

## Agro-Based Social Enterprises: Leveraging Digital Innovation for Sustainable Rural Development

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### Abstract

This study scrutinizes the role of agro-based social-enterprises in promoting sustainable agriculture and rural development in the hilly regions of Kerala, particularly Idukki. As social enterprises aim to achieve financial viability alongside social impact, they are uniquely positioned to address the challenges faced by farmers in ecologically sensitive areas. The research identifies a significant gap in existing literature concerning the specific impacts of these enterprises on sustainable agricultural practices, rural livelihoods, and migration patterns in hilly terrains. Utilizing a descriptive and analytical approach, the study analyses secondary data to explore the effectiveness of technological innovations such as precision farming, block-chain-enabled supply chains, and e-commerce platforms. Findings indicate that agro-based social enterprises have successfully encouraged sustainable farming practices, improved market access, and created new employment opportunities, thereby mitigating rural-urban migration. However, challenges such as limited digital literacy and insufficient policy support hinder their potential. This study provides valuable insights and practical recommendations for policymakers, practitioners, and scholars aiming to leverage social entrepreneurship for sustainable rural development in hilly regions.

**Keywords:** agro-based social enterprises, sustainable agriculture, rural livelihoods, technological innovation, rural-urban migration

### Introduction

In recent years, the role of agro-based social-enterprises in promoting sustainable agriculture and rural development has garnered increasing attention, especially in remote and ecologically sensitive areas such as the hilly regions of Kerala. Social enterprises, driven by a dual mission of financial viability and social impact, are uniquely positioned to tackle challenges like declining agricultural productivity, rural poverty, and migration by introducing innovative solutions tailored to local needs (Schaltegger & Wagner, 2011). These enterprises can act as catalysts for sustainable development, particularly in regions like Idukki, Kerala, where agriculture forms the backbone of the local economy.

Kerala, renowned for its biodiversity and agricultural diversity, is home to the hilly district of Idukki, which accounts for a significant portion of India's cardamom and tea production. However, farmers in these regions face numerous challenges, including fragmented landholdings, soil erosion, unpredictable rainfall, and limited access to markets. According to the Agricultural Census of India (2015-16), more than 95% of farmers in Idukki are smallholders, cultivating less than two hectares of land (Department of Agriculture & Farmers Welfare, 2018). These smallholders are often constrained by limited resources and low

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technological adoption, making it difficult for them to scale up operations or secure fair market prices.

Technological innovations, such as precision farming, blockchain for supply chain transparency, and e-commerce platforms, hold significant promise for addressing these challenges. Precision farming, which uses data-driven insights to optimize water usage, fertilizer application, and crop yields, can be particularly beneficial for hilly areas where resource management is crucial (Jat et al., 2019). Similarly, blockchain technology can improve supply chain transparency, ensuring that farmers receive fair prices by reducing dependency on middlemen and enhancing trust in product authenticity (Kamble et al., 2020). Moreover, e-commerce platforms provide a vital opportunity for farmers to access wider markets, including urban consumers and export channels, potentially transforming their income streams (Sharma et al., 2021).

Despite these promising innovations, rural farmers in Idukki face significant barriers to adopting these technologies. Limited digital literacy, inadequate infrastructure, and low capital investment hinder widespread adoption. Moreover, the lack of awareness about sustainable practices and the absence of coordinated support systems often leave farmers in a vulnerable position. This is where agro-based social enterprises can play a pivotal role. By integrating technology into sustainable farming practices and providing farmers with the necessary resources and training, social enterprises have the potential to revolutionize agricultural practices in these hilly regions while improving livelihoods and reducing rural-urban migration.

According to the Kerala Migration Survey (2018), nearly 50% of households in Idukki report having at least one member who has migrated to urban areas or abroad in search of better economic opportunities (Zachariah & Rajan, 2018). This outmigration not only depletes the local labor force but also weakens the rural economy. Agro-based social enterprises, by creating locally sustainable economic opportunities through innovative agricultural practices, could significantly mitigate this trend. By fostering entrepreneurship and empowering smallholder farmers with technological solutions, such enterprises could ensure the economic sustainability of rural regions like Idukki while contributing to the broader goals of the United Nations Sustainable Development Goals (SDGs), particularly SDG-1 (No Poverty), SDG-8 (Decent Work and Economic Growth), and SDG-12 (Responsible Consumption and Production) (United Nations, 2015).

This study targets to explore the potential of agro-based social enterprises in the hilly regions of Idukki, Kerala, focusing on how technological innovations such as precision farming, blockchain, and e-commerce can promote sustainable agriculture, improve livelihoods, and reduce rural-urban migration. By understanding the challenges and opportunities within this framework, this research intends to provide policy recommendations and practical solutions for scaling these models in other similar rural areas

### Literature Review

The intersection of entrepreneurship, technological innovation, and sustainable development has gained significant attention in recent years, particularly in the context of agro-based social enterprises. These enterprises are seen as key drivers of inclusive and sustainable growth in rural economies, combining economic viability with social impact. This literature review synthesizes key studies on agro-based social enterprises, technological innovations in

agriculture (such as precision farming, block-chain, and e-commerce platforms), and their impact on livelihoods and rural-urban migration.

Agro-based social enterprises focus on uplifting marginalized farming communities through sustainable agricultural practices. These enterprises not only facilitate the adoption of environmentally friendly farming techniques, such as organic farming and agro-ecology, but also help ensure income stability and fair trade for smallholders (Bocken et al., 2019). (Schaltegger and Wagner, 2011) emphasize that sustainable entrepreneurship fosters innovation within social enterprises by promoting local capacity-building through access to resources, training, and technologies. By facilitating the use of sustainable practices and ensuring fair income distribution, social enterprises contribute to both ecological and economic sustainability, particularly in rural, which are ecologically sensitive and dependent on agriculture for livelihoods (Saenz & Ruben, 2004).

In addition to promoting sustainable practices, agro-based social enterprises play a critical role in addressing systemic challenges faced by smallholder farmers, such as limited access to markets, training, and financing (Smith et al., 2016). By involving communities and leveraging local resources, these enterprises ensure that the benefits of sustainable agriculture are widely distributed, thus promoting social equity and reducing economic vulnerability (Peredo & McLean, 2006).

Technological advancements, such as precision farming, block-chain for supply chain transparency, and e-commerce platforms, have demonstrated immense potential in transforming agricultural productivity and market access. Precision agriculture, which uses technologies like GPS, sensors, and data analytics, allows farmers to optimize resource use and improve efficiency. Studies have shown that precision farming enhances yields and reduces input costs, particularly in regions with challenging terrains (Jat et al., 2019). (Gebbers, 2010) argue that precision agriculture helps smallholders manage resources more effectively, which can reduce environmental impacts and increase profitability. Block-chain technology, with its ability to provide supply chain transparency, has emerged as a powerful tool for improving trust and reducing the role of middlemen in agriculture. Block-chain enables traceability from farm to consumer, which is particularly valuable for high-value crops like cardamom, tea, and spices, allowing farmers to command premium prices (Kamble et al., 2020; Tripoli & Schmidhuber, 2018). This transparency increases farmers' bargaining power and reduces dependence on intermediaries, further contributing to economic sustainability in rural areas.

E-commerce platforms, by connecting rural farmers directly to consumers, wholesalers, and retailers, are revolutionizing market access. Sharma et al. (2021) note that these platforms enable farmers to bypass traditional supply chains, reducing transaction costs and expanding market reach. This is particularly beneficial for smallholder farmers in remote areas, who often face logistical barriers and lack market information (Chauhan et al., 2022). Moreover, digital platforms provide real-time data on market prices and demand trends, allowing farmers to make informed decisions, which ultimately improves their income and reduces economic vulnerability. Another major concern in rural economies is the migration of rural populations to urban areas, driven by economic hardship and a lack of sustainable livelihood opportunities. Studies show that enhancing rural economic resilience through entrepreneurship can significantly reduce rural-urban migration (Van der Gaag et al., 2021). Agro-based social enterprises can play a vital role in this regard by promoting sustainable livelihoods through

innovative agricultural practices, making agriculture more profitable and attracting both young and older populations back to rural areas (Anseeuw & Baldock, 2013). Empowering women and youth through social enterprises has a multiplier effect on rural development, as women participation in agriculture and decision-making leads to broader community benefits (Acharya & Gentle, 2006), and youth entrepreneurship helps curb migration by creating meaningful job opportunities within the community (Swinnen & Kuijpers, 2020).

Several case studies support these claims. For instance, Uravu and Buffalo Back, two social enterprises in India, have successfully integrated sustainable farming practices and community development, serving as models that can be replicated in other rural areas (Thomas & Geo Alex, 2023). Similarly, the Bakrichhap Agro Tourism model demonstrates how community-based entrepreneurship, supported by public-private partnerships, can promote rural sustainability and economic development (Anil & Misra, 2023). These models offer valuable insights for enhancing local employment and entrepreneurship, particularly in rural village hubs (Begum, 2020; Unjia et al., 2024). Despite the potential benefits of agricultural entrepreneurship, several challenges persist. Access to finance, markets, and technology remains limited, particularly in rural areas (Shah et al., 2023). Moreover, environmental degradation, climate change, and gender inequality pose additional barriers to agricultural innovation. As Biradar et al. (2023) point out, entrepreneurial opportunities in agriculture, such as organic farming, agro-tourism, and value-added products, have grown, but challenges remain in scaling these opportunities to benefit marginalized groups. Shah and colleagues (2023) further identify innovation aversion and a perceived lack of control over technological advancements as core barriers to adopting sustainable agricultural practices. This is steady with the findings of Kasi et al. (2023), who highlight that complexity in innovations and socio-demographic factors often impede farmers' willingness to adopt new technologies. To fully realize the potential of agricultural entrepreneurship for sustainable development, innovative and sustainable approaches must be adopted. Biradar et al. (2023) suggest that emerging technologies like blockchain and precision agriculture offer new avenues for growth by improving supply chain transparency and resource efficiency. However, overcoming barriers to innovation adoption will require concerted efforts from policymakers and stakeholders to simplify technological processes and make them more accessible to smallholder farmers (Kasi et al., 2023).

The literature highlights the importance of agro-based social enterprises as catalysts for sustainable development in rural areas, particularly when combined with technological innovations like precision farming, block-chain, and e-commerce. By improving market access, enhancing productivity, and providing sustainable livelihoods, these enterprises can significantly reduce rural-urban migration and contribute to the overall economic resilience of hilly rural regions. However, barriers such as infrastructure deficits and low digital literacy remain significant challenges that require policy support and coordinated action to overcome.

#### Research Gap

Despite the growing recognition of agro-based social enterprises as critical drivers for sustainable development and rural empowerment, there is a noticeable gap in understanding their potential impact in hilly and ecologically sensitive regions such as Idukki in Kerala. Much of the existing research on social enterprises and technological innovations in agriculture focuses on lowland rural areas or regions with relatively better access to infrastructure and

markets (Smith et al., 2016; Bocken et al., 2019). However, the exceptional challenges faced by farmers in hilly terrains such as difficult topography, climate vulnerabilities, limited market access, and infrastructural deficits require a tailored approach that integrates both social entrepreneurship and cutting-edge technological solutions like precision farming, block-chain-enabled supply chains, and e-commerce platforms.

Additionally, while there is research on the impact of social enterprises on rural livelihoods, there is limited empirical evidence on how these enterprises can simultaneously address multiple challenges, including sustainable agriculture, income improvement, and rural-urban migration, in the context of hilly rural areas (Swinnen & Kuijpers, 2020; Jat et al., 2019). The specific dynamics of social enterprise-driven innovations in agricultural supply chains and their role in mitigating out-migration from areas like Idukki remain underexplored.

This study addresses this gap by focusing on agro-based social enterprises in the hilly regions of Kerala, particularly Idukki, to examine how they can promote sustainable agriculture, improve rural livelihoods, and reduce migration through technological innovations. The study integrates a multi-disciplinary approach, incorporating insights from rural development, entrepreneurship, technological adoption, and sustainable agriculture, thereby filling a critical gap in the literature and offering practical solutions to real-world challenges.

#### Significance of the Study

This study is significant for several reasons. First, it provides an in-depth exploration of the potential for agro-based social enterprises to promote sustainable agriculture in geographically challenging areas. With Idukki's unique terrain and agricultural profile, the research contributes to a region-specific understanding of how social enterprises can be leveraged to improve both environmental and economic outcomes. Second, the study sheds light on the role of technology in bridging gaps in the agricultural value chain in remote areas. Precision farming, block-chain for transparent supply chains, and e-commerce platforms offer promising tools for addressing the barriers faced by farmers in hilly regions. By examining the application and effectiveness of these technologies, the research can guide policy interventions and support the scaling of such innovations in similar terrains across India and other developing regions. Third, the study's focus on rural-urban migration makes it highly relevant in the context of India's growing urbanization challenges. The research examines how sustainable livelihood opportunities created through social enterprises and technology can mitigate migration pressures, a key concern for policymakers aiming to balance rural and urban development. The findings will have implications for national development policies, such as the Make in India and Digital India initiatives, and contribute to achieving several United Nations Sustainable Development Goals (SDGs), including no poverty, decent work and economic growth, and reduced inequalities.

#### Scope of the Study

The scope of the study is geographically concentrated on the Idukki district of Kerala, a hilly region known for its agricultural output, including high-value crops like tea, spices, and cardamom. However, the insights and recommendations drawn from this research will have broader applicability to other hilly regions across Kerala and India.

The results of this study will offer valuable insights for practitioners, policymakers, and scholars interested in sustainable development, rural entrepreneurship, and agricultural

innovations. It will also provide practical recommendations for enhancing the role of agro-based social enterprises in rural economic transformation.

### Objectives of the Study

Based on insights from the literature reviews and supported by recent reports and data, the objectives of the study on agro-based social enterprises in the hilly regions of Kerala, particularly Idukki, are as follows:

1. To analyse the role of agro-based social enterprises in promoting sustainable agricultural practices
2. To evaluate the impact of technological solutions, such as precision farming, blockchain-enabled supply chains, and e-commerce platforms, on enhancing agricultural productivity and market access for smallholder farmers
3. To assess the potential of agro-based social enterprises in improving livelihoods and reducing rural-urban migration
4. To identify the challenges faced by agro-based social enterprises in scaling their operations and ensuring long-term sustainability in the hilly regions of Idukki
5. To propose strategies for integrating agro-based social enterprises with local governance and development frameworks for sustainable rural development.

### Methodology

This study will primarily rely on secondary data sources and a desk-based research approach. The research will focus on analysing existing literature, reports, and data sets relevant to agro-based social enterprises, sustainable agriculture, technological innovations, and rural development in the hilly regions of Kerala, specifically Idukki. The study will employ a descriptive and analytical research design to explore the role of agro-based social enterprises in promoting sustainable agricultural practices, improving rural livelihoods, and addressing rural-urban migration through technological interventions. This approach will utilize secondary data from credible sources to establish a comprehensive understanding of the topic.

### Research Findings and Discussion

This section presents the research findings based on the analysis of secondary data and existing literature on agro-based social enterprises, sustainable agriculture, and rural development in Idukki, Kerala. The findings are discussed in relation to the study's objectives and the broader context of sustainable development and technological innovation.

#### *1. Agro-Based Social Enterprises and Sustainable Agriculture*

Many social enterprises in Idukki have encouraged farmers to adopt organic farming methods, which are both environmentally sustainable and financially viable. Organic farming initiatives have led to a reduction in chemical inputs and improved soil health in the region. Given the hilly terrain and variable rainfall patterns in Idukki, social enterprises have introduced water-saving technologies such as drip irrigation and rainwater harvesting. These interventions have improved water use efficiency and enhanced crop yields for smallholder farmers. Social enterprises have encouraged farmers to diversify their crops beyond traditional staples like tea and coffee. There has been a shift toward high-value crops such as spices, medicinal plants, and organic vegetables, which are better suited to the local agro-climatic conditions and more profitable for farmers.

## *2. Technological Solutions Driving Agricultural Transformation*

Technologies such as soil sensors, GPS-enabled machinery, and data analytics platforms have been introduced by social enterprises to help farmers optimize their input usage and improve crop yields. Farmers using precision farming techniques have seen yield increases in key crops. Social enterprises have also begun experimenting with block-chain technology to improve transparency and traceability in agricultural supply chains. This has allowed farmers to get better prices for their products by eliminating middlemen and ensuring that buyers can verify the authenticity of organic and fair-trade certifications. To overcome the geographic isolation of the hilly areas, social enterprises have facilitated the use of e-commerce platforms to connect farmers directly with urban markets. By cutting out intermediaries, farmers have been able to access larger markets and obtain better prices for their products.

## *3. Impact on Livelihoods and Rural-Urban Migration*

By adopting sustainable farming practices and leveraging technology, farmers in Idukki have experienced notable improvements in their incomes. This has been particularly important for smallholder farmers who were previously dependent on middlemen and volatile market prices. Social enterprises in Idukki have also created new employment opportunities in rural areas, particularly for women and young people. By engaging in activities such as organic farming, product processing, and value addition, rural residents have been able to diversify their income sources. Agro-based social enterprises in Idukki have contributed to the creation of job opportunities. The findings suggest that social enterprises, through improving incomes and providing local employment opportunities, have significantly reduced the push factors driving migration. A survey conducted by the Kerala Migration Survey (2022) indicated a reduction in migration from Idukki, with many respondents attributing this to improved livelihood prospects due to social enterprises.

## *4. Challenges and Opportunities*

Despite the positive impacts, the study also identified several challenges facing agro-based social enterprises in Idukki. Microfinance institutions and government programs provide some support, there is a need for more investment in rural enterprises to ensure their long-term sustainability. Although technology has been a key driver of success, many farmers still face challenges in adopting new technologies due to limited digital literacy. Social enterprises must invest in training and capacity-building programs to ensure that farmers can fully utilize these innovations. While the Kerala government has been supportive of rural enterprises, there is still a gap in comprehensive policies that integrate agro-based social enterprises into broader rural development strategies. Strengthening the policy framework will be crucial to ensuring that these enterprises can thrive.

## *Discussion and Suggestions*

The findings of this study highlight the critical role that agro-based social enterprises can play in promoting sustainable agriculture, improving rural livelihoods, and reducing migration pressures in hilly regions like Idukki. The use of technological solutions such as precision farming, blockchain, and e-commerce platforms has been instrumental in enhancing agricultural productivity and market access, providing a blueprint for how similar regions can address the challenges of rural development.

The study also underscores the need for greater investment and policy support to scale these enterprises and ensure their long-term impact. Addressing barriers related to capital access,

technological adoption, and policy alignment will be essential for the continued success of agro-based social enterprises in Kerala and beyond.

1. Technological solutions such as precision farming, blockchain for supply chains, and e-commerce platforms have demonstrated positive impacts, there is a need to further invest in digital literacy and technological training for farmers. Future efforts should focus on capacity-building programs to ensure that farmers can fully leverage these technologies, particularly in remote and less connected areas.
2. Many agro-based social enterprises face significant challenges in accessing capital, which limits their scalability and long-term sustainability. Developing tailored financial products and investment models specifically for rural social enterprises, potentially through partnerships with microfinance institutions and Fin-Tech companies, could help bridge this gap and enhance the impact of these enterprises.
3. Policymakers should consider creating incentive structures (e.g., tax breaks, grants, or subsidies) that support social enterprises contributing to sustainable agriculture and rural livelihoods. Public-private partnerships could provide the necessary support to scale these initiatives and ensure widespread impact.
4. Efforts should be made to expand market opportunities both within India and internationally, agro-based social enterprises could benefit from partnerships with larger retailers, export markets, and fair-trade organizations that are aligned with sustainable and organic farming principles.
5. Future initiatives could focus on empowering these groups through specialized training programs, leadership roles within social enterprises, and creating targeted funding mechanisms for women and young entrepreneurs in agriculture.

#### *Scope for Further Research*

1. The study focused on the hilly regions of Idukki, Kerala, further research could compare the success and challenges of agro-based social enterprises in other regions with similar agro-climatic conditions.
2. A more detailed study on the role of policy frameworks and government interventions in supporting agro-based social enterprises would be valuable.
3. By tracking changes over time, future research could provide a deeper understanding of the long-term impacts of social enterprises on poverty reduction, food security, and migration trends.
4. Further research is needed to explore the barriers to technology adoption among rural farmers in greater depth.

#### *Conclusion*

This study has demonstrated the significant role that agro-based social enterprises can play in transforming rural economies, particularly in hilly areas like Idukki. However, further research and practical interventions are needed to deepen the understanding of their long-term impact, enhance scalability, and address the challenges they face. By exploring the various suggestions and research avenues proposed here, scholars and practitioners can contribute to creating more resilient, inclusive, and sustainable rural communities.

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