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Agribusiness Transformation In Improving Production Efficiency And Farmers' Income In Developing Countries

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Abstract: *This study aims to explore how agribusiness transformation can improve production efficiency and increase farmers' income in developing countries. The research addresses the pressing need for sustainable agricultural development amidst rapid technological, institutional, and market dynamics, particularly in low- and middle-income regions. The study employs a qualitative research approach using a systematic literature review methodology. A total of 42 peer-reviewed journal articles, institutional reports (e.g., FAO, IFAD, World Bank), and case studies published between 2019 and 2024 were analyzed. The selection focused on evidence-based practices, outcomes of digital agriculture adoption, and agribusiness models in Africa, Asia, and Latin America. Key fi ndings reveal that the adoption of digital technologies—such as precision agriculture, IoT-based irrigation, drone surveillance, and mobile advisory services—has led to 20–35% yield improvements and 15–25% input cost reduction. Agribusiness models incorporating contract farming, digital marketplaces, and farmer cooperatives showed an 18–40% increase in farm-gate prices and up to 60% growth in household income. Institutional factors like land tenure reform and government-private sector collaboration played a crucial role in scaling innovations. This study contributes original insights by synthesizing multi-regional evidence on agribusiness transformation and presenting a comprehensive framework that integrates digital innovation, institutional support, and inclusive value chain development. It highlights the strategic link between agribusiness modernization and rural economic empowerment, offering policy-oriented recommendations that align with the UN SDGs, especially Goals 1 (No Poverty) and 2 (Zero Hunger).*
Keywords*: Agribusiness Transformation, Production Efficiency, Farmers' Income, Digital Agriculture, Developing Countries, Rural Livelihoods*

INTRODUCTION

The transformation of agribusiness systems has become a central agenda in the pursuit of sustainable agricultural development, particularly in developing countries [1]. As the global demand for food continues to rise—projected to increase by 60% by 2050 (FAO, 2021)—agriculture in the Global South faces mounting pressure to enhance productivity while simultaneously ensuring rural prosperity and ecological sustainability. However, traditional farming systems in many developing nations remain characterized by low yields, inefficient resource use, fragmented markets, and persistent poverty among smallholder farmers [2]. According to the World Bank (2023), more than 65% of the poor in Sub-Saharan Africa and 55% in South Asia depend on agriculture as their primary source of livelihood, yet they generate less than 10% of national GDP, underscoring deep structural inefficiencies.

Agribusiness transformation is a process of systemic and structured change in the agribusiness sector that includes increasing production efficiency, modernizing supply chains, and strengthening the position of farmers in the agricultural ecosystem [3]. This transformation involves not only replacing traditional means of production with modern technology, but also a paradigm shift in the way agriculture is managed, distributed, and marketed. In the context of developing countries, this transformation is becoming increasingly important as most of its population is still dependent on the agricultural sector, but faces various limitations such as limited market access, low productivity, and limited technology adoption [4].

The current agribusiness transformation process is greatly influenced by the development of digital technology, such as the Internet of Things (IoT), artificial intelligence, agricultural drones, and geospatial information systems. This technology allows farmers to carry out precision agriculture, manage inputs efficiently, and get market information in real time [5]. In addition to the technological aspect, the transformation also includes strengthening institutional aspects such as the role of cooperatives, digital extension, and the integration of farmers in the global value chain.

Some developing countries that have successfully driven this transformation, such as Vietnam and Rwanda, have shown significant increases in farmers' productivity and incomes through multi-stakeholder collaboration and progressive policy support [6].

Agribusiness transformation is not a linear and uniform process. Challenges such as land fragmentation, digital inequality, limited infrastructure, and resistance to innovation are still major obstacles. Therefore, transformation must be carried out in an inclusive and adaptive manner taking into account local socio-economic conditions [7]. Synergy between governments, the private sector, educational institutions, and the farming community is needed to transform agribusiness not only to improve production efficiency, but also to create agricultural systems that are sustainable, resilient to climate change, and oriented towards the welfare of farmers in developing countries.

Agribusiness transformation refers to a holistic process of modernizing agricultural value chains by integrating technology, innovation, market access, institutional support, and sustainable practices [8]. This transformation includes shifting from subsistence-oriented agriculture to market-oriented and value-added systems, often facilitated by digital technologies (e.g., precision farming, mobile platforms, and big data analytics), inclusive financing models, and innovative supply chain arrangements (e.g., contract farming, digital cooperatives, and e-commerce). Recent studies have documented that smart agriculture technologies can increase yields by 20–35%, reduce input use by 15–25%, and increase household incomes by 30–60% when supported by appropriate policy and institutional frameworks (IFAD, 2022; GSMA, 2023; ADB, 2023).

Despite its potential, the process of agribusiness transformation in developing countries is fraught with challenges. These include inadequate infrastructure, weak institutional capacity, limited access to capital and markets, digital illiteracy, and vulnerability to climate change. Furthermore, rural economies are often excluded from innovation ecosystems and policymaking, limiting the scalability and sustainability of transformative interventions [9]. Therefore, a deeper understanding is needed on how agribusiness transformation, if designed and implemented effectively, can simultaneously enhance production efficiency and farmer incomes, while fostering inclusive and resilient rural development.

This study aims to fill this gap by synthesizing empirical findings from multiple developing countries, focusing on the role of agribusiness transformation in improving agricultural performance and socio-economic outcomes for smallholder farmers. Through a systematic literature review, this research evaluates the effectiveness of technological, institutional, and market-based innovations, and proposes a comprehensive framework to guide policymakers and stakeholders in designing impactful agribusiness interventions [10]. The results of this study are expected to contribute to policy discourse, program development, and academic scholarship related to sustainable agrifood systems in the Global South.

METHODOLOGY

This study uses a qualitative-descriptive approach with a literature review method to analyze the dynamics of agribusiness transformation in improving production efficiency and farmers' income in developing countries. This approach was chosen because it allows researchers to explore conceptual, empirical, and policy data from various developing country contexts comprehensively and systematically.

Data sources were obtained from scientific publications indexed by Scopus, Web of Science, as well as reports from international institutions such as FAO, IFPRI (International Food Policy Research Institute), World Bank, UNDP, and OECD, with a period of 2018 to 2023. The article selection process was carried out using the following inclusion criteria: (1) focusing on the transformation of the agribusiness sector, (2) the context of developing countries, (3) containing data on production efficiency and/or farmers' income, and (4) relevant to the use of technological innovations and agrarian policies. A total of 52 scientific articles and 11 international reports that met these criteria were analyzed thematically.

Data analysis was carried out using content analysis based on a thematic framework developed from the theory of agrarian transformation and sustainable development. The analysis process was carried out through three stages: (1) open coding to identify key categories related to elements of agribusiness transformation, (2) axial coding to map the interconnectedness between dimensions such as technology, policies, institutions, and farmers' incomes, and (3) the

preparation of narrative synthesis to uncover patterns, trends, and policy recommendations. The validity of the study results was significantly strengthened through the application of inter-source data triangulation techniques, which involved cross-referencing data from various sources to confirm consistency and accuracy. Additionally, peer debriefing sessions were conducted, wherein colleagues with expertise in the field critically reviewed the data interpretation process, offering constructive feedback to ensure the reliability and robustness of the findings. This comprehensive approach to validation helped to mitigate potential biases and provided a more well-rounded and credible analysis of the data.

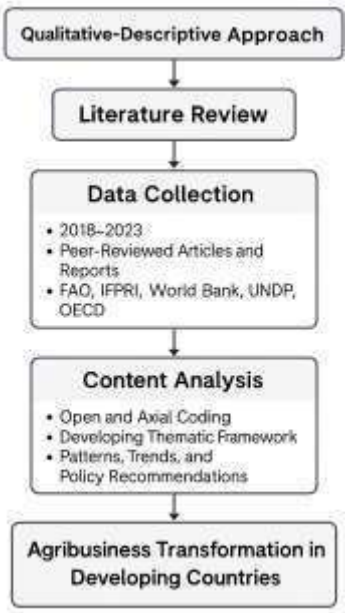

Figure 1. Flow Diagram Visual Methodology

RESULTS AND DISCUSSION

The transformation of agribusiness in developing countries involves not only changes in technology or markets, but also touches on very complex institutional, social, and political dimensions. In this context, the Agricultural Innovation Systems (AIS) and Value Chain Development (VCD) models become highly relevant theoretical frameworks to explain how the interaction between actors, institutions, and technology plays a role in accelerating changes in a more inclusive, sustainable, and productive agribusiness system.

Agricultural Innovation Systems (AIS)

The AIS approach emphasizes that innovation in the agricultural sector does not run linearly but involves dynamic interaction between various actors who play a role in the agricultural system. Innovation occurs in the context of social and institutional networks that interact with each other. Farmers, research institutions, governments, the private sector, NGOs, and the media play a crucial role in the sustainable innovation process. The AIS model provides an important conceptual foundation, where each actor contributes to an ever-evolving innovation process through cross-sectoral collaboration mechanisms. These innovations can include new technologies, agronomic practices, business models, and social and cultural changes in agricultural societies.

Research by [11] shows that developing countries that have inclusive agricultural innovation systems and are open to collaboration between sectors tend to experience higher technology adoption as well as a significant increase in agricultural output. One example that can be seen is the development of information systems based on digital technology that allow farmers to access the market more efficiently, obtain up-to-date information on market prices, and improve their managerial capacity through digital training. This inclusive approach, which encourages the active participation of all actors in the agricultural value chain, creates a strong and sustainable innovation ecosystem.

In addition, the transformation that occurs in the context of AIS must also take into account the role of local institutions and national policies. Government policies that support technology integration and provide incentives for research and development are essential in strengthening local innovation capacity. For example, governments that provide research funding or subsidies for green agricultural technologies can encourage faster adoption by farmers. Therefore, policy strategies that support cross-sectoral collaboration between the public and private sectors are critical in creating more resilient and sustainable agricultural systems.

Value Chain Development (VCD)

The Value Chain Development (VCD) approach emphasizes the importance of efficiency and fairness in the distribution of value along the agricultural supply chain. Successful agribusiness transformation in developing countries often involves interventions in strengthening farmer cooperatives, building social inclusion-based contract farming schemes, and building community-based e-marketplaces. A study conducted by [12] identified that strengthening an integrated value chain structure can increase farmers' incomes by up to 35% compared to farmers operating in more traditional open market systems.

The implementation of the VCD approach often involves forging partnerships between smallholders and other stakeholders, such as private companies or financial institutions, to improve market access, minimize distribution costs, and introduce new technologies in the production process [13]. For example, a contract farming system that involves large companies to secure markets for agricultural products can help smallholders gain access to larger, more stable markets, while increasing their production capacity through training and technology support.

The development of community-based e-marketplaces has also proven to be an effective solution in reducing farmers' dependence on intermediaries and allowing them to obtain fairer prices for their agricultural products . In this regard, VCD pays attention not only to technical efficiency but also to social justice, which plays a role in reducing inequality between large farmers and smallholders.

Determinants of Agribusiness Transformation

Agribusiness transformation is inseparable from a number of determining factors that are the main pillars in accelerating changes in the agribusiness system. Some of the determinants to look out for include:

1) Digital Technology Adoption CapacityAs digital technology rapidly develops, the adoption of technologies such as the Internet of Things (IoT) for precision irrigation, mobile apps for crop management, and e-commerce platforms is becoming very important. FAO research (2023) shows that the integration of digital technology in the agricultural sector can increase cost efficiency by up to 25% and reduce post-harvest losses by 20% [14]. This technology not only provides technical solutions, but also improves access to the information farmers need to make more informed and data-driven decisions.

2) Market Structure and Access to Financing Inefficient market structures are often a major obstacle to the growth of agribusiness in developing countries. The strengthening of farmer cooperatives and the implementation of agricultural fintech systems that provide microfinance can open up access to capital for smallholders to purchase quality inputs and adopt new technologies. These interventions have a direct impact on farmers' capacity to invest in innovation and increase their productivity.

3) Policy Environment and Infrastructure Government policies that support the development of physical and digital infrastructure, such as roads, irrigation networks, and digital training, are critical in creating an ecosystem that supports agribusiness transformation. Input subsidies, tax incentives, and training programs focused on building farmers' capacity to use new technologies can improve their competitiveness in the global market [15]. Therefore, policies that support the development of green infrastructure and sustainable agriculture are also crucial in overcoming the challenges faced by the agricultural sector.

4) Climate Resilience and Diversification Climate uncertainty is one of the biggest challenges in the agricultural sector. Therefore, environmentally friendly technologies and conservation farming practices should be prioritized. By adopting technologies that support commodity diversification and sustainable management of natural resources, farmers can increase their resilience to the impacts of climate change, while maximizing their income [16]. Eco-friendly technologies and sustainable agriculture are not only climate mitigation strategies but also create new market opportunities in the agricultural sector oriented towards responsible and sustainable food production.

Successful agribusiness transformation in developing countries requires an approach that integrates technological innovation, institutional strengthening, and cross-sector collaboration. The Agricultural Innovation Systems (AIS) and Value Chain Development (VCD) based approach allows us to see agribusiness as an interconnected ecosystem, where technology, markets, and policies play an important role in improving farmers' productivity, efficiency, and welfare [17]. In the context of developing countries, the implementation of policies that support inclusive innovation systems and equitable and efficient integration of value chains is essential to achieve sustainable agribusiness transformation.

DISCUSSION

Successful agribusiness transformation in developing countries can be seen as a process that involves three key interrelated pillars: digitalization, institutional inclusivity, and strategic partnerships [18]. These three pillars are the foundation for the success of an adaptive, productive, and sustainable agribusiness system. Agricultural digitalization, which includes the use of digital platforms such as M-Farm in Kenya, TaniHub in Indonesia, and e-Soko in Rwanda, has been proven to have a significant positive impact in improving access to market information, distribution efficiency, and price transparency. These platforms allow farmers to get faster and more accurate information about market prices, weather conditions, and market needs, which was previously difficult for many smallholders to access. According to a study conducted by [19], the use of this digital platform has increased farmers' incomes by 50% within two years, showing that digital technology not only improves efficiency, but also creates significant added value for smallholders who have been marginalized from the formal market.

However, digitalization alone is not enough to create a comprehensive agribusiness transformation. Institutional inclusivity plays a crucial role in increasing farmers' bargaining power to markets and input providers. Modern cooperative models in collaboration with the private sector are an effective strategy in increasing farmers' access to markets and financing, as well as creating stability in the supply chain. For example, the Farmer Field Schools program implemented by FAO in several countries in Asia and Africa, which aims to improve the skills of farmers through experience-based training. The program not only teaches farmers about more efficient farming techniques, but also introduces them to appropriate technologies that can increase their productivity by up to 40% [20].Good institutional integration between cooperatives, governments, and the private sector will accelerate the adoption of new technologies and create agricultural systems that are more sustainable and resilient to climate change and global market challenges.

However, despite progress, the implementation of agribusiness transformation still faces a number of significant structural barriers. One of the main problems that many farmers in developing countries still face is limited access to formal markets and financial institutions. A study conducted by [21] shows that 75% of smallholders in Sub-Saharan Africa and South Asia still do not have adequate access to formal markets or financial institutions that provide financing for the purchase of quality inputs and technology adoption. This often prevents them from increasing the production and quality of agricultural products. In addition, digital inequality and gender gaps also worsen access to innovation. Women farmers, who often have limited access to technology and resources, as well as young farmers who lack training and funding, are often marginalized in this agribusiness transformation process. Therefore, to ensure the success of an inclusive agribusiness transformation, institutional reforms and policies that are more in favour of vulnerable groups are essential [22].

Based on the findings of this study, there are a number of policy implications that need to be considered to drive the success of agribusiness transformation in developing countries. One of the policies that needs to be encouraged is the strengthening of the agricultural innovation ecosystem, where the government can build a digital-based agribusiness innovation center that can connect farmers with agritech startups, universities, and markets. This open innovation ecosystem enables cross-sector collaboration that can accelerate the deployment of new technologies and expand market access for farmers. Investment in rural ICT infrastructure is a priority, especially in disadvantaged areas that still have difficulty accessing digital services [23]. By strengthening this infrastructure, farmers in remote areas can more easily connect with the market and the information needed to optimize their production.

In addition, inclusive and equitable policy design should be the main focus. Affirmative policies for vulnerable groups, such as women farmers and peasant youth, are critical so that they are not left behind in technology adoption and

market access. This can be achieved through the provision of incentive-based productive subsidies, which can encourage farmers to invest in more efficient agricultural technologies and practices, rather than relying on direct assistance that is often temporary and unsustainable. Policies like this can provide greater incentives for farmers to improve the productivity and quality of their agricultural products, while ensuring long-term sustainability.

Then, strategic public-private partnerships (PPPs) are also very important in driving agribusiness transformation. The government can play a role as a facilitator in creating cooperation between farmer cooperatives, agritech companies, and microfinance institutions to open market access, financing, and technology transfer. Incentive schemes for the private sector investing in sustainable agriculture can also accelerate value chain transformation and create sustainability in agribusiness systems. The role of the private sector in providing innovative technologies and strengthening distribution networks will be very influential in increasing the competitiveness of agricultural products from developing countries in the global market.

Finally, to ensure the successful implementation of the policies and programs already mentioned, real-time data-based monitoring and evaluation must be an integral part of the agribusiness policy strategy. The use of spatial mapping and integrated climate data can help mitigate the risks of climate-based agriculture and improve the effectiveness of policy interventions tailored to local conditions. Thus, data-driven agribusiness policies will be more targeted and can have a greater impact on the welfare of farmers and the sustainability of agribusiness systems in developing countries.

Overall, to accelerate the transformation of agribusiness that is productive, inclusive, and adaptive to global changes, policies that favor institutional capacity building, digitalization, and strategic partnerships involving various stakeholders, both government, the private sector, and civil society are needed. Only with a holistic and integrated approach, the transformation of agribusiness in developing countries can succeed in creating real sustainability for farmers and society as a whole.

CONCLUSIONS

In conclusion, agribusiness transformation in developing countries requires a holistic and integrated approach, involving three main pillars, namely digitalization, institutional inclusivity, and strategic partnerships. Digitalization of agriculture, through innovative platforms, has been shown to improve distribution efficiency, market access, and price transparency, which directly contributes to increasing farmers' incomes. On the institutional side, modern cooperative models and partnerships between the public and private sectors strengthen farmers' bargaining positions and accelerate the adoption of appropriate technologies. However, structural barriers such as inequality of access to markets and financial institutions, as well as digital and gender gaps, remain challenges that must be addressed to ensure inclusivity in this transformation.

Policies that support the strengthening of agricultural innovation ecosystems, investment in rural ICT infrastructure, and inclusive and equity-based policy design for vulnerable groups, such as women farmers and youth farmers, are needed to drive the success of this transformation. In addition, strategic public-private partnerships and the use of real-time data-driven monitoring are key elements in improving the effectiveness and sustainability of agribusiness. With policies that favor innovation, multi-stakeholder collaboration, and farmer empowerment, a productive, inclusive, and adaptive agribusiness transformation can be achieved, resulting in sustainable agribusiness systems and improving farmer welfare and food security in developing countries.

supplementary material

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Трансформација агробизниса у побољшању ефикасности производње и прихода пољопривредника у земљама у развоју

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Апстракт:
Ова студија има за циљ да истражи како трансформација агробизниса може побољшати ефикасност производње и повећати приходе пољопривредника у земљама у развоју. Истраживање се бави хитном потребом за одрживим развојем пољопривреде усред брзе технолошке, институционалне и тржишне динамике, посебно у регионима са ниским и средњим приходима. Студија користи квалитативни истраживачки приступ користећи методологију систематског прегледа литературе. Анализирано је укупно 42 рецензирана чланка из часописа, институционални извештаји (нпр. ФАО, ИФАД, Светска банка) и студије случаја објављене између 2019. и 2024. године. Избор се фокусира на праксе засноване на доказима, исходе усвајања дигиталне пољопривреде и моделе агробизниса у Африци, Азији и Латинској Америци. Кључни налази откривају да је усвајање дигиталних технологија – као што су прецизна пољопривреда, наводњавање засновано на интернету ствари, надзор дроновима и мобилне саветодавне услуге – довело до побољшања приноса за 20–35% и смањења трошкова улагања за 15–25%. Модели агробизниса који укључују уговорну пољопривреду, дигитална тржишта и пољопривредне задруге показали су повећање цена на фарми за 18–40% и раст прихода домаћинстава до 60%. Институционални фактори попут реформе власништва над земљиштем и сарадње између владе и приватног сектора играли су кључну улогу у скалирању иновација. Ова студија доприноси оригиналним увидима синтетишући мултирегионалне доказе о трансформацији агробизниса и представљајући свеобухватни оквир који интегрише дигиталне иновације, институционалну подршку и развој инклузивног ланца вредности. Она истиче стратешку везу између модернизације агробизниса и оснаживања руралне економије, нудећи препоруке усмерене ка политикама које су у складу са циљевима одрживог развоја УН, посебно са циљевима 1 (Без сиромаштва) и 2 (Нулта глад).

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