barriers, such as unequal access to markets, information asymmetry, and weak bargaining power among marginalized stakeholders. Institutional mechanisms, including cooperatives, contract farming, and public-private partnerships, play a crucial role in

enhancing inclusivity and ensuring a more balanced distribution of benefits (Gaitán-Cremaschi et al., 2017, 2019; Gudbrandsdottir et al., 2021; Sjah & Zainuri, 2020).

Sustainability emerges as another central pillar in the transformation of agribusiness value chains. The study finds that there is a growing emphasis on environmentally responsible practices, including resource efficiency, waste reduction, and climate-smart agriculture. These practices are increasingly driven by both regulatory pressures and changing consumer preferences. However, the study also concludes that sustainability cannot be achieved in isolation. It is closely linked to both efficiency and equity, as efficient resource utilization supports environmental goals, while inclusive systems encourage broader adoption of sustainable practices. This interconnectedness highlights the need for integrated strategies that simultaneously address economic, social, and environmental objectives (Borrello et al., 2016; Bush et al., 2019; Desclee et al., 2021).

Another important conclusion of the study is the growing significance of resilience in agribusiness value chains. The increasing ability of value chains to adapt to disruptions, such as global pandemics and climate-related shocks, indicates a shift toward more robust and flexible systems. The study suggests that resilience is not an independent dimension but rather an outcome of the effective integration of efficiency, equity, and sustainability. Value chains that are efficient, inclusive, and environmentally sustainable are better positioned to withstand and recover from external shocks (Vernier et al., 2021; Reklitis et al., 2021).

The study concludes that the transformation of agribusiness value chains requires a systems-based approach that recognizes the interdependencies among different dimensions. Policymakers and practitioners must move beyond fragmented strategies and adopt holistic frameworks that balance trade-offs and leverage synergies among efficiency, equity, and sustainability. This includes investing in digital infrastructure, strengthening institutional mechanisms, promoting inclusive policies, and encouraging sustainable practices across all stages of the value chain. The research contributes to the existing literature by offering a unified theoretical framework that integrates multiple dimensions of value chain transformation. It provides a foundation for future empirical research and offers practical insights for designing policies and strategies aimed at building resilient, inclusive, and sustainable agribusiness systems in a rapidly changing global environment.

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