

The Role of Social Relations on Sustainable Agricultural Practices and Innovation Adoption among Smallholder Orange Farmers in Muheza District, Tanzania

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Abstract

This study aimed to examine the role of social relations in influencing sustainable agricultural practices, innovation adoption, and market participation among smallholder orange farmers in Mkuzi Village, Muheza District, Tanzania. Specifically, the study investigated: first how trust, cooperation, and networks shape productivity and innovation uptake; second, the barriers posed by mistrust and weak social ties; and third, the institutional and social interventions that can support sustainable farming outcomes. A mixed-methods design was employed, integrating both qualitative and quantitative approaches. Data were collected through household surveys (n = 60), semi-structured interviews, focus group discussions, and participant observation. Quantitative data were analysed using descriptive statistics and regression analysis via SPSS Version 25, while qualitative data were thematically coded using NVivo 12. Findings reveal that strong social relations, characterized by trust, cooperation, and active group membership, were associated with higher adoption of improved inputs, greater market access, and increased resilience. Conversely, weak social networks, insecure land tenure, and theft undermined innovation and investment, particularly among smallholder farmers. The implications of these results underscore the need to strengthen local institutions, promote inclusive cooperatives, improve land tenure systems, and rebuild community trust. The study recommends that policymakers and development practitioners integrate social capital considerations into agricultural programs to enhance sustainability, innovation uptake, and rural livelihoods.

Keywords: social relations, sustainable agriculture, innovation adoption, orange farmers, Tanzania

1. Introduction

Social relations, encompassing trust, cooperation, and social networks, play a foundational role in shaping sustainable agricultural systems, yet their importance has often been underemphasized in agricultural research and policy discourse. In contexts where formal institutions are weak or inaccessible, the informal social structures that govern interactions among farmers, communities, and local institutions become central to resource sharing, knowledge dissemination, innovation adoption, and collective action. Emerging evidence suggests that social capital can either enable or constrain the implementation of sustainable agricultural practices, depending on the nature and strength of local relationships (Bjornlund et al., 2020; Gadeberg & Lecoutere, 2023). Positive social relations promote collaboration, reduce transaction costs, and facilitate access to inputs and markets. Conversely, social fragmentation, mistrust, and elite capture can block innovation and undermine environmental stewardship. It is therefore critical to understand how social dynamics interact with agrarian systems to either support or hinder sustainability goals.

Building on this understanding, sustainable agriculture is increasingly recognized as a complex socio-technical system that requires not only the adoption of improved inputs and environmentally sound practices, but also enabling social environments that facilitate cooperation, learning, and adaptation. In Sub-Saharan Africa, smallholder farmers often operate under challenging conditions characterized by insecure land tenure, limited access to extension services, and fragmented market systems. These challenges are deeply intertwined with local social structures and norms, which can either support or inhibit farmers' capacity to innovate and respond to changing conditions (Kamara et al., 2019; Mtui, 2023). Thus, understanding the social underpinnings of sustainable agriculture is not just a theoretical concern but a practical necessity for agricultural transformation.

Globally, oranges are among the most economically significant fruit crops, contributing to nutrition, livelihoods, and trade. In Tanzania, Muheza District in Tanga Region stands out for its vibrant citrus production, particularly among smallholder farmers. While previous research has documented the technical and economic characteristics of orange farming in the area, relatively little attention has been given to the role of social relations in shaping innovation, sustainability, and market participation in this sector. This study aims to fill that gap by examining the social dynamics that influence sustainable agricultural practices among orange producers in Mkuzi Village, Muheza District.

Drawing on Social Capital Theory and Agricultural Innovation Systems Theory, the study investigates how trust, cooperation, and social networks influence smallholders' engagement with sustainable practices, technology adoption, and markets. The analysis is grounded in recent empirical work that highlights the double-edged nature of social capital—capable of both enabling and constraining agricultural progress depending on context (Paudel et al., 2023; Gadeberg & Lecoutere, 2023). In doing so, the study contributes to a more nuanced understanding of how social structures intersect with agrarian change and offers policy-relevant insights for improving rural livelihoods through socially inclusive agricultural development.

This study explores how social relations both enable and constrain smallholder orange farmers in Mkuzi village, Muheza District. Grounded in Social Capital Theory (Bourdieu, 1986; Coleman, 1988; Woolcock & Narayan, 2000) and Agricultural Innovation Systems Theory (Röling & Jiggins, 1998), the research investigates three main questions: (1) How do trust, cooperation, and networks influence productivity and innovation uptake? (2) What barriers, including mistrust and individualism, impede sustainable practices and market access? (3) What social and institutional interventions can strengthen positive dynamics to support sustainability and livelihoods?

2. Literature Review

Social relations—particularly trust, cooperation, and social networks have emerged as central yet underexplored determinants of sustainable agricultural practices. Globally, research has highlighted how the structure and quality of social interactions among farmers shape access to resources, knowledge dissemination, and the diffusion of innovation. In North America and Europe, cooperative institutions and peer learning networks have promoted soil conservation, climate-smart agriculture, and integrated pest management, largely because of strong norms of reciprocity and trust (Jones et al., 2020; Pretty & Ward, 2001). In South and Southeast Asia, community-based seed systems and farmer field schools thrive in regions where dense networks of mutual support underpin collective action and agroecological knowledge exchange (Paudel et al., 2023; Aker, 2011).

In Sub-Saharan Africa, empirical research increasingly emphasizes the pivotal role of social capital in influencing sustainable land management and innovation adoption. For instance, Mwangi and Ouma (2015) found that social trust and community norms improved collective soil fertility management and rainwater harvesting in Kenya. Similarly, Meinzen-Dick and Mwangi (2009) observed that informal institutions, such as self-help groups and rotating savings schemes, supported sustainable intensification among smallholders in Uganda and Tanzania. However, studies also show that negative forms of social capital—such as elite capture, exclusion, and mistrust—can hinder sustainability efforts, particularly where formal institutions are weak or contested (Woolcock & Narayan, 2000; Ostrom, 2009). These findings align with broader theoretical work suggesting that the dual nature of social capital—as both enabling and constraining—must be understood contextually (Bourdieu, 1986; Coleman, 1988).

Within the Tanzanian context, Kahimba et al. (2014) documented how trust-based labour sharing, access to group extension services, and communal land governance practices influenced conservation agriculture in Arusha and Dodoma. They found that social fragmentation significantly reduced the effectiveness of these sustainability interventions. Mtui (2023) further demonstrated that agricultural transformation in Tanzania requires socially inclusive policy frameworks that strengthen both formal and informal networks. Yet despite growing interest in social capital and rural development, much of the literature remains narrowly focused on economic or technical factors, overlooking the relational dimensions that shape everyday agricultural decision-making.

In Muheza District specifically, Mhando and Ikeno (2017) explored orange production and marketing systems but did not engage deeply with the socio-cultural institutions influencing farmer behaviour. Their work emphasized economic constraints but left unexplored how social trust, communal tenure, and inter-household cooperation affect sustainability outcomes. This current study addresses that gap by explicitly foregrounding the role of social relations both as facilitators and barriers to sustainable agricultural practices in Mkuzi Village. It builds on the theoretical framework of Social Capital Theory and Agricultural Innovation Systems Theory to interpret the dynamic interplay between social cohesion, innovation diffusion, and resilience among smallholder farmers.

Thus, this review points out that sustainable agriculture in Tanzania and Africa more broadly, cannot be fully

understood without examining the social infrastructures that underlie production systems. By integrating lessons from both global and African contexts, this study situates itself at the intersection of rural sociology, development theory, and agroecological transition, offering a novel contribution to empirical and theoretical debates on sustainability.

3. Materials and Methods

3.1 Research Area

The study was conducted in Mkuzi Village, located in Muheza District of Tanga Region in northeastern Tanzania. Muheza lies between latitudes 5°10'–5°20' S and longitudes 38°45'–39°00' E and is known for its favourable agroecological conditions for citrus cultivation. The district has a tropical climate with bimodal rainfall patterns averaging 1,200–1,600 mm annually, supporting mixed cropping systems dominated by orange, cassava, and maize. Mkuzi Village, inhabited predominantly by the Bondei and Bena ethnic groups, is characterized by both communal and individualized land tenure systems, which influence patterns of land use and investment. Social interactions in the village are shaped by extended family networks, seasonal labour arrangements, and informal cooperative groups, factors critical for examining the role of social relations in shaping sustainable farming behaviours.

This study employed a mixed-methods research design to examine how social relations, specifically trust, cooperation, and social cohesion, shape sustainable agricultural practices among smallholder orange farmers in Mkuzi Village, Muheza District, Tanzania. The investigation was anchored in the relationship between the independent variable (social relations) and the dependent variable (sustainable agriculture), with sustainability measured through practices such as soil conservation, seedling management, agroecological input use, and land stewardship behaviours. Mkuzi Village, located in the citrus-producing region of Tanga, was selected due to its established farming traditions, observable social dynamics, and ongoing challenges related to sustainability. The study focused on how social interactions within and across farming households influence the adoption and persistence of environmentally sound agricultural practices under communal and individual land tenure systems.

3.2 Sampling Design and Size

A stratified random sampling technique was employed to ensure representation across varying household sizes and production scales. The total number of orange-producing households in Mkuzi Village was 230, as identified through the village agricultural register. Using Yamane's formula (1967), the required sample size was calculated as follows:

$$n = N / (1 + N * e^2)$$

Where: n = sample size N = population size (230 orange-farming households) e = level of precision (0.10)

$$n = 230 / (1 + 230 * 0.10^2) = 230 / (1 + 2.3) = 230 / 3.3 \approx 70$$

A total of 70 respondents were selected as a representative sample. Stratification was done by dividing Mkuzi into five sub-villages (*Kwea, Daisalamu, Maweni, Kumba, and Mtoni*), ensuring geographic diversity. Within each sub-village, farmers were further categorized into small, medium-, and large-scale producers based on the number of orange trees cultivated. Random selection was applied within each category to ensure proportional representation of all farming types. While the study acknowledges the recommendation to include villages from multiple districts in the Tanga Region, this initial phase focused on Mkuzi Village to enable in-depth investigation of context-specific social dynamics. However, future research will expand the geographic scope to include comparative analysis across other citrus-producing districts such as Korogwe, Pangani, and Handeni to enhance generalizability and scientific rigor.

3.3 Data Collection and Analysis

This study employed a mixed-methods approach to comprehensively examine how social relations influence sustainable agricultural practices among smallholder orange farmers in Mkuzi Village, Muheza District. Data collection combined multiple instruments to capture both quantitative indicators and qualitative insights. First, structured questionnaires were administered to a stratified sample of 60 farmers to gather data on household characteristics, farm practices, yields, market participation, and key social capital indicators, including trust, cooperation, and group membership. Second, semi-structured interviews were conducted with purposively selected stakeholders—, including farmers, village leaders, agricultural extension officers, and cooperative representatives—to explore perceptions of social dynamics, innovation diffusion, land tenure, and market access. Third, focus group discussions (FGDs) were organized in each of the five sub-villages (*Kwea, Daisalamu, Maweni, Kumba, and Mtoni*) to capture collective experiences and community-level dynamics. These discussions provided

a forum for exploring socially embedded practices such as seedling sharing, informal credit systems, and labour exchange. In addition, participant observation was used throughout the fieldwork period to contextualize reported behaviours and validate information from interviews and surveys. Ethical approval for the study was granted by the Ministry of Local Government and Regional Administrations of Tanzania, and all participants provided informed consent in accordance with institutional guidelines.

3.4 Data Analysis

Data analysis was structured to ensure methodological rigor and integration across the qualitative and quantitative domains. Quantitative data collected from the household questionnaires were analysed using SPSS Version 25. Descriptive statistics, including means, frequencies, and percentages—were used to summarize patterns in social relations and sustainability-related practices across different farming scales (small-, medium-, and large-scale producers). Inferential statistical methods, such as chi-square tests, were employed to explore associations between categorical variables. Binary logistic regression models were used to examine the effect of trust, cooperation, and social cohesion on the likelihood of adopting specific sustainability practices, such as soil conservation, organic input use, and diversified cropping.

Simultaneously, qualitative data from key informant interviews and FGDs were transcribed, translated from Kiswahili to English, and thematically coded using NVivo 12 software. This analysis employed an inductive approach to identify recurring themes and subthemes, such as mistrust, seedling theft, tenure insecurity, and patterns of informal cooperation. Particular attention was paid to differences in social capital formation among ethnic groups (e.g., Bondei vs. Bena) and between farm categories. Triangulation across data sources and methods was employed to validate findings and to ensure analytical robustness. The integrated analytical strategy, inking statistical results with qualitative narratives reflected the interdisciplinary nature of the research problem and aligned with the study's theoretical foundations in Social Capital Theory and Agricultural Innovation Systems Theory. This approach not only enhanced internal validity but also allowed for a more nuanced understanding of how social structures shape sustainability outcomes in agrarian settings.

4. Results and Discussion

This section presents a deeply integrated and theoretically grounded analysis of the relationships between the aspects of social relations—namely family, friendship, workplace ties, shared interests, and geographical proximity—and the adoption of sustainable agricultural practices among smallholder orange farmers in Mkuzi Village. These practices include crop diversification, cover cropping, reduced tillage, and integrated pest management (IPM). Findings are interpreted through Social Capital Theory (Bourdieu, 1986; Coleman, 1988; Woolcock & Narayan, 2000) and Agricultural Innovation Systems Theory (Röling & Jiggins, 1998), offering both empirical detail and conceptual insight.

4.1 Demographic and Social Profiles

Understanding the demographic landscape is essential for interpreting the structure and efficacy of social networks that influence agricultural practices. Table 1 details demographic characteristics across farm categories, highlighting critical socio-economic constraints.

Table 1. Demographic characteristics by farm size

Farmer Type	Average Age (years)	Male (%)	Primary Education Only (%)
Smallholders	48	68%	74%
Medium-scale	51	80%	60%
Large-scale	53	83%	50%

Source: Field data, 2024.

The results on Table 1 reveals that smallholders are older and less formally educated compared to medium- and large-scale farmers. This demographic profile influences the flow of information and innovation, making informal networks more crucial for marginalized groups. As Mwangi and Ouma (2015) observe, lower levels of formal education often result in greater reliance on bonding social capital, where trust and reciprocity substitute for formal extension systems. This underscores the necessity of context-specific approaches to knowledge dissemination.

4.2 Family and Friendship Ties: Predictors of Seedling Innovation and Crop Diversification

Social ties rooted in kinship and friendship serve as primary pathways for accessing agricultural innovations, especially among smallholders. Table 2 presents data on preferred seedling sources.

Table 2. Preferred seedling sources

Seedling Source	Percentage of Respondents
Family/friends	70%
Local nurseries	18%
Extension programs	12%

Source: Field data, 2024.

The findings in Table 2 confirm that most respondents access improved seedlings through familial or friendship-based networks. This reliance signifies a form of bonding capital that reduces transaction costs, enhances trust, and promotes informal quality assurance. Regression analysis supports a positive correlation ($p < 0.05$) between these social networks and crop diversification, a key marker of agroecological resilience. These patterns are consistent with findings in South Asia, where familial seed systems have facilitated the adoption of climate-resilient crops (Paudel et al., 2023). However, excessive dependence on insular networks may restrict exposure to broader innovations, reinforcing the need for hybrid systems that blend informal and formal seed access.

4.3 Workplace Cooperation and Reduced Tillage Practices

Workplace-based relations manifested through shared labour groups and cooperative membership, significantly influence the uptake of labour-intensive sustainability practices such as reduced tillage. Table 3 presents variations in cooperation and trust across farm sizes.

Table 3. Trust and cooperation by farm size

Indicator	Smallholders (%)	Medium scale (%)	Large-scale (%)
Cooperative membership	28%	45%	70%
Shared labour groups	20%	35%	50%
Trust in neighbours	52%	65%	80%

Source: Field data, 2024.

Large-scale farmers report higher participation in labour-sharing and greater trust, both of which are associated with higher adoption of reduced tillage practices ($p < 0.01$). These results support the thesis that workplace-based cooperation acts as a bridging form of social capital that facilitates access to resources and knowledge beyond immediate family ties. Kahimba et al. (2014) similarly reported that shared labour schemes enhanced conservation agriculture in Tanzania. For smallholders, the lack of these relations represents a critical barrier to adopting soil-conserving methods. Policy responses should include capacity-building for labour-sharing initiatives and the formalization of informal work groups.

4.4 Shared Interests and Integrated Pest Management (IPM)

Collective action formed around shared interests and cooperative endeavours is central to knowledge-intensive practices such as IPM. Table 4 offers a composite view of key agricultural and social indicators.

Table 4. Summary of key indicators

Indicator	Smallholders (%)	Medium-scale (%)	Large-scale (%)
Cooperative membership	28%	45%	70%
Use of improved seedlings	12%	36%	67%
Land ownership	15%	45%	90%
Input expenditure (\$)	\$120	\$350	\$620
Reported theft	60%	40%	20%
Access to external market	35%	52%	68%
Formal credit access	10%	18%	32%

Source: Field data, 2024.

Farmers with greater cooperative engagement and input investment were more likely to implement IPM practices. Logistic regression confirms a strong predictive relationship (OR = 2.78, $p < 0.05$). These findings validate Meinzen-Dick and Mwangi (2009), who emphasized the role of institutional density in enabling pest management strategies. The absence of shared goals and the collapse of farmer groups in Mkuzi further demonstrate that the sustainability of such practices is contingent upon stable and inclusive social infrastructure.

4.5 Geographical Proximity and Market-Linked Sustainability

Proximity to infrastructure and social institutions is a determinant of market integration and, by extension, sustainability. Table 5 details access to markets and credit.

Table 5. Market access by farm size

Indicator	Smallholders (%)	Medium-scale (%)	Large-scale (%)
Sell to local markets	88%	72%	50%
Sell to external buyers	35%	52%	68%
Access to formal credit	10%	18%	32%

Source: Field data, 2024.

Table 5 shows that spatial remoteness correlates with limited market participation and low credit access among smallholders. This reflects a form of structural exclusion, where physical distance and weak social links intersect to create a compounded disadvantage. Mwangi and Kimenyi (2016) and Ndah et al. (2015) have identified similar patterns in East Africa. Investment in rural infrastructure should be accompanied by interventions aimed at strengthening place-based social networks to ensure equitable sustainability outcomes.

4.6 Mistrust, Seedling Theft, and Barriers to Innovation

Mistrust within a farming community is not merely a social challenge, it poses a direct obstacle to the uptake of sustainable agricultural innovations. Table 6 provides evidence of seedling theft across different categories of farmers in Mkuzi.

Table 6. Reported seedling theft by farm size

Farm Size	Reported Theft (%)
Smallholders	60%
Medium-scale	40%
Large-scale	20%

Source: Field data, 2024.

The high rate of theft among smallholders, as shown in Table 6, illustrates how the erosion of trust undermines not

only social cohesion but also economic and environmental outcomes. Farmers experiencing frequent theft are disincentivized from investing in improved seedlings, soil enhancement techniques, or long-term orchard development. This behaviour reflects a rational response to risk under conditions of social fragmentation. Ostrom (2009), noted that trust is a foundational element in collective action, enabling the enforcement of informal rules and the mutual monitoring necessary for managing common resources. Bjornlund et al. (2020) similarly emphasize that the breakdown of trust is closely linked to a decline in communal innovation and resilience. In Mkuzi, farmers' reluctance to adopt innovations under such conditions reveals how social disintegration can compromise sustainable agricultural transitions. Interventions aimed at rebuilding trust, through community policing, restorative justice, and group-based accountability structures are critical to reversing this trend.

4.7 Land Ownership and Investment Behaviour

Security of land tenure is one of the strongest predictors of a farmer's willingness to adopt sustainable practices. Table 7 disaggregates land ownership and input investment data by farm size.

Table 7. Land ownership and investment by farm size

Ownership Type	Smallholders (%)	Medium-scale (%)	Large-scale (%)
Communal/inherited land	85%	55%	10%
Purchased/individual title	15%	45%	90%
Input expenditure (\$/year)	\$120	\$350	\$620

Source: Field data, 2024.

Table 7 reported that most smallholders cultivate land under communal or inherited arrangements, while large-scale farmers predominantly operate with formally titled land. This ownership differential explains the stark variation in input investment. Farmers with secure titles are more likely to invest in soil conservation, orchard rehabilitation, and agroforestry. The results align with Kamara et al. (2019), who argue that insecure tenure suppresses long-term planning and discourages sustainable land management across sub-Saharan Africa. These findings affirm the importance of linking land governance reforms with agricultural sustainability agendas. Mhando and Ikeno (2017) also reported that communal tenure in Muheza discouraged orange farmers from investing in seedling grafting or orchard replacement. Institutional responses must therefore include participatory land formalization programs, coupled with legal education and dispute resolution services to enhance perceived and actual security.

4.8 Ethnic Variation and Social Cohesion

Beyond economic and institutional factors, ethnic identity plays a formative role in shaping social capital. Field data from focus group discussions revealed significant differences between the Bondei and Bena communities in terms of trust, cooperation, and participation in collective farming activities. Bena farmers tended to engage more actively in group work and cooperative organizations, while Bondei farmers were more individualistic and reported higher levels of mistrust. This divergence is consistent with Gadeberg and Lecoutere (2023), who highlight how socio-cultural norms influence the structure and function of social networks. The variation also supports Woolcock and Narayan's (2000) classification of social capital into bonding (strong ties within a group) and bridging (ties across different groups). Where ethnic boundaries align with social fragmentation, the potential for bridging capital and therefore for inclusive innovation is diminished. Thus, in order to ensure effectiveness, agricultural interventions must be culturally nuanced and sensitive to intra-community differences. Strategies such as peer mentoring across ethnic lines, community dialogue forums, and culturally embedded farmer field schools may help bridge social cleavages and rebuild collective efficacy.

4.9 Synthesis of Findings

The cumulative evidence from this study demonstrates that social relations are not peripheral but central to the adoption of sustainable agricultural practices. The findings show that different forms of social capital bonding (family and kinship), bridging (workplace and shared interest), and linking (proximity to markets and institutions) have varying effects on different dimensions of sustainability. Farmers embedded in strong family networks were more likely to access diverse and improved seedlings, while those with strong workplace ties adopted reduced tillage and participated in shared labour. Cooperative membership and shared goals were key to implementing knowledge-intensive practices like IPM, while geographical proximity shaped access to markets and financial

institutions. However, mistrust, ethnic fragmentation, and tenure insecurity emerged as significant barriers to innovation. These findings reinforce theoretical insights from Ostrom (2009), Coleman (1988), and Röling and Jiggins (1998), suggesting that sustainable agriculture is not merely a function of technology or training but depends critically on the social architecture of farming communities. As Mtui (2023) emphasizes, without addressing the socio-institutional context, technical innovations are unlikely to be equitably adopted. Consequently, policy and development initiatives must therefore adopt a systems approach, one that simultaneously strengthens social networks, improves institutional access, enhances tenure security, and reduces the structural disadvantages facing smallholder farmers. Only through such integrated strategies can sustainable agriculture become both a possibility and a reality for marginalized rural populations in Tanzania and beyond.

5. Conclusion

This study offers nuanced empirical evidence on the intricate interplay between social relations and sustainable agricultural practices among smallholder orange farmers in Mkuzi Village, Tanzania. Drawing on Social Capital Theory and Agricultural Innovation Systems Theory, the findings reveal that while social capital can enhance innovation, resilience, and market integration, its present configuration in Mkuzi, marked by mistrust, individualism, and fragmented networks, undermines these benefits. The differential experiences between the Bondei and Bena communities underscore the significance of culturally embedded social structures and their influence on agricultural behaviour and innovation uptake. Despite the study's geographic limitation to a single village, its in-depth qualitative and quantitative inquiry provides foundational insights for understanding how social dynamics affect sustainability outcomes. The findings highlight the urgency of integrating social capital considerations into rural development strategies, particularly in agrarian contexts where formal institutions are weak or absent. By foregrounding the role of social relations in shaping access to inputs, extension services, and markets, this study contributes to broader debates on rural transformation and agricultural innovation in sub-Saharan Africa.

In summary, the study argues for a shift in agricultural policy frameworks from purely technical interventions toward socially embedded and context-specific solutions. Such a transformation requires coordinated efforts among policymakers, community leaders, development practitioners, and farmers themselves to reshape the social fabric underpinning agricultural production. In doing so, sustainable agricultural practices can be more effectively fostered, leading to inclusive rural development and improved livelihoods.

6. Recommendations

Based on the study's findings, a multifaceted approach is recommended to improve sustainable agricultural practices among smallholder orange farmers in Mkuzi Village. Strengthening farmer cooperatives and local organizations is essential for rebuilding trust, facilitating group-based input procurement, and enhancing collective market access. Evidence from other Sub-Saharan African contexts suggests that inclusive, well-managed farmer groups can increase bargaining power, improve access to quality inputs, and promote peer-to-peer learning. In Mkuzi, revitalized cooperatives could play a pivotal role in reversing social fragmentation and supporting innovation. Furthermore, improving land tenure security is critical, particularly for Bondei farmers who predominantly rely on communal or inherited land. Policy interventions that clarify and formalize land rights through participatory and culturally sensitive mechanisms would likely encourage greater investment in long-term agricultural improvements. Extension services also need to be redesigned to leverage existing social networks, employing respected local figures and farmer champions to deliver context-specific innovations. This approach would help mitigate mistrust in formal institutions and strengthen the reach and effectiveness of agricultural advisory systems. Additionally, addressing seedling theft and rebuilding community cohesion through restorative justice mechanisms, youth engagement, and regular community dialogues can reinforce social norms of cooperation and trust. Finally, expanding smallholders' access to formal credit and high-value markets through the promotion of producer groups and collective marketing schemes is vital. These efforts would not only increase household incomes but also reduce reliance on informal and exploitative market actors. Together, these recommendations emphasize the importance of integrating social, institutional, and technical dimensions in efforts to promote sustainable agriculture and improve rural livelihoods in Mkuzi and similar agrarian contexts.

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Authors contributions

David Gongwe Mhando is the sole author of this manuscript and is fully responsible for the study design, data collection, data analysis, manuscript drafting, and all revisions. There are no co-authors or special agreements concerning shared authorship. All contributions to the research and writing were undertaken independently, and the final version of the manuscript was approved solely by the author.

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Competing interests

The author declares no competing interests.

Informed consent

Informed consent was obtained from all participants involved in this study prior to data collection. Participants were assured of confidentiality and their right to withdraw at any time without consequence.

Ethics approval

This study was conducted in accordance with ethical research standards involving human participants. Ethical approval was obtained from [insert name of ethics committee or institutional review board, if applicable], and all procedures followed ethical guidelines for social science research.

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Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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