

An Investigation into Maize Yield Utilization Practices and Challenges Faced by Small-scale Farmers in Kondoa District, Tanzania

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Abstract

Maize remains the cornerstone of rural livelihoods in Tanzania, particularly among small-scale farmers in semi-arid regions such as Kondoa District. However, persistent poverty and livelihood vulnerability among maize-producing households raise critical questions regarding the extent to which maize production and utilization translate into sustainable livelihood outcomes. This study examines maize yield utilization practices and the challenges facing small-scale farmers in Kondoa District, guided by the Sustainable Livelihood Framework (SLF). Specifically, the study analyses how maize utilization contributes to livelihood improvement, the extent to which income derived from maize is reinvested into livelihood-enhancing activities, and the structural and environmental constraints limiting these outcomes. A mixed-methods cross-sectional design was employed, integrating quantitative data from 406 household surveys with qualitative insights from key informant interviews and focus group discussions. The findings reveal that maize is predominantly utilized for household consumption, income generation, local processing, and socio-cultural functions, making it a central livelihood asset. Income derived from maize supports food security, education, healthcare, and reinvestment into small businesses and agricultural expansion, thereby contributing to the accumulation of financial, human, and physical capital. Despite these contributions, the study identifies critical challenges that constrain the effective transformation of maize utilization into sustainable livelihoods. These include market inefficiencies, price volatility, inadequate storage facilities, limited access to credit, weak extension services, gender disparities, and increasing climate variability. These constraints disrupt livelihood strategies and reduce the capacity of households to accumulate assets and build resilience. The study concludes that while maize utilization has significant potential to enhance rural livelihoods, its impact remains mediated by structural, institutional, and environmental factors. It recommends integrated policy interventions focusing on improving market systems, strengthening rural infrastructure, enhancing access to financial and extension services, and promoting climate-resilient agricultural practices. Such interventions

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are essential to unlock the full livelihood potential of maize-based systems in semi-arid regions.

Keywords: Maize Utilization; Sustainable Livelihood Framework; Small-Scale Farmers; Livelihoods; Agricultural Challenges; Kondoa District

1.0 Introduction

Maize (*Zea mays*) remains one of the most important staple crops globally and a critical pillar of food security and rural livelihoods, particularly in developing countries (Food and Agriculture Organization [FAO], 2024; Erenstein et al., 2022). In Sub-Saharan Africa (SSA), maize contributes significantly to household nutrition, income generation, and employment, with over half of the population depending on it for daily caloric intake (Ranum et al., 2014; Smale et al., 2020). In Tanzania, maize occupies a dominant position within the agricultural sector, cultivated by approximately 85% of small-scale farmers and accounting for a substantial share of national food consumption and rural incomes (URT, 2025; FAO, 2024). Its dual role as both a subsistence and commercial crop makes it central to livelihood systems, especially in semi-arid regions such as Kondoa District .

Despite its centrality, a persistent paradox characterizes maize-based livelihoods: increased production does not necessarily translate into sustained improvements in household welfare (Jayne et al., 2018; Barrett et al., 2017). Empirical evidence from rural Tanzania indicates that even in areas with relatively high maize yields, many small-scale farmers continue to experience poverty, food insecurity, and limited asset accumulation (NBS, 2023; URT, 2022). This disconnect suggests that agricultural productivity alone is insufficient to drive livelihood transformation unless supported by effective utilization pathways and enabling structural conditions (Ellis, 2000; Scoones, 1998).

From a conceptual standpoint, the Sustainable Livelihood Framework (SLF) provides a useful lens for understanding this paradox. The SLF posits that livelihood outcomes are determined not only by access to natural capital (such as land and rainfall) but also by the interaction of human, financial, social, and physical capital within a broader context of policies, institutions, and vulnerability factors (Chambers & Conway, 1992; DFID, 1999; Scoones, 1998). Within this framework, maize is not merely an agricultural output but a livelihood asset whose value depends on how it is utilized, transformed, and integrated into broader livelihood strategies. Therefore, the way maize yields are consumed, marketed, processed, or reinvested plays a decisive role in shaping household resilience and long-term welfare.

In semi-arid districts like Kondoa, maize utilization practices are multifaceted. Households rely on maize for direct consumption, income generation through market sales, local processing into flour and traditional products, and socio-cultural functions such as

ceremonies and social exchanges (Suleiman & Rosentrater, 2015; Mushi et al., 2023). These utilization pathways are critical in determining how agricultural production is converted into tangible livelihood outcomes, including food security, income stability, and asset accumulation (Ellis, 2000). However, the effectiveness of these pathways is often constrained by structural and environmental challenges that limit value realization.

Existing studies highlight several interrelated constraints affecting small-scale maize farmers in Tanzania and similar contexts. Market inefficiencies, characterized by price volatility and weak bargaining power, often force farmers to sell produce at low farm-gate prices (FANRPAN, 2016; Jayne et al., 2018). Post-harvest losses, driven by inadequate storage facilities and pest infestation, further reduce the quantity and quality of marketable surplus (Affognon et al., 2015; FAO, 2021). Limited access to credit and financial services constrains farmers' ability to invest in improved inputs, technologies, and value addition activities (World Bank, 2020). Additionally, weak extension services and low levels of formal education limit the adoption of improved agricultural and post-harvest practices (URT, 2022; NBS, 2023). These challenges are compounded by climate variability, including erratic rainfall and prolonged dry spells, which undermine production stability and increase livelihood vulnerability (Jägermeyr et al., 2021; Cairns et al., 2025).

While these factors are widely acknowledged in the literature, there remains a significant gap in understanding how they interact specifically with maize utilization practices to influence livelihood outcomes at the household level (Oduniyi et al., 2022). In particular, limited empirical attention has been given to the pathways through which maize-derived income is allocated, reinvested, or dissipated within rural economies (Mushi et al., 2023). Furthermore, the role of socio-cultural practices, gender dynamics, and institutional arrangements in shaping maize utilization and livelihood outcomes remains underexplored, especially in semi-arid contexts such as Kondoa District.

This study addresses these gaps by examining maize yield utilization practices and the challenges faced by small-scale farmers in Kondoa District, Tanzania. Specifically, it seeks to: (i) identify the dominant maize utilization practices among small-scale farmers; (ii) assess how these practices contribute to livelihood improvement; and (iii) analyse the structural and environmental challenges that constrain the effective transformation of maize utilization into sustainable livelihood outcomes.

The findings of this study are expected to contribute to both academic discourse and policy formulation. Academically, the study advances the application of the Sustainable Livelihood Framework in analysing crop utilization and rural development dynamics (Scoones, 1998; Ellis, 2000). From a policy perspective, it provides evidence to inform interventions aimed at strengthening maize value chains, improving rural infrastructure, enhancing access to financial and extension services, and promoting climate-resilient agricultural practices (FAO, 2021; World Bank, 2020). Ultimately, the study underscores the need for integrated approaches that move beyond production-focused strategies towards holistic livelihood-oriented agricultural development.

Literature Review

This section reviews theoretical and empirical literature on maize utilization and its implications for livelihood outcomes among small-scale farmers. It is anchored in the Sustainable Livelihood Framework (SLF), which explains how households transform various forms of capital into livelihood outcomes within a context shaped by institutions and vulnerability factors. In this study, maize is conceptualized as a livelihood asset whose contribution depends on its utilization through consumption, market participation, processing, and reinvestment.

Empirical evidence from global, Sub-Saharan Africa (SSA), and Tanzanian contexts highlights the important role of maize in food security and income generation, while also pointing to persistent constraints such as market inefficiencies, post-harvest losses, climate variability, and limited access to financial and institutional support. However, much of the existing literature focuses on production, with limited attention to utilization pathways and their influence on livelihood outcomes.

This study addresses this gap by examining how maize utilization practices and associated challenges shape livelihood outcomes among small-scale farmers in Kondoa District, Tanzania.

Theoretical framework: sustainable livelihood framework (SLF)

This study is anchored in the Sustainable Livelihood Framework (SLF), a widely applied analytical model in rural development studies that explains how households utilize available resources to achieve livelihood outcomes under varying institutional and environmental conditions. The framework was originally conceptualized by Robert Chambers and Gordon Conway in the early 1990s and later refined by the Department for International Development (DFID) (Chambers & Conway, 1992; DFID, 1999).

At its core, the SLF conceptualizes livelihoods as comprising the capabilities, assets, and activities required for a means of living, emphasizing sustainability in terms of resilience to shocks, maintenance of asset bases, and intergenerational viability (Chambers & Conway, 1992). A livelihood is considered sustainable when it can cope with and recover from stresses and shocks while maintaining or enhancing its capabilities and assets without undermining the natural resource base (Scoones, 1998).

Core components of the SLF

The SLF is structured around five interrelated components: livelihood assets, vulnerability context, transforming structures and processes, livelihood strategies, and livelihood outcomes (DFID, 1999; Scoones, 1998).

Livelihood assets (Capitals)

The framework identifies five categories of capital assets used by households: natural capital, including land, water, and environmental resources; human capital, comprising education, skills, knowledge, and health; financial capital, involving income, savings, and credit access; physical capital, covering infrastructure and equipment; and social capital, consisting of networks, relationships, and institutions.

These assets are not static; rather, they interact dynamically to shape livelihood strategies and outcomes (Ellis, 2000). In the context of this study, maize production is primarily rooted in natural capital, but its transformation into improved livelihoods depends on the effective mobilization of other assets. For instance, farmers' ability to store maize, access markets, or engage in value addition depends on physical capital, while financial capital determines investment capacity in inputs and diversification activities.

Vulnerability context

The SLF emphasizes that livelihoods operate within a vulnerability context, which includes shocks (e.g., droughts), trends (e.g., population growth, price fluctuations), and seasonal variations (DFID, 1999). In semi-arid regions such as Kondo District, this context is particularly critical due to erratic rainfall patterns and climate variability.

Empirical evidence shows that climate variability significantly affects maize production and utilization in Sub-Saharan Africa, reducing yield stability and increasing livelihood risks (Jägermeyr et al., 2021; Cairns et al., 2025). These conditions influence not only production but also the timing and effectiveness of maize utilization strategies, including storage, sales, and consumption.

Transforming structures and processes

Transforming structures (e.g., government institutions, private sector actors) and processes (e.g., policies, laws, cultural norms) mediate access to assets and shape livelihood opportunities (Scoones, 1998). In the case of small-scale maize farmers in Tanzania, these include agricultural policies and subsidy programs, extension services and knowledge dissemination systems, market institutions and value chain actors, as well as financial institutions and credit systems.

Studies indicate that weak institutional support, limited extension services, and inadequate rural infrastructure constrain the ability of farmers to convert maize production into sustainable livelihoods (URT, 2022; World Bank, 2020). Thus, institutional effectiveness plays a critical role in determining whether maize utilization translates into meaningful welfare improvements.

Livelihood strategies

Livelihood strategies refer to the combination of activities and choices that households make to achieve their livelihood goals (Frank Ellis 2000). In agricultural settings, these strategies include crop production and diversification, market participation and trade, value addition and processing, as well as non-farm income-generating activities.

Within this study, maize utilization itself is conceptualized as a core livelihood strategy, encompassing multiple pathways such as consumption, sale, processing, and reinvestment. These pathways determine how agricultural output is transformed into income, assets, and well-being.

Livelihood outcomes

Livelihood outcomes are the results of livelihood strategies and include increased income, improved food security, reduced vulnerability, as well as enhanced well-being and resilience. The SLF emphasizes that outcomes are multidimensional and interconnected. For example, income derived from maize may improve food security, support education, and enable asset accumulation simultaneously (Ellis, 2000). However, evidence from rural Tanzania suggests that increased agricultural production does not automatically lead to improved livelihood outcomes due to structural constraints and inefficient utilization systems (NBS, 2023; URT, 2022). This reinforces the importance of examining utilization pathways rather than focusing solely on production levels.

Application of SLF to maize utilization

The application of the SLF in this study allows for a shift from a production-centered perspective to a livelihood-centered analysis. Maize is treated not merely as an output but as a strategic livelihood asset whose value depends on how it is utilized and integrated into household strategies.

Specifically, maize utilization contributes to different forms of capital, including financial capital through income from sales, human capital through improved nutrition and education investment, social capital through cultural exchanges and community interactions, as well as physical capital through reinvestment in assets such as tools and housing.

However, the effectiveness of these contributions is mediated by constraints such as market inefficiencies, post-harvest losses, and limited access to financial services, which disrupt the conversion of maize output into sustainable livelihood gains (Affognon et al., 2015; Jayne et al., 2018).

Critiques and limitations of the SLF

Despite its widespread application, the Sustainable Livelihood Framework (SLF) has been subject to several critiques. Scholars argue that it may underemphasize power relations and political economy dynamics affecting resource access (Leo de Haan and Annelies Zoomers

2005), tends to be descriptive rather than predictive, thereby limiting its analytical precision, and may not fully capture macroeconomic and structural inequalities shaping rural livelihoods. Nevertheless, the SLF remains highly relevant due to its holistic and flexible approach, particularly in analyzing complex livelihood systems in developing countries (Scoones, 2015).

Justification for using SLF in this study

The selection of the Sustainable Livelihood Framework (SLF) is justified because it provides a holistic perspective of livelihoods beyond income, including social, human, and environmental aspects. It is relevant to smallholders in developing agricultural contexts, offers analytical flexibility through integration of quantitative and qualitative data, and provides a suitable framework for examining maize utilization pathways and their influence on livelihood outcomes. In the context of Kondoa District, where high maize production coexists with persistent livelihood challenges, the SLF offers a robust framework for analyzing the disconnect between production and welfare outcomes.

Theoretical implication for this study

By applying the Sustainable Livelihood Framework (SLF), this study conceptualizes maize utilization as a central mechanism linking agricultural production to livelihood outcomes. It posits that livelihood improvement is not determined solely by production levels, but that the pathways of utilization and reinvestment are critical determinants, while structural and institutional constraints mediate these pathways.

Thus, the SLF provides the theoretical foundation for investigating how maize utilization practices influence livelihood outcomes among small-scale farmers in Kondoa District.

Empirical Literature

This section reviews theoretical and empirical literature on maize utilization and its implications for livelihood outcomes among small-scale farmers. It is anchored in the Sustainable Livelihood Framework (SLF), which explains how households transform various forms of capital into livelihood outcomes within a context shaped by institutions and vulnerability factors. In this study, maize is conceptualized as a livelihood asset whose contribution depends on its utilization through consumption, market participation, processing, and reinvestment.

Empirical evidence from global, Sub-Saharan Africa (SSA), and Tanzanian contexts highlights the important role of maize in food security and income generation, while also pointing to persistent constraints such as market inefficiencies, post-harvest losses, climate variability, and limited access to financial and institutional support. However, much of the existing literature focuses on production, with limited attention to utilization pathways and their influence on livelihood outcomes. This study addresses this gap by examining how

maize utilization practices and associated challenges shape livelihood outcomes among small-scale farmers in Kondoa District, Tanzania.

Global perspectives on maize utilization and livelihoods

Globally, maize plays a multifunctional role within agricultural and economic systems, serving as a staple food, livestock feed, and industrial raw material (FAO, 2024; Erenstein et al., 2022). In developed economies such as the United States and Europe, a substantial proportion of maize is utilized for feed and industrial purposes, including biofuel production and starch processing, while in developing countries it remains primarily a subsistence crop (USDA, 2024; Pingali et al., 2019). This divergence reflects structural differences in value chains, technological advancement, and market integration across regions.

Empirical studies demonstrate that maize contributes significantly to household income, food security, and employment, particularly among smallholder farmers in developing economies (Ranum et al., 2014; Barrett et al., 2017). Income derived from maize sales is often allocated toward essential household needs such as education, healthcare, and food consumption, thereby playing a critical role in poverty reduction (Ellis, 2000; Jayne et al., 2018). However, global evidence also indicates that the benefits of maize production are unevenly distributed, with small-scale farmers often constrained by limited access to markets, credit, and value addition opportunities (World Bank, 2020).

Furthermore, recent studies emphasize that utilization pathways, rather than production alone, determine the extent to which maize contributes to livelihood improvement (Erenstein et al., 2022). For instance, households that engage in value addition, storage, and strategic marketing are more likely to achieve sustainable income gains compared to those relying solely on immediate post-harvest sales (Affognon et al., 2015). This suggests that the transformation of maize into livelihood outcomes depends on institutional and infrastructural support systems.

Maize utilization in Sub-Saharan Africa (SSA)

In Sub-Saharan Africa, maize is the dominant staple crop, accounting for a significant proportion of caloric intake and rural livelihoods (Smale et al., 2020; FAO, 2021). Empirical studies across countries such as Kenya, Uganda, Nigeria, and Zambia indicate that maize utilization extends beyond food consumption to include income generation, local processing, livestock feed, and socio-cultural functions (Suleiman & Rosentrater, 2015; Jayne et al., 2018).

Despite its importance, small-scale maize farmers in SSA face persistent constraints that limit the effectiveness of utilization pathways. One of the most critical challenges is post-harvest loss, which ranges between 15% and 40% due to poor storage facilities, pest infestation, and inadequate preservation technologies (Affognon et al., 2015; FAO, 2021). These losses

significantly reduce the quantity of maize available for both consumption and sale, thereby limiting income realization.

Market-related constraints also play a significant role. Studies show that smallholder farmers often sell maize immediately after harvest when prices are lowest due to oversupply, a phenomenon commonly referred to as “distress selling” (Jayne et al., 2018). Limited access to market information, weak bargaining power, and dependence on intermediaries further exacerbate income inefficiencies (FANRPAN, 2016). As a result, the potential of maize to generate sustainable livelihoods remains underutilized.

Climate variability constitutes another major constraint affecting maize utilization in SSA. Erratic rainfall, drought, and temperature fluctuations reduce yield stability and affect both production and post-harvest outcomes (Jägermeyr et al., 2021; Cairns et al., 2025). These environmental factors increase vulnerability and reduce the predictability of income derived from maize.

Institutional factors such as access to extension services, financial resources, and agricultural training have also been identified as key determinants of successful maize utilization. Where farmers have access to credit, training, and organized markets, maize utilization is more likely to translate into improved livelihoods (World Bank, 2020; Smale et al., 2020). Conversely, weak institutional support systems contribute to low productivity, limited value addition, and reduced income generation.

Maize utilization and livelihoods in Tanzania

In Tanzania, maize is the most widely cultivated crop and a central component of rural livelihoods, with approximately 85% of small-scale farmers depending on it for both subsistence and income generation (URT, 2025; FAO, 2024). Empirical evidence shows that maize utilization occurs through multiple pathways, including direct consumption, market sales, processing into flour, and socio-cultural uses such as ceremonies and community exchanges.

Studies indicate that maize-derived income contributes to household welfare by supporting food security, education, healthcare, and small-scale investments (Mushi et al., 2023; Oduniyi et al., 2022). In many rural areas, maize functions as both a food crop and a financial asset, enabling households to smooth consumption and manage risks associated with income variability (Ellis, 2000).

However, despite increases in maize production in some regions, the translation of these gains into improved livelihoods remains limited (NBS, 2023; URT, 2022). One major constraint is inadequate storage infrastructure, which leads to significant post-harvest losses and reduces the quality of maize available for sale (Affognon et al., 2015). Poor rural infrastructure, including limited road networks, further restricts market access and increases transportation costs (World Bank, 2020).

Additionally, access to financial services remains limited among small-scale farmers, constraining their ability to invest in improved inputs, technologies, and value addition activities (URT, 2022). Weak extension services also limit the adoption of improved farming and post-harvest practices, thereby affecting productivity and utilization outcomes (NBS, 2023).

The role of maize-derived income in supporting livelihood diversification has been documented in several studies. Farmers often reinvest income into activities such as livestock rearing, petty trade, and small-scale enterprises, which enhance resilience and income stability. However, the extent and sustainability of such reinvestment activities vary significantly depending on access to resources, institutional support, and household decision-making dynamics.

Challenges facing small-scale maize farmers

Empirical literature consistently demonstrates that the contribution of maize to rural livelihoods is constrained by a complex interaction of structural, institutional, and environmental factors rather than production alone (Jayne et al., 2018; Barrett et al., 2017). In Sub-Saharan Africa, and particularly in Tanzania, these constraints operate simultaneously to limit the transformation of maize production into sustainable livelihood outcomes.

One of the most significant challenges is market inefficiency and price volatility. Small-scale farmers often sell maize immediately after harvest when prices are lowest due to seasonal supply gluts, a phenomenon widely documented in African agricultural markets (Jayne et al., 2018). Limited access to structured markets, poor bargaining power, and reliance on intermediaries further reduce farm-gate prices and income retention (Fafchamps & Hill, 2005). In Tanzania, this problem is exacerbated by weak market integration and limited access to reliable market information, which constrains farmers' ability to optimize returns from maize sales (World Bank, 2020).

Another critical constraint is post-harvest loss, which significantly reduces both food availability and marketable surplus. Studies estimate that post-harvest losses in Sub-Saharan Africa range between 15% and 40%, largely due to inadequate storage facilities, pest infestation, and poor handling practices (Affognon et al., 2015; Hodges et al., 2011). In Tanzania, inadequate storage infrastructure and limited adoption of improved preservation technologies further exacerbate these losses, undermining income realization and food security (FAO, 2021).

Climate variability also poses a major challenge to maize-based livelihoods. Small-scale farmers in semi-arid regions such as Kondoia are highly vulnerable to erratic rainfall, prolonged droughts, and increasing temperature variability, all of which affect yield stability and production reliability (Jägermeyr et al., 2021). Climate-related shocks not only reduce output but also disrupt utilization pathways by affecting timing of harvest, storage conditions, and market participation (Cairns et al., 2013).

In addition, limited access to financial services constrains farmers' ability to invest in productivity-enhancing inputs, storage facilities, and value addition activities. Access to credit remains low among smallholder farmers in Tanzania, limiting their capacity to adopt improved technologies and diversify livelihood strategies (World Bank, 2020). Without financial capital, farmers are often unable to reinvest maize-derived income into sustainable livelihood-enhancing activities.

Institutional and infrastructural weaknesses further compound these challenges. Limited access to agricultural extension services reduces the adoption of improved farming, storage, and processing practices (Anderson & Feder, 2007). Poor rural infrastructure, including inadequate road networks and market facilities, increases transaction costs and limits access to profitable markets (Dorosh et al., 2010). These structural constraints restrict the ability of farmers to move beyond subsistence-level production and engage in higher-value maize utilization activities.

Socio-economic factors, particularly gender inequality and education levels, also influence maize utilization outcomes. Studies indicate that women often have limited access to land, credit, and agricultural inputs, despite playing a central role in production and household food management (Doss, 2013). This affects intra-household decision-making and the allocation of maize-derived income, ultimately influencing livelihood outcomes.

In the context of Kondoa District, these challenges manifest in multiple ways. While maize production is relatively high, the ability of farmers to convert this production into improved livelihoods remains constrained by market inefficiencies, storage limitations, financial exclusion, and environmental risks. These constraints disrupt the accumulation of livelihood assets and reduce household resilience.

Research gap and study contribution

Despite extensive literature on maize and rural livelihoods, several critical gaps remain. First, much of the existing research focuses on production and productivity, with limited attention to maize utilization pathways and how they influence livelihood outcomes (Erenstein et al., 2022). These limits understanding of how agricultural outputs are translated into income, asset accumulation, and overall household well-being.

Second, although challenges facing small-scale farmers are well documented, there is insufficient empirical integration of these constraints with maize utilization processes. Most studies examine factors such as climate variability, market access, and post-harvest losses in isolation, without adequately capturing how they interact to shape utilization patterns and livelihood outcomes (Barrett et al., 2017).

Third, the linkage between maize-derived income and its reinvestment into livelihood-enhancing activities remains underexplored. While existing studies acknowledge the role of agricultural income in supporting diversification, there is limited empirical evidence on how

such income is allocated, reinvested, or consumed within rural households, and how these decisions influence long-term asset accumulation (Ellis, 2000; Oduniyi et al., 2022).

Fourth, the role of gender dynamics and socio-cultural practices in shaping maize utilization and livelihood outcomes has received limited attention, particularly in localized contexts such as semi-arid regions of Tanzania.

Finally, there is a lack of context-specific empirical evidence explaining why relatively high maize production does not consistently translate into improved livelihood outcomes in districts such as Kondoa. Existing national and regional studies provide general insights but do not adequately capture household-level utilization patterns, reinvestment behavior, and institutional constraints within specific agro-ecological settings.

Against this background, this study addresses these gaps by examining maize utilization practices, income use and reinvestment, and the structural, institutional, and environmental factors shaping livelihood outcomes among small-scale farmers in Kondoa District. By integrating these dimensions within the Sustainable Livelihood Framework, the study provides a more comprehensive and context-specific understanding of how agricultural production is translated into sustainable rural livelihoods.

2.0 Methodology

This section describes the research design, study area, sampling procedures, data collection methods, and analytical techniques used in the study. It outlines how both quantitative and qualitative data were collected and analyzed to examine maize utilization practices and their implications for livelihood outcomes among small-scale farmers in Kondoa District.

Research design and approach

This study adopted a mixed-methods cross-sectional research design to examine maize yield utilization practices and the challenges facing small-scale farmers in Kondoa District, Tanzania. The mixed-methods approach integrates both quantitative and qualitative data to provide a comprehensive understanding of complex livelihood systems, allowing for triangulation and complementarity of findings (Creswell & Plano Clark, 2018; Tashakkori & Teddlie, 2010).

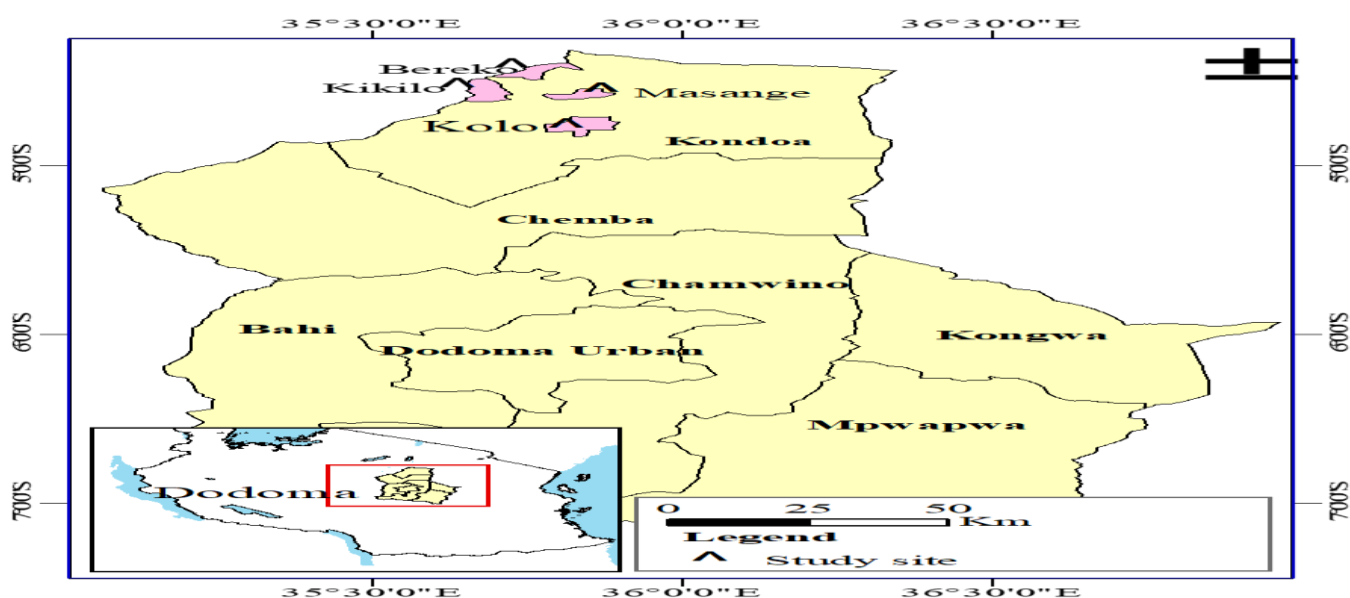
The quantitative component enabled the measurement of maize utilization patterns, income allocation, and livelihood outcomes across households, while the qualitative component provided in-depth insights into farmers' experiences, perceptions, and contextual realities shaping these practices. This integration is consistent with sustainable livelihood studies, which require both numerical trends and contextual explanations to capture multidimensional livelihood dynamics (Scoones, 1998; Ellis, 2000).

The cross-sectional design was appropriate because the study aimed to capture prevailing conditions, behaviors, and relationships at a single point in time, particularly regarding maize utilization and livelihood outcomes. Cross-sectional designs are widely used in agricultural and rural development research to analyze patterns and associations within populations where longitudinal data may be limited (Bryman, 2016).

Study area

The study was conducted in Kondoa District, located in Dodoma Region in central Tanzania. The district is characterized by a semi-arid agro-ecological environment, with annual rainfall ranging between approximately 400 mm and 800 mm, and agriculture is predominantly rain-fed. Kondoa District was purposively selected due to its high dependence on maize as a staple and commercial crop, its representation of semi-arid farming systems in Tanzania, and the coexistence of relatively high maize production with persistent livelihood challenges. This makes it an ideal case for examining the paradox between agricultural production and livelihood outcomes, as highlighted in the study problem.

Figure 2: Map of Kondoa district showing the study wards – Soera, Bereko, Kikilo, and Masange.



Source: Researcher's construction, 2022

Study population, sampling procedure, and sample size

The study targeted small-scale maize farming households, agricultural field officers, and district-level agricultural officials. The total population of maize farming households in the selected wards was estimated at 81,069 households. A sample size of 406 household respondents was determined using Slovin's formula, which is appropriate when the population is large and variability is unknown (Israel, 1992). This ensured adequate representativeness and statistical reliability.

A multistage sampling technique was employed whereby purposive sampling was used to select wards with high maize production, namely Soera, Kikilo, Masange, and Bereko. Simple random sampling was then applied to select households within each village in the respective wards to ensure representativeness and reduce selection bias. In addition, purposive sampling was used to select key informants, including four agricultural field officers and one district agricultural officer, based on their expertise and involvement in agricultural activities. This combination of sampling techniques ensured both representativeness (quantitative) and depth of insight (qualitative) (Creswell, 2014).

Data collection methods

Primary data

Primary data were collected using structured household questionnaires, which captured quantitative data on maize utilization, income use, and livelihood outcomes; key informant interviews (KIIs), which provided institutional and policy-level perspectives; and focus group discussions (FGDs), which explored shared experiences, cultural practices, and collective challenges. These methods are widely recommended in livelihood studies because they allow triangulation of perspectives and improve data validity (Scoones, 1998; Tashakkori & Teddlie, 2010).

Secondary data

Secondary data were obtained from government reports, including those from the United Republic of Tanzania and the National Bureau of Statistics, policy documents, and academic literature. These sources were used to contextualize findings and strengthen the empirical foundation of the study.

Measurement of variables and data analysis

The study was guided by variables aligned with the Sustainable Livelihood Framework (SLF). Key variables Independent variables include maize utilization practices (consumption, sale, processing, reinvestment), Dependent variables: livelihood outcomes (income, food security, asset accumulation) as well as Contextual variables: challenges (market, climate, finance, infrastructure)

Quantitative data analysis

Quantitative data were analyzed using descriptive statistics (frequencies, percentages) To describe demographic characteristics and utilization patterns. Inferential statistics using Pearson correlation to examine relationships between maize utilization and livelihood outcomes one-way ANOVA: to test differences across groups. These techniques are appropriate for identifying patterns and relationships in cross-sectional datasets (Bryman, 2016).

Qualitative data analysis

Qualitative data were analyzed using thematic analysis, which involved coding data into categories, identifying recurring themes, and interpreting patterns in relation to the study objectives. Thematic analysis is widely used in rural development studies to capture contextual realities and lived experiences (Braun & Clarke, 2006). The integration of quantitative and qualitative findings enhanced the validity and depth of analysis, enabling a comprehensive understanding of maize utilization and livelihood dynamics.

Validity and reliability

To ensure validity and reliability, the study used pre-tested data collection instruments, triangulation of methods and data sources including surveys, Key Informant Interviews, and Focus Group Discussions, and standardized questionnaires to maintain consistency in data collection. These measures enhance both internal validity (accuracy of findings) and external validity (generalizability) (Creswell, 2014).

Ethical considerations

Ethical principles were strictly observed throughout the study, whereby informed consent was obtained from all participants, participation was voluntary, respondents were assured of confidentiality and anonymity, and data were used strictly for academic purposes. Ethical compliance is essential in social research to protect participants and ensure credibility of findings (Bryman, 2016).

Methodological justification

The chosen methodology is appropriate for this study for several reasons. First, the mixed-methods approach allows a comprehensive analysis of both measurable and contextual aspects of livelihoods. Second, the cross-sectional design captures current utilization practices and livelihood conditions. Third, alignment with the Sustainable Livelihood Framework ensures theoretical consistency between variables and analysis. Fourth, triangulation enhances reliability and validity. This methodological approach is therefore well-suited to examining the complex relationship between maize utilization and livelihood outcomes in a semi-arid context.

3.0 Results

This section presents the empirical findings of the study in relation to the research objectives. It covers respondents' characteristics, maize production and utilization practices, livelihood outcomes, reinvestment patterns, and the key challenges faced by small-scale farmers in Kondoa District.

Maize production levels

Table 3: Average annual household maize production (n = 406)

Production level (kg/year)	Frequency	Percentage (%)
Below 500 kg	52	12.8
500–1,000 kg	96	23.6
1,001–2,000 kg	148	36.5
Above 2,000 kg	110	27.1
Total	406	100

Source: Field data (2022)

The findings indicate that the majority of households (36.5%) produce between 1,001 and 2,000 kg annually, followed by 27.1% producing above 2,000 kg. This suggests that maize production in Kondoa District is relatively substantial among small-scale farmers.

However, despite this production level, earlier sections of the study highlight that increased production does not necessarily translate into improved livelihood outcomes. This reinforces the study’s central argument that utilization pathways, rather than production alone, determine livelihood improvement.

Maize Utilization Patterns

Table 4: Maize utilization practices among households (n = 406)

Utilization type	Frequency	Percentage (%)
Household consumption	406	100
Sale (local markets)	312	76.8
Processing (flour, local products)	185	45.6
Livestock feed	96	23.6
Social/cultural use	128	31.5

Source: Field data (2022)

The results show that all households (100%) utilize maize for consumption, confirming its central role in food security. A significant proportion (76.8%) also sell maize, indicating its importance as a source of income. However, only 45.6% engage in processing, suggesting limited value addition. This indicates that most farmers operate at a low-value utilization level, which restricts income maximization and livelihood transformation. The presence of socio-cultural use (31.5%) highlights the embedded role of maize in community life, reinforcing its importance beyond purely economic functions.

4.4 Maize utilization and livelihood outcomes

Table 5: Contribution of maize utilization to human capital (n = 406)

Indicator	Yes (%)	No (%)
Supports household food security	92.4	7.6
Supports children's education	74.1	25.9
Supports healthcare expenses	68.3	31.7

Source: Field data (2022)

Table 6: Contribution to financial and social capital (n = 406)

Indicator	Yes (%)	No (%)
Income generation from maize sales	78.6	21.4
Participation in social/community activities	64.0	36.0
Ability to save or invest	41.2	58.8

Source: Field data (2022)

Table 7: Contribution to physical and natural capital (n = 406)

Indicator	Yes (%)	No (%)
Investment in farming inputs	52.7	47.3
Improvement in housing/assets	38.9	61.1
Land expansion or improvement	29.5	70.5

Source: Field data (2022)

The findings demonstrate that maize utilization contributes significantly to human capital, particularly food security (92.4%), education (74.1%), and healthcare (68.3%). This indicates that maize plays a critical role in sustaining household welfare. However, contributions to financial and physical capital are relatively weaker. While 78.6% generate income from maize, only 41.2% report savings or investment, and less than 40% report improvements in assets such as housing. This suggests that maize income is primarily used for consumption smoothing rather than capital accumulation, limiting long-term livelihood transformation.

Reinvestment activities

Table 8: Reinvestment of maize income (n = 406)

Reinvestment Activity	Frequency	Percentage (%)
Purchase of farm inputs	214	52.7

Reinvestment Activity	Frequency	Percentage (%)
Small business activities	156	38.4
Livestock rearing	132	32.5
Education investment	201	49.5
No reinvestment	96	23.6

Source: Field data (2022)

The results indicate that more than half of respondents (52.7%) reinvest maize income into agricultural inputs, suggesting a cycle of production-oriented investment. However, diversification into non-farm activities such as small businesses (38.4%) and livestock (32.5%) remains limited. Notably, 23.6% of households do not reinvest at all, indicating constraints in surplus generation or financial management. This highlights a key limitation: while maize generates income, it does not consistently translate into diversified or sustainable livelihood strategies.

Challenges facing small-scale maize farmers

Table 9: Major challenges faced by farmers (n = 406)

Challenge	Frequency	Percentage (%)
Price volatility	298	73.4
Poor storage facilities	276	68.0
Limited access to credit	254	62.6
Climate variability (drought, rainfall)	289	71.2
Poor infrastructure (roads, markets)	233	57.4
Limited extension services	210	51.7
Pest and diseases	245	60.3

Source: Field data (2022)

The findings reveal that the most significant challenges include price volatility (73.4%), climate variability (71.2%), and storage limitations (68.0%). These challenges directly affect both production and utilization processes. Financial constraints (62.6%) and infrastructure limitations (57.4%) further restrict farmers' ability to invest in value addition and market participation.

These results confirm that maize utilization is heavily constrained by structural and environmental factors, which limit its effectiveness as a pathway to sustainable livelihoods.

4.0 Discussion

Overview of findings

This section discusses the study findings in relation to the research objectives, existing literature, and the Sustainable Livelihood Framework (SLF). The study examined maize utilization practices and their implications for livelihood improvement among small-scale farmers in Kondo District, Tanzania. The findings indicate that, although maize production is relatively substantial, its contribution to sustainable livelihoods remains constrained by structural, institutional, and environmental factors. In this context, the section interprets how maize utilization practices, reinvestment patterns, and associated challenges shape livelihood outcomes among small-scale farmers.

Maize Utilization practices and livelihood implications

The findings indicate that maize is utilized primarily for household consumption and income generation, with all households reporting consumption and a significant proportion (76.8%) engaging in market sales. This confirms the dual role of maize as both a subsistence and commercial crop, consistent with studies in Sub-Saharan Africa which highlight maize as a central pillar of food security and rural livelihoods (Ranum et al., 2014; Smale et al., 2020).

However, the relatively low engagement in value addition (45.6%) suggests that most farmers operate within low-value segments of the maize value chain. This finding aligns with existing literature indicating that limited processing and value addition reduce the income potential of small-scale farmers (Suleiman & Rosentrater, 2015). According to the SLF, this reflects constraints in physical capital (processing facilities) and human capital (skills and knowledge), which limit the ability to transform agricultural outputs into higher-value products (Scoones, 1998).

Furthermore, the presence of socio-cultural utilization (31.5%) underscores the multidimensional role of maize beyond economic functions. This supports arguments by Ellis (2000) that rural livelihoods are embedded in social systems where agricultural products serve both economic and cultural purposes.

Maize utilization and livelihood outcomes

The findings demonstrate that maize utilization contributes significantly to human capital, particularly in supporting food security (92.4%), education (74.1%), and healthcare (68.3%). This confirms that maize plays a crucial role in sustaining household welfare, consistent with empirical studies showing that agricultural income is often used to meet essential household needs (Barrett et al., 2017; Jayne et al., 2018).

However, the study also reveals a critical limitation: while maize supports immediate consumption needs, its contribution to financial and physical capital accumulation is relatively weak. Only 41.2% of respondents reported savings or investment, and less than 40% reported improvements in assets such as housing.

This finding supports the argument that smallholder agriculture often functions as a consumption-smoothing mechanism rather than a pathway to accumulation (Ellis, 2000). Within the SLF framework, this indicates that while maize contributes to short-term livelihood outcomes, it is less effective in enabling long-term resilience and asset building.

Reinvestment of maize income and livelihood diversification

The results show that a majority of farmers reinvest maize income into agricultural inputs (52.7%), while fewer engage in diversification activities such as small businesses (38.4%) and livestock rearing (32.5%). This suggests a strong dependence on agriculture, with limited diversification into alternative income sources.

This finding aligns with studies indicating that rural households in semi-arid regions often reinvest in agriculture due to limited opportunities in non-farm sectors (Barrett et al., 2017). However, the relatively low level of diversification suggests constrained livelihood strategies, which increases vulnerability to shocks such as climate variability.

Notably, 23.6% of respondents reported no reinvestment at all, indicating that a significant proportion of households are unable to generate sufficient surplus for investment. This reflects constraints in financial capital, as emphasized in the SLF, and highlights the importance of access to credit and financial services in enabling livelihood transformation (World Bank, 2020).

Structural and environmental constraints

The findings identify several key constraints, including price volatility (73.4%), climate variability (71.2%), and poor storage facilities (68.0%), which significantly affect maize utilization and livelihood outcomes. The prevalence of price volatility confirms findings by Jayne et al. (2018), who argue that smallholder farmers often face unstable market conditions that reduce income predictability. The tendency to sell immediately after harvest at low prices further limits income generation and investment capacity.

Similarly, the high incidence of storage-related challenges supports evidence that post-harvest losses remain a major constraint in Sub-Saharan Africa (Affognon et al., 2015). Poor storage reduces both the quantity and quality of maize available for sale, thereby undermining income realization.

Climate variability emerges as another critical constraint, particularly in semi-arid regions such as Kondoia. This finding is consistent with studies showing that climate change negatively affects agricultural productivity and increases livelihood vulnerability (Jägermeyr et al., 2021). Within the SLF, this reflects the vulnerability context, which shapes both production and utilization outcomes.

Institutional and socio-economic constraints

The study also highlights the role of institutional and socio-economic factors, including limited access to credit (62.6%), weak extension services (51.7%), and poor infrastructure (57.4%). Limited access to financial services restricts farmers' ability to invest in improved inputs, storage, and value addition, thereby limiting the effectiveness of maize utilization (World Bank, 2020). Similarly, weak extension services reduce the adoption of improved practices, affecting both productivity and post-harvest management (Anderson & Feder, 2007).

Infrastructure constraints, particularly poor road networks, increase transaction costs and limit access to profitable markets (Dorosh et al., 2010). These factors collectively reduce the efficiency of maize value chains and constrain livelihood improvement. In addition, gender dynamics and education levels influence access to resources and decision-making processes, affecting how maize income is utilized within households. This supports findings by Doss (2013), who emphasizes the importance of gender in shaping agricultural outcomes.

Synthesis within the sustainable livelihood framework

When interpreted through the Sustainable Livelihood Framework (SLF), the findings reveal that maize utilization contributes to multiple livelihood assets despite systemic limitations. Natural capital through maize production is relatively strong, human capital benefits are evident, financial and physical capital accumulation remain weak, and social capital is reinforced through cultural practices.

However, the effectiveness of these contributions is mediated by a challenging vulnerability context (climate variability) as well as weak transforming structures and processes (markets, institutions) This interaction explains why high maize production does not automatically translate into improved livelihood outcomes.

Overall Interpretation

The findings support the central argument of this study: Maize production alone is insufficient to improve livelihoods unless supported by effective utilization pathways and enabling structural conditions. While maize plays a critical role in sustaining household welfare, its potential as a driver of sustainable livelihoods remains constrained by limited value addition, weak market systems, financial exclusion and climate variability.

5.0 Conclusion and Policy Implication

The findings indicate that maize utilization in Kondoa District remains largely subsistence-oriented, with limited value addition and weak market integration. Although maize contributes significantly to food security and income, its transformative potential is constrained by structural and institutional challenges.

Policy interventions should align with Tanzania’s National Agricultural Policy (2013) and ASDP II framework by promoting value addition and agro-processing through the Ministry of Agriculture (MoA) and Ministry of Industry and Trade (MIT). Investment in storage and post-harvest systems should be strengthened under PO-RALG and District Councils to reduce losses and improve market participation.

Improving access to finance requires inclusive credit schemes through the Ministry of Finance (MoF) and Bank of Tanzania (BoT), enabling farmers to access inputs and invest in small-scale processing. Strengthening extension services under the MoA is essential to enhance agribusiness skills and adoption of improved utilization practices.

Furthermore, rural infrastructure and market coordination—guided by MIT and PO-RALG—are necessary to address price volatility and limited access, while climate-resilient strategies should be advanced through the Vice President’s Office (Environment) and Ministry of Water (MoW).

These findings reinforce the need for integrated interventions that address both production and utilization dimensions of agricultural development. In conclusion, transforming maize into a driver of sustainable livelihoods requires coordinated policy implementation across sectors to enhance value addition, market integration, and resilience among small-scale farmers.

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