A Systematic Review of the Challenges and Opportunities for Enhancing Food Security Among Smallholder Farmers in Sub-Saharan Africa

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ABSTRACT

This systematic review examined the challenges and promising opportunities for enhancing food security among smallholder farmers in Sub-Saharan Africa. The study's methodology involved analysis of peer-reviewed studies utilizing PRISMA guidelines and thematic content analysis across multiple databases including Scopus, Web of Science, and African Journals Online. Findings revealed that smallholder farmers face interconnected challenges including limited access to finance, climate change vulnerability, inadequate infrastructure, weak market linkages, and insufficient extension services. However, significant opportunities were identified through digital agriculture adoption, agroecological practices, participatory research approaches, women's empowerment initiatives, and innovative financing mechanisms. The study demonstrates that successful interventions typically integrate multiple approaches tailored to local contexts rather than pursuing single-factor solutions. Consequently, the study recommends policy reforms prioritizing smallholder-centric national agricultural strategies, increased investment in climate-resilient farming practices, strengthening farmer organizations, developing context-specific technology solutions, and creating enabling environments for youth engagement in agriculture.

Keywords: Food Security, Smallholder Farmers, Sub-Saharan Africa, Systematic Review, PRISMA

JEL Classification: Q18, Q12, O13, O55.

INTRODUCTION

Food security remains one of the most pressing global challenges of the 21st century, with profound implications for sustainable development, economic stability, and human welfare worldwide. Despite significant advances in agricultural technology and global food production capacity, regional disparities in food access and availability continue to persist, creating a complex picture of food security outcomes across different geographical contexts. Sub-Saharan Africa (SSA) represents the epicenter of this global food security crisis, where structural vulnerabilities, environmental constraints, and socio-economic challenges converge to create unprecedented levels of food insecurity. In 2024, 29.3% of SSA's population (approximately 824.6 million people) faces food insecurity, defined as inadequate access to 2,100 daily calories, representing the highest regional rate globally (Cardell & Zereyesus, 2024; Wudil et al., 2022). This alarming statistic underscores the magnitude of the food security challenge confronting the region and highlights the urgent need for comprehensive analytical frameworks to understand the underlying dynamics driving these outcomes.

The trajectory of food insecurity in SSA reveals a concerning pattern of deterioration over the past decade, challenging assumptions about global progress toward achieving Zero Hunger as outlined in Sustainable Development Goal 2. Food insecurity has risen since 2015, with a notable 24 million increase in undernourished people between 2015-2016 (Food Tank, 2020), indicating a reversal of previous gains and highlighting the fragility of food systems in the region. By 2022, acute food insecurity affected 123 million people (12% of SSA's population) (International Monetary Fund [IMF], 2022; Wudil et al., 2022), demonstrating the severity and widespread nature of the crisis. This deteriorating situation becomes even more troubling when considering future projections, as despite global improvements, SSA lags significantly, with food insecurity expected to

persist at elevated levels through 2030 (Cardell & Zereyesus, 2024). These trends collectively paint a picture of a region trapped in a cycle of food insecurity that threatens to undermine broader development aspirations and human welfare outcomes.

At the heart of SSA's food security challenge lies the complex relationship between smallholder farming systems and agricultural productivity outcomes. Smallholder farmers, who constitute the backbone of agricultural production across the region and represent approximately 75% of total agricultural output in countries like Kenya (Nzengya & Onyango, 2023), find themselves paradoxically positioned as both food producers and among the most food insecure populations. This contradiction reflects deeper structural challenges within agricultural systems that fail to translate production potential into sustained food security outcomes. The empirical evidence reveals a troubling disconnect between localized success stories and broader productivity trends, with pilot interventions demonstrating promising yield increases of 24-69% (Hlophe-Ginindza et al., 2023; Amede et al., 2023), while empirical analyses reveal concerning annual productivity declines of 3.5% across smallholder farming systems (Bentze et al., 2024). This micro-macro disconnect suggests that understanding the challenges and opportunities facing smallholder farmers requires a more intricate analytical approach that can bridge the gap between individual success stories and systemic agricultural transformation.

The complexity of smallholder farming challenges in SSA extends beyond simple productivity metrics to encompass a multifaceted array of interconnected barriers that collectively constrain food security outcomes. Financial constraints emerge as a primary limitation, with 15.90% of farmers citing inadequate access to capital as a critical barrier to adopting improved agricultural practices (Hlophe-Ginindza et al., 2023). Simultaneously, information asymmetries compound these challenges, as 9.74% of farmers identify limited access to agricultural information as a significant constraint (Hlophe-Ginindza et al., 2023). Climate change adaptation represents another critical dimension, with farmers increasingly relying on indigenous knowledge systems and diversification strategies to maintain household food security under conditions of environmental uncertainty (Derbile et al., 2023; Theodory et al., 2024). Digital technologies present emerging opportunities for transformation, with 70% of farmers expressing interest in drone technology adoption, though universal cost concerns and limited digital literacy constrain widespread implementation (McCarthy et al., 2023; Mustafa et al., 2024). The convergence of these challenges creates a complex adaptive system where traditional agricultural development approaches may prove insufficient to address the scale and scope of transformation required to enhance food security outcomes across the region.

Therefore, this systematic review aims to comprehensively examine the challenges and opportunities for enhancing food security among smallholder farmers in SSA, synthesizing existing literature to identify key factors influencing food security outcomes and inform evidence based policy and intervention strategies that can bridge the gap between localized successes and regional food security transformation.

LITERATURE REVIEW

Conceptual Literature

The concept of "Challenges"

Based on academic literature, challenges can be defined through scholarly perspectives that offer varying emphases on constraint and complexity. Firstly, challenges represent multifaceted barriers encompassing environmental, socioeconomic, and institutional constraints that impede smallholder farmers' ability to achieve sustainable food production and household food security (Johansson et al., 2021). On the other hand, challenges constitute dynamic adaptive pressures emerging from climate variability, market failures, and resource limitations, requiring continuous responses from farming communities (Terlau et al., 2018). Similarly, challenges represent systemic disruptions within agricultural value chains that create vulnerabilities across multiple scales, from household food access to regional food system resilience (Berhanu et. al., 2024). Among these three definitions, Johansson et al.'s (2021) definition forms this study's working definition because it provides the most comprehensive framework for this systematic review research, as it explicitly recognises the multidimensional nature of barriers whilst maintaining specificity regarding food security outcomes, thereby

enabling systematic examination of environmental, socioeconomic, and institutional dimensions as distinct yet interconnected challenge domains.

The concept of "Opportunities"

Opportunities have been conceptualised differently across various scholarly perspectives, each emphasising distinct dimension of their nature and application. Shane and Venkataraman (2000) define opportunities as situations in which new goods, services, raw materials, and organising methods can be introduced and sold at greater than their cost of production, representing an economic perspective that focuses on market gaps and profit potential through innovation and resource reconfiguration. On the other hand, Johnson and So (2016) conceptualises opportunities as unrecognised profit possibilities that exist due to market disequilibrium and information asymmetries, emphasising the discovery aspect where alert entrepreneurs identify and exploit these temporal market imperfections. Similarly, yet with a broader scope, Porter (1985) defines opportunities as favourable external conditions or circumstances that enable organisations to gain competitive advantage through strategic positioning, highlighting the environmental and contextual factors that create potential for value creation and sustainable development. Among these three definitions, Shane and Venkataraman's (2000) conceptualisation represents the most suitable definition for this study, as it encompasses the diverse nature of opportunities in agricultural contexts where smallholder farmers require access to new goods, services, raw materials, and organising methods that can be economically viable, with the emphasis on cost-effectiveness aligning with the resource constraints faced by smallholder farmers whilst focusing on practical interventions needed to enhance food security outcomes.

The concept of "Food Security"

The Food and Agriculture Organisation's (FAO) institutional definition posits that food security exists when all people have physical and economic access to sufficient, safe, and nutritious food (FAO, 2003), representing a supply-focused approach prioritising availability. On the other hand, entitlement-based perspectives conceptualise food security as individuals' capabilities to command food through production, trade, and transfers, emphasising that food security represents only one subset of poor households' objectives (Maxwell, 1996). Similarly, multidimensional frameworks integrate food availability, access, stability and biological utilisation as interconnected pillars determining household outcomes (Pérez-Escamilla, 2017). For this systematic review on smallholder farmers in SSA, the entitlement-based definition (Maxwell, 1996) proves most appropriate because it acknowledges that food security challenges extend beyond production to encompass broader livelihood strategies and capability development, recognising that effective interventions must address poverty and resource access rather than focusing solely on agricultural productivity.

The concept of "Smallholder Farmers"

Smallholder farmers are characterised by their limited land holdings, with the FAO defining them as agricultural producers operating on farms of less than two hectares (FAO, 2023). On the other hand, development economists emphasise socio-economic dimensions, conceptualising them as family based agricultural units relying on household labour with limited capital, representing marginalised rural populations (World Bank, 2021). Similarly, agricultural systems researchers adopt a holistic perspective, defining them as producers integrating crop and livestock production while maintaining subsistence-oriented practices prioritising food security over profit (Lowder et al., 2016). The development economists' definition (World Bank, 2021) represents the most appropriate framework for systematic reviews of food security challenges in SSA, as it captures multidimensional constraints and social vulnerabilities directly influencing food security outcomes.

THEORETICAL FRAMEWORK

The Sustainable Livelihoods Framework (SLF) served as this study's theoretical framework. SLF emerged from development discourse during the 1980s and 1990s, with significant contributions from Robert Chambers and Gordon Conway (1992) who initially conceptualised sustainable livelihoods as the capacity to cope with and recover from stress and shocks whilst maintaining or enhancing capabilities and assets. In addition, the framework was further refined by the Department for International Development (DFID, 1999) and subsequently

adapted by various international organisations including the United Nations Development Programme (UNDP) and Oxfam (Scoones, 2009). The framework fundamentally recognises that people's livelihoods depend on five capital assets: human capital (skills, knowledge, health), natural capital (land, water, forests), physical capital (infrastructure, tools), social capital (networks, institutions), and financial capital (savings, credit access). Also, the framework emphasises how these assets interact within vulnerability contexts (shocks, trends, seasonality) and are mediated by institutions and policies to produce livelihood outcomes (Serrat, 2017).

The SLF's strength lies in its holistic approach to understanding poverty and development, providing a comprehensive lens for analysing complex livelihood systems whilst recognising the interconnectedness of various factors affecting people's well being (Ellis, 2000). Furthermore, the framework's people centred approach emphasises local knowledge and participatory approaches, making it particularly relevant for understanding smallholder farming systems. Additionally, its flexibility allows for adaptation across different contexts and scales, from household to community levels. However, the framework faces criticism for its complexity and potential difficulty in operationalisation, particularly in quantifying intangible assets like social capital (Scoones, 2009). Similarly, critics argue that the framework may oversimplify power relations and structural inequalities that affect livelihood outcomes.

In this systematic review examining food security challenges and opportunities among smallholder farmers in SSA, the SLF provides an ideal analytical framework because it recognises food security as a multidimensional outcome influenced by various interacting factors. The framework's asset-based approach will enable the systematic categorisation and analysis of literature findings, examining how different capital assets influence food security outcomes amongst smallholder farmers. In addition, the framework's emphasis on vulnerability contexts will help identify and analyse the various shocks, trends, and seasonal factors that affect food security in the region. Also, the institutional and policy dimensions of the framework will facilitate understanding of how governance structures, markets, and policies mediate access to resources and food security outcomes, providing a comprehensive foundation for synthesising existing literature and identifying key intervention points for enhancing food security.

Empirical Literature

Using recent studies, the empirical review is organized thematically. Looking at *Climate Change Adaptation, Agricultural Innovation, and Technology Adoption*; Several empirical studies have examined the relationship between climate-smart agriculture, technological innovations, and food security outcomes among smallholder farmers across SSA. Mpandeli et al. (2023) conducted a systematic review across 14 SSA countries, employing PRISMA guidelines methodology with analysis of 58 peer-reviewed articles, finding that organic manure adoption reached 10.26%, followed by agroforestry and crop rotation at 9.62% each, with financial constraints (15.90%) and information access barriers (9.74%) being primary adoption hindrances. In contrast, Nzengya and Onyango (2023) utilized a systematic review methodology encompassing ten studies (three quantitative and seven mixed-methods) focusing specifically on climate change adaptation strategies, revealing that quantitative studies identified seed variety adoption and fertilizer pattern changes as significant strategies, whilst mixed-methods studies revealed different approaches including tree planting, mulching, and crop diversification. The methodological divergence between these studies demonstrates varying analytical approaches yield different strategic priorities.

Similarly, McCarthy et al. (2023) employed a mixed-methods approach in Neno district, Malawi, with focus group discussions and individual interviews among 30 smallholder farmers, finding that 70% expressed interest in drone technology adoption, with commercial farmers showing greater enthusiasm (100%) compared to subsistence farmers (57%), whilst identifying cost concerns as universal barriers (100%). However, Theodory et al. (2024) adopted a different methodological approach in Kongwa District, Tanzania, utilizing Generalized Linear Models and Inverse Probability Weighted techniques with 299 smallholder farmers, finding no conclusive evidence linking drought and heavy rainfall to reductions in household dietary diversity, contrasting with the technological optimism found in the Malawian study. The comparative analysis reveals that whilst climate-smart agricultural practices show promise, their effectiveness varies significantly based on regional contexts, methodological approaches, and farmer typologies, with technology adoption being constrained by universal financial barriers across different SSA contexts.

Assessing Sustainable Agricultural Practices, Market Participation, and Income Diversification; Empirical evidence on sustainable agricultural practices and market participation reveals complex relationships with food security outcomes across different SSA contexts. Setsoafia et al. (2022) conducted research in northern Ghana's three regions using multinomial endogenous switching regression methodology with 1,284 households, finding that simultaneous adoption of improved seeds, fertilizer, and soil-water conservation practices generated 23% farm income increases and 53% reduction in coping strategy index scores compared to single practice adoption. This contrasts with Osewe et al. (2023), who employed multinomial endogenous treatment effects methodology with Uganda National Panel Survey data, revealing that sustainable intensification cluster adoption improved food consumption scores and household dietary diversity compared to non-adopters, with maize-legume intercropping combined with inorganic fertilizer proving most effective.

However, Mavondo et al. (2022) adopted a different analytical approach in Zimbabwe, utilizing survey data from 464 smallholder farmer-entrepreneurs and finding that market orientation, access to ancillary services, and functional literacy enabled farmers to overcome market participation challenges, revealing both financial and non-financial outcomes including increased marketplace credibility. The methodological diversity demonstrates that whilst sustainable agricultural practices consistently improve food security outcomes, the magnitude and pathways differ significantly based on practice combinations and regional contexts.

Furthermore, Salifu and Salifu (2023) examined income diversification challenges in northern Ghana using a sample of 500 agricultural households, finding that income diversification positively correlated with food security, with spousal incomes accounting for 29.2% of household food purchase capacity during distress seasons. In contrast, Mukaila (2024) focused specifically on women farmers in Nigeria using ordered logit and binary logit methodologies, finding that agricultural commercialization ranged from 0-89.4% with an average of 54.53%, and that commercialization significantly enhanced household food security. The comparative analysis indicates that while sustainable practices and market participation generally improve food security, the effectiveness is mediated by gender dynamics, spousal income contributions, and the degree of commercialization achieved.

Analyzing Productivity Trends, Land Management, and Systemic Challenges; Recent empirical studies examining productivity trends and land management practices reveal concerning patterns and persistent challenges affecting food security among smallholder farmers. Bentze et al. (2024) conducted a comprehensive analysis across six African countries (Ethiopia, Malawi, Mali, Niger, Nigeria, and Tanzania) using harmonized longitudinal data from over 55,000 smallholder farms across 180,000 plot observations through LSMS-ISA methodology, finding no evidence of productivity improvement over the 12-year period (2008-2019), with total factor productivity indicating an overall annual decline of 3.5%, though with significant country variations including positive growth in Niger (29%) but declines in Nigeria (-4.8%) and Malawi (-3.5%). This contrasts sharply with more optimistic findings from Ezui et al. (2022), who reviewed site-specific nutrient management progress across SSA using QUEFTS model framework and field trials, finding that SSNM increased rice and maize yields by 24% and 69% respectively compared to farmer practices, whilst improving profitability. The methodological differences between large-scale longitudinal analysis and focused intervention studies highlight the gap between experimental successes and real-world implementation challenges.

Additionally, Elhindi et al. (2024) examined sustainable land management practices in Ogun State, Nigeria, employing Poisson endogenous treatment model with 120 rice farmers, finding that SLM adoption significantly improved dietary diversity by 27% among non-adopting households, with formal education and vocational training being key determinants. However, Hu et al. (2022) adopted a different analytical approach examining Nigeria's food production using FAO food balance sheets and Federal Ministry data, finding that despite smallholder contributions, rice, sorghum, soybean, cassava, and yam yields declined from 2015-2018, with post-harvest losses remaining constant and cereal production inadequate for per capita requirements.

This systematic review will fill a critical synthesis gap in the fragmented literature on smallholder farmer food security in SSA. Current research suffers from methodological inconsistency, thematic isolation, and contradictory findings - with localized studies showing promising results (24-69% yield increases) while large-scale analyses reveal concerning productivity declines (3.5% annually). This review will provide a unified analytical framework that bridges the micro-macro disconnect between pilot successes and broader

implementation challenges, synthesizing evidence across different scales and themes to translate fragmented findings into comprehensive, evidence-based policy recommendations for enhancing food security outcomes across SSA.

METHODOLOGY

This systematic review study employed a detailed and comprehensive approach to examine the challenges and opportunities for enhancing food security among smallholder farmers in SSA. The methodology adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure rigorous and transparent reporting of the review process (Moher et al., 2009). A systematic search strategy was developed to identify relevant literature published between 2000 and 2025, focusing specifically on empirical studies conducted within Sub-Saharan African contexts. The search encompassed multiple electronic databases including PubMed, Web of Science, Scopus, and Agricultural and Environmental Sciences databases to capture the breadth of available research on smallholder food security interventions and constraints.

The study selection process followed a multi-stage screening approach designed to ensure comprehensive coverage whilst maintaining methodological rigour (refer to the PRISMA Flow Diagram on Figure 1). Initially, 128 records were identified through database searching, which underwent preliminary screening based on predetermined inclusion criteria. Studies were required to be empirical investigations (excluding all or systematic studys), published in English, and specifically address food security challenges or opportunities among smallholder farmers in SSA or its constituent countries. Following the initial screening, 87 records proceeded to full-text evaluation, where detailed assessment was conducted to determine eligibility for inclusion in the final review (Higgins & Green, 2011). This rigorous screening process resulted in the exclusion of 58 studies due to various factors including insufficient data quality, methodological limitations, duplication, and language barriers.

The final dataset comprised 29 high quality studies that met all inclusion criteria and underwent thematic analysis to identify key patterns and insights. These studies were systematically categorised into seven distinct thematic areas: Technology Adoption and Agricultural Innovation (6 studies), Structural and Scale-Related Constraints (5 studies), Climate Change Adaptation and Environmental Pressures (5 studies), Gender Dynamics and Women's Empowerment (4 studies), Market Access and Commercialisation Opportunities (4 studies), Income Diversification and Livelihood Strategies (3 studies), and Institutional Support and Policy Interventions (2 studies). Data extraction and synthesis were conducted using a standardised framework to ensure consistency and reliability in the analysis process (Petticrew & Roberts, 2006). The retention rate of approximately 23% from initial identification to final inclusion demonstrates the stringent quality standards applied throughout the review process, enhancing the validity and reliability of the findings.

Quality Assessment of Included Studies

Beyond the eligibility screening described above, each of the 29 included studies was appraised for methodological quality during the full-text evaluation stage. Appraisal criteria were adapted to the study design rather than applying a single uniform checklist: quantitative studies (e.g., panel surveys and cross-sectional surveys employing endogenous switching or treatment-effects models) were evaluated against sample representativeness, appropriateness of the analytical technique, clarity of outcome measurement, and control for confounding; mixed-methods and qualitative studies were evaluated against clarity of the research question, appropriateness of the data collection method, and transparency of the analytic process. These criteria draw broadly on principles underlying established appraisal instruments such as the Mixed Methods Appraisal Tool (MMAT) and the Joanna Briggs Institute (JBI) critical appraisal checklists, although no single standardised instrument was formally administered across the full sample.

Quality-related concerns—principally small or non-representative samples, limited methodological transparency, or unclear analytical procedures—contributed to some of the 58 full-text exclusions, alongside duplication, ineligible study designs, and language restrictions, although a precise breakdown by exclusion reason was not systematically recorded. This review was conducted by a single reviewer, and no second, independent rater was involved in study selection or quality appraisal; consequently, no inter-rater reliability

statistic could be calculated, and no summary quality-scoring table is presented, as scores were not formally recorded for each study. This represents a methodological limitation of the review, discussed further in the Limitations subsection below.

The review also did not include a formal assessment of publication bias, such as a funnel plot or Egger's test, approaches more commonly applied in meta-analyses of quantitative effect sizes than in thematic systematic reviews of this kind. It remains plausible, however, that studies reporting positive or statistically significant associations between interventions and food security outcomes were more likely to be published—and therefore more likely to be captured by the search strategy—than studies reporting null or negative findings. This possibility should be borne in mind when interpreting the generally favourable picture that the reviewed evidence presents regarding technology adoption, sustainable intensification, and market participation, as the true average effect of some interventions may be more modest than the published literature suggests.

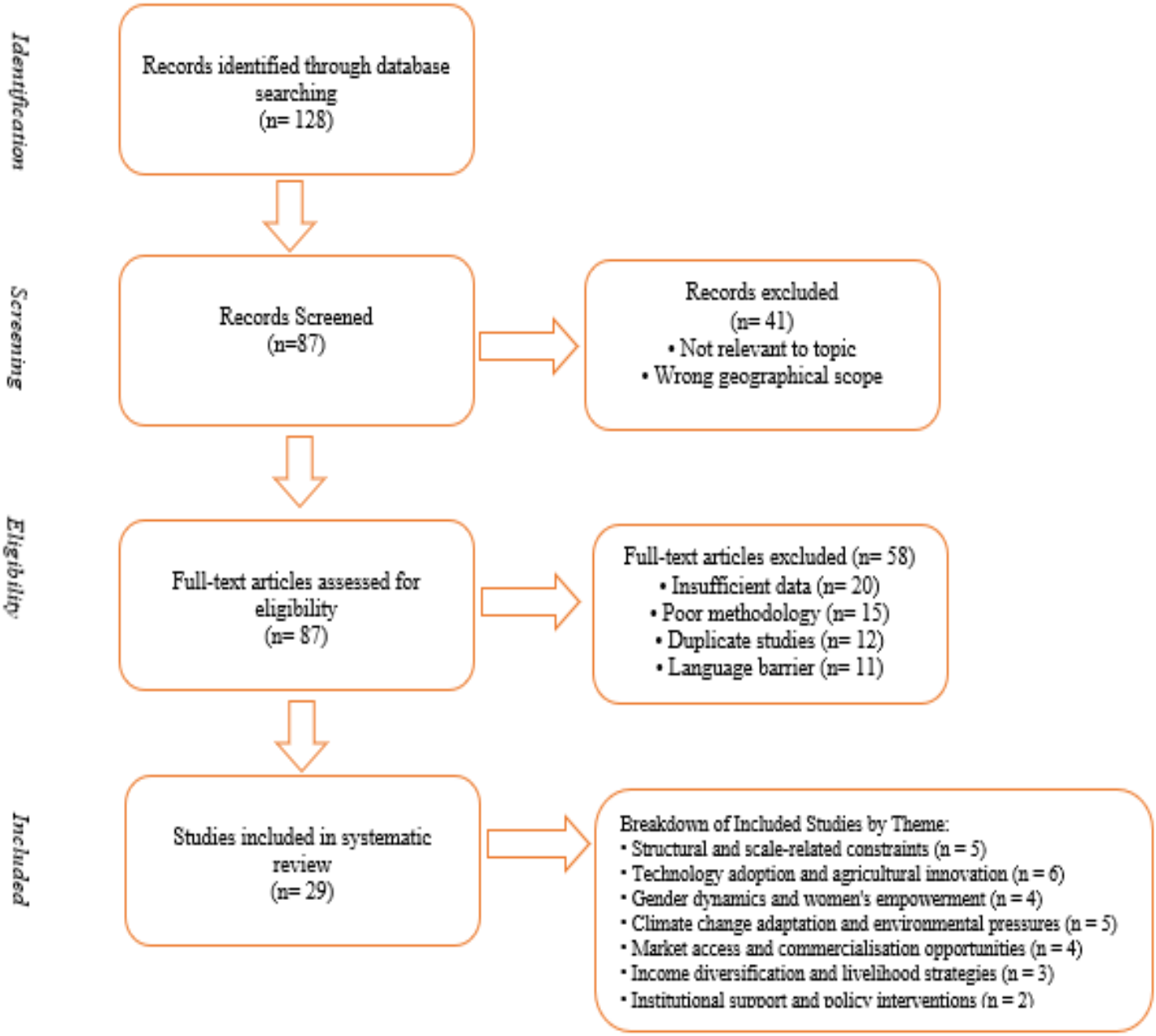

Figure 1: PRISMA Flow Diagram

RESULTS AND DISCUSSION OF FINDINGS

This systematic review critically examines existing literature to identify key factors influencing food security amongst smallholder farmers in SSA, with particular emphasis on challenges and opportunities for enhancement. The analysis adopts a thematic approach, examining convergent and divergent findings across multiple contexts.

Geographical Distribution of Included Studies

To enhance the transparency of the evidence base and help readers assess its representativeness, Table 1 presents the distribution of the 29 included studies by country and by broader multi-country grouping.

Country / Study Grouping	Number of Studies	Share of Total (%)
Ghana	8	27.6
Nigeria	6	20.7
Multi-country / regional studies*	5	17.2
South Africa	3	10.3
Uganda	2	6.9
Tanzania	2	6.9
Malawi	1	3.4
Zimbabwe	1	3.4
Kenya	1	3.4
Total	29	100.0

Table 1: Distribution of Included Studies by Country/Grouping (n = 29)

*Multi-country/regional studies draw on data spanning several SSA countries (e.g., Ethiopia, Ghana, Kenya, Mali, Malawi, Niger, Nigeria, Tanzania, Uganda), and are reported separately here because they cannot be attributed to a single national context.

The evidence base is heavily concentrated in West Africa: Ghana and Nigeria together account for 48.3% of the 29 included studies. East Africa (Uganda, Tanzania, Kenya) and Southern Africa (South Africa, Malawi, Zimbabwe) are each represented by five single-country studies, supplemented by multi-country studies that incorporate Ethiopia, Mali, and Niger as secondary observations within larger panel datasets. Notably, no study in the review is drawn primarily from Central Africa (e.g., Democratic Republic of Congo, Cameroon, Chad), the Horn of Africa (e.g., Somalia, South Sudan), Lusophone Africa (e.g., Mozambique, Angola), or Francophone West Africa beyond the secondary inclusion of Mali and Niger within panel studies (e.g., Côte d'Ivoire, Senegal, Burkina Faso). This concentration in a small number of, predominantly Anglophone, countries limits the extent to which the review's findings can be generalised across the full diversity of smallholder farming contexts in SSA, a point discussed further in the Limitations subsection.

Structural and Scale-Related Constraints to Food Security

The fundamental challenge of farm size emerges as a critical determinant of food security outcomes across SSA. Giller et al. (2021) demonstrate that the majority of farms across Ethiopia, Ghana, Mali, Malawi, Tanzania, and Uganda are less than one hectare, creating inherent limitations for food self-sufficiency and income generation. This finding resonates with Bentze et al. (2024), who established that despite covering six countries representing 39% of SSA's population, crop productivity has failed to improve over a 12-year period from 2008 to 2019. Furthermore, their analysis reveals concerning productivity declines in key countries such as Nigeria (-4.8%) and Malawi (-3.5%), suggesting that scale constraints are compounded by deteriorating agricultural performance.

The implications of these structural limitations extend beyond simple land availability. Giller et al. (2021) argue convincingly that closing yield gaps, whilst improving food self-sufficiency, remains insufficient to lift most households out of poverty due to fundamental land scarcity. This analysis challenges prevalent assumptions

about agricultural intensification as a panacea for food insecurity. Similarly, Hu et al. (2022) demonstrate that Nigerian smallholder farmers, despite contributing meaningfully to food supply, cannot currently ensure national food self-sufficiency, particularly for cereals. Their temporal analysis from 2015-2018 reveals declining yields for rice, sorghum, soybean, cassava, and yam despite increased harvested areas, indicating that expansion strategies alone are inadequate.

However, the relationship between farm size and food security is not uniformly negative across all contexts. Modika and Oluwatayo (2022) found that amongst macadamia nuts and avocado farmers in South Africa's Limpopo Province, 54% achieved food security despite operating on relatively small scales. This suggests that crop selection and market orientation may partially offset scale constraints. Additionally, Sinyolo (2020) established that improved maize varieties increased annual food expenditure per capita by over R4,000 per additional hectare, indicating that technological interventions can amplify the benefits of limited land resources.

Technology Adoption and Agricultural Innovation

The role of technological innovation in addressing food security challenges presents a nuanced picture characterised by both promising opportunities and persistent barriers. Osewe et al. (2023) provide compelling evidence that sustainable intensification practices combining maize-legume intercropping with inorganic fertiliser significantly improve food consumption scores, household dietary diversity, and per capita expenditure amongst Ugandan farmers. Their multinomial endogenous treatment effects model demonstrates that farmers adopting comprehensive sustainable intensification packages achieve superior outcomes compared to those implementing individual practices. This finding underscores the importance of integrated technological approaches rather than piecemeal interventions.

Furthermore, technological innovation extends beyond conventional agricultural practices to encompass digital solutions. McCarthy et al. (2023) reveal that 70% of Malawian farmers expressed interest in drone technology, with commercial farmers showing universal enthusiasm (100%) compared to subsistence farmers (57%). Their analysis demonstrates that drone imagery successfully identified critical on-farm issues including land management problems, soil erosion, and water stress across multiple farms. Nevertheless, universal cost concerns and limited willingness to share data (53%) highlight significant barriers to technology adoption.

The integration of Internet of Things (IoT) technologies presents additional opportunities for enhancing food security. Musumba et al. (2020) demonstrate that locally-processed IoT systems using LoRaWAN connectivity could substantially improve irrigation efficiency across Ethiopia, Kenya, and South Africa. Their case study analysis reveals that simple wetting front detectors reduced water consumption by 36% for wheat and potato crops, whilst the Koga irrigation system operated at only 89% capacity due to poor water management. This suggests considerable potential for technology-enabled efficiency gains. However, technology adoption faces substantial constraints that limit its food security impact. Prah et al. (2023) identify high interest rates, short credit repayment periods, and elevated input costs as primary barriers to Input Credit Scheme participation amongst Ghanaian rice farmers. Similarly, Ankuyi et al. (2024) establish that whilst conservation agriculture adoption significantly improves food security through practices like mulching and zero tillage, credit access constraints and high input costs continue to hinder widespread adoption.

Gender Dynamics and Women's Empowerment

Gender emerges as a fundamental dimension shaping food security outcomes, with women's empowerment presenting both opportunities and challenges within smallholder farming systems. Sinyolo (2020) demonstrates that female farmers in KwaZulu-Natal not only show greater likelihood of adopting improved maize varieties but also spend more to ensure household food security and benefit more substantially from adoption compared to their male counterparts. This finding challenges conventional assumptions about gender constraints in agricultural technology adoption.

Furthermore, Mukaila (2024) provides evidence that agricultural commercialisation amongst women bambara nut farmers in Nigeria significantly enhances household food security. Her analysis reveals that commercialisation levels ranging from 0 to 89.4% with an average of 54.53% contribute substantially to reducing

food insecurity, with 56.67% of women farmers experiencing food insecurity levels that decrease as commercialisation increases. This suggests that market participation offers viable pathways for women's economic empowerment and food security enhancement. However, the relationship between women's empowerment and food security outcomes is complex and context-dependent. Ogunnaike et al. (2021) present nuanced findings indicating that whilst gender parity and female achievement in group membership, income control, and workload reduce food insecurity, female achievement in productive decision-making and credit access paradoxically increases food insecurity severity amongst Nigerian smallholder farmers. This counterintuitive finding suggests that women's formal empowerment may not automatically translate into improved food security outcomes without addressing underlying structural constraints.

Additionally, Salifu and Salifu (2023) identify spousal incomes from diversification activities as accounting for 29.2% of total household incomes used for food purchases during distress seasons in northern Ghana. This finding emphasises the critical importance of women's economic contributions to household food security, particularly during vulnerable periods. Furthermore, their analysis demonstrates that highly diversified households with significant spousal income contributions are more likely to achieve food security status.

Climate Change Adaptation and Environmental Pressures

Climate change emerges as a pervasive threat multiplying existing food security challenges whilst simultaneously creating opportunities for adaptive innovation. Nchanji and Lutomia (2021) demonstrate that COVID-19's impact on common bean production across eleven SSA countries was exacerbated by underlying climate vulnerabilities, with Southern and Eastern Africa experiencing more severe temporal food shortages compared to Western and Central Africa. Their analysis reveals that climate-related production challenges including reduced access to seeds, farm inputs, and agricultural finance threaten to reverse progress towards Sustainable Development Goals 1 (No Poverty) and 2 (Zero Hunger).

The complexity of climate adaptation is further illustrated by Theodory et al. (2024), who found that whilst Tanzanian farmers increasingly rely on indigenous farming practices to enhance climate resilience, their study revealed no conclusive evidence linking drought and heavy rainfall to reductions in household dietary diversity or meal frequency. This finding challenges linear assumptions about climate-food security relationships and suggests that farmer adaptation strategies may be more effective than commonly recognised. Additionally, Emenike et al. (2022) provide evidence that climate change adaptation strategies significantly improve food security amongst Nigerian rice farmers, with adoption increasing household food security by approximately 3 units whilst decreasing food insecurity severity by 3.2 units. Their endogenous switching probit model reveals that access to market information, extension agents, gender considerations, off-farm income, and cooperative membership all contribute to differential food security outcomes between adopters and non-adopters of climate adaptation strategies.

However, climate adaptation faces substantial implementation barriers. Abalo et al. (2021) identify pest and disease incidences, inadequate access to agricultural credit, high costs of improved crop varieties, and limited government support as primary constraints to climate-smart agricultural practice adoption in Ghana. Their analysis reveals problem confrontation index values of 2530, 2502, 2334, and 2296 respectively for these barriers, indicating their severe limiting effects on adaptation efforts. Furthermore, Derbile et al. (2023) demonstrate that smallholder farmers in north-western Ghana employ diverse adaptation strategies encompassing both farm-based approaches (crop diversification, drought-tolerant varieties, improved tillage practices) and non-farm strategies (forest product gathering, seasonal migration, village savings associations). Their qualitative analysis reveals that local knowledge systems play critical roles in enabling livelihood diversification under conditions of poverty and climate uncertainty, suggesting opportunities for integrating indigenous and scientific knowledge systems.

Market Access and Commercialisation Opportunities

Market participation emerges as a crucial determinant of food security outcomes, presenting both opportunities for income generation and challenges related to access and integration. Mavondo et al. (2022) demonstrate that market orientation, access to ancillary services, functional literacy, entrepreneurial abilities, and marketplace

metacognition enable Zimbabwean smallholder farmers to achieve sustained market participation and improved food security outcomes. Their analysis of 464 farmer-entrepreneurs reveals both financial and non-financial benefits including enhanced marketplace credibility.

Additionally, Kirui et al. (2020) establish significant variations in food security outcomes across different value chains in north-west Mt. Kenya, with households participating in beef value chains experiencing relatively higher food insecurity compared to those engaged in wheat and dairy value chains. Their Household Food Insecurity Access Scale analysis reveals that 61% of households experience varying degrees of food insecurity, with household size, income variables, transport assets, and farmers' association membership emerging as significant determinants. The potential for market-oriented interventions is further demonstrated by Prah et al. (2023), who establish that Input Credit Scheme participation increased rice productivity by approximately 30% (from 1,131.81 kg/ha to 1,476.83 kg/ha) whilst improving household dietary diversity by 0.45 points amongst Ghanaian farmers. Their inverse probability weighted regression adjustment analysis provides robust evidence of credit schemes' effectiveness in enhancing both productivity and food security outcomes.

Although, market access faces persistent structural constraints. Ramatshekgisa and Naidoo (2024) identify lack of finances, water shortages, and limited access to formal markets as primary challenges facing smallholder farmers in South Africa's Limpopo Province. Similarly, Mukaila (2024) documents that high input costs, low capital availability, poor credit access, land usage restrictions, inadequate pricing mechanisms, and insufficient storage facilities constitute major barriers to women's agricultural commercialisation in Nigeria.

Income Diversification and Livelihood Strategies

Income diversification emerges as a critical strategy for enhancing food security resilience amongst smallholder farmers facing multiple constraints. Giller et al. (2021) argue that small farms alone cannot ensure food security or living incomes, necessitating off-farm employment and broader rural development strategies. Their analysis across six SSA countries demonstrates that food security and income heavily depend on land availability and cash crop integration, but structural limitations require diversified livelihood approaches.

Furthermore, Salifu and Salifu (2023) provide empirical evidence that income diversification positively correlates with food security status amongst 500 agricultural households in northern Ghana. Their analysis demonstrates that highly diversified households are more likely to report food security status, with spousal income diversification accounting for 29.2% of household food purchases during distress seasons. This finding emphasises the particular importance of women's diversification activities for household food security. The relationship between diversification and food security is further supported by Setsoafia et al. (2022), who demonstrate that comprehensive adoption of sustainable agricultural practices (improved seed, fertiliser, soil and water conservation) generates larger positive impacts on both farm income (23% increase) and food security (53% reduction in reduced coping strategy index, 14% improvement in household dietary diversity) compared to single or dual practice adoption. Their multinomial endogenous switching regression analysis provides robust evidence for integrated diversification approaches.

Nevertheless, diversification faces significant implementation challenges. Salifu and Salifu (2023) identify poor access to start-up capital, inadequate infrastructure conditions, and high transportation costs as cardinal barriers to effective income diversification in northern Ghana. These constraints reflect broader underdevelopment challenges that limit diversification opportunities for smallholder farmers. Also, Modika and Oluwatayo (2022) establish that education level, off-farm work, and farming experience positively influence intra-household food security amongst tree crop farmers in South Africa. Their analysis reveals that 54% of households achieve food security status, with coping strategies including gathering wild fruits, purchasing less expensive food, buying on credit, and occasional meal skipping. This suggests that diversification benefits are contingent upon human capital development and access to alternative economic opportunities.

Institutional Support and Policy Interventions

The role of institutional support emerges as a fundamental factor determining the effectiveness of food security interventions amongst smallholder farmers. Bjornlund et al. (2020) demonstrate that agricultural innovation

platforms combined with soil water monitoring tools significantly enhance crop yields, reduce irrigation frequency, and improve water and nutrient management amongst Tanzanian farmers. Their mixed-methods analysis reveals that farmers adopting these institutional innovations report higher incomes, improved food security, and greater participation in collective scheme management.

Furthermore, Nyagumbo et al. (2021) provide evidence from the InnovAfrica project that sustainable agricultural intensification practices, when supported by Multi-Actor Platforms and improved dissemination strategies, significantly increase crop yields and build climate-resilient farming communities across six African countries. Their analysis emphasises that promotion of sustainable practices requires enabling institutions and conducive policies enhancing access to inputs, market linkages, credit, and good agricultural lands.

The importance of extension services is further demonstrated by Elhindi et al. (2024), who establish that sustainable land management practice adoption significantly improves household food security amongst Nigerian rice farmers, with education, extension access, and training programmes emerging as key determinants. Their Poisson endogenous treatment model reveals that comprehensive sustainable land management packages improve dietary diversity by approximately 27% for non-adopting households. Nonetheless, institutional support faces significant quality and accessibility challenges. McNulty et al. (2023) document that amongst 200 smallholder households in Uganda's Teso sub-region, 17.5% experienced borderline food consumption despite 82.5% having 'acceptable' food consumption scores. Their analysis reveals high reliance on starchy staples, oils, and sugar, with limited consumption of vegetables, fruits, and protein sources, suggesting that institutional interventions may not adequately address nutritional quality dimensions of food security.

Additionally, Ogunniyi et al. (2021) establish that whilst value of output sold, education, credit access, and government safety net programme participation significantly influence food security amongst Nigerian maize farmers, only 23.2% of households experience food insecurity incidence with 5.5% and 1.8% experiencing depth and severity respectively. This relatively low incidence suggests that institutional programmes may be achieving some success, though targeting and coverage remain critical concerns.

Nutritional Dimensions and Dietary Diversity: The nutritional quality of food security outcomes presents a complex dimension often overlooked in productivity-focused interventions. McNulty et al. (2023) reveal that despite 82.5% of Ugandan smallholder farmers achieving 'acceptable' food consumption scores, dietary patterns demonstrate concerning nutritional imbalances characterised by high reliance on starchy staples (6.7 days per week), oils, and sugar (3.7 and 4.2 days respectively), whilst vegetables, fruits, and protein sources are consumed only 1.8, 1.9, and 2.1 days respectively. When adjusted thresholds are applied, only 64% of households maintain acceptable food consumption status, with 32.5% and 3.5% categorised as borderline and poor respectively. Similarly, the relationship between agricultural interventions and nutritional outcomes is not automatically positive. Osewe et al. (2023) demonstrate that sustainable intensification practices amongst Ugandan maize farmers improve food consumption scores and household dietary diversity, but their analysis focuses primarily on quantity rather than quality indicators. Similarly, Prah et al. (2023) establish that Input Credit Scheme participation increases household dietary diversity by 0.45 points (8% improvement), though the study does not examine specific nutritional adequacy outcomes.

The gender dimension of nutritional security is particularly significant. Salifu and Salifu (2023) demonstrate that spousal income contributions are crucial for food purchases during distress seasons, suggesting that women's economic empowerment may have direct nutritional implications. However, their analysis does not examine specific dietary quality outcomes or nutritional adequacy measures. Furthermore, Nkansah-Dwamena (2023) provides evidence that small-scale circular agriculture systems in Ghana enhance household food security whilst reducing external input dependency. His ethnographic analysis across five communities demonstrates that mixed cropping, livestock-crop integration, and agroforestry contribute to more robust and sustainable food systems. However, the study does not provide quantitative measures of nutritional adequacy or dietary diversity improvements.

Considered together, the studies reviewed here point to a more systematic pattern in the relationship between agricultural interventions and nutritional outcomes than has typically been acknowledged. Interventions oriented toward crop diversification and mixed cropping (Nkansah-Dwamena, 2023) and toward integrated maize-legume

intercropping (Osewe et al., 2023) are consistently associated with improvements in dietary diversity, while interventions oriented primarily toward single-crop productivity gains or input credit (Prah et al., 2023) show smaller and less consistent effects on dietary diversity relative to their effects on productivity or income. This pattern suggests that interventions explicitly designed around dietary diversity—crop diversification, livestock-crop integration, and agroforestry—may generate more robust nutritional benefits than interventions designed primarily around calorie-yield or income objectives, even where the latter also report modest dietary diversity gains as a secondary outcome.

None of the 29 included studies directly evaluated biofortification (e.g., vitamin A-enriched cassava or orange-fleshed sweet potato, iron-biofortified beans) as an intervention, despite its prominence in the wider agriculture-nutrition literature; this represents a specific evidence gap that a supplementary, nutrition-focused search of the literature could help to address in future reviews. Taken together with McNulty et al.'s (2023) finding that 82.5% of Ugandan households achieved an 'acceptable' food consumption score despite heavy reliance on starchy staples and minimal fruit, vegetable, and protein consumption, the evidence base suggests that calorie- or frequency-based measures of food security can mask underlying micronutrient inadequacy. This has direct implications for intervention design and monitoring: food security programmes and monitoring frameworks that rely solely on calorie-based or food consumption score thresholds risk certifying households as food secure while nutritionally significant gaps in dietary quality persist, underscoring the case for routinely pairing such measures with dietary diversity or micronutrient-adequacy indicators.

The nutritional security of smallholder households is also shaped by gender dynamics. Salifu and Salifu's (2023) finding that spousal incomes account for 29.2% of household food-purchasing capacity during distress seasons, and Sinyolo's (2020) finding that female farmers benefit more from improved maize variety adoption than their male counterparts, together suggest that women's economic contributions are particularly consequential for household nutritional security during periods of stress. However, Ogunnaike et al.'s (2021) counterintuitive finding—that women's empowerment in productive decision-making and credit access can be associated with greater food insecurity severity—indicates that the pathway from women's economic empowerment to improved nutritional outcomes is neither automatic nor uniform, and may depend on complementary changes in intra-household bargaining power, time allocation, and control over the income generated. This points to a need for future research that examines nutritional outcomes, rather than food security status alone, as a distinct dependent variable in studies of women's empowerment.

Regional Variations and Context Specificity: Regional variations in food security outcomes and intervention effectiveness highlight the importance of context-specific approaches rather than universal solutions. Giller et al. (2021) demonstrate significant disparities across SSA countries, with food security and income heavily dependent on agroecological conditions and market access. Their comparative analysis reveals that regional differences in land availability, cash crop opportunities, and agricultural productivity require differentiated policy approaches. Furthermore, Nchanji and Lutomia (2021) establish that COVID-19's impact on common bean production varied significantly across SSA sub-regions, with Southern and Eastern Africa experiencing more severe temporal food shortages compared to Western and Central Africa. Their analysis of eleven countries demonstrates that containment measure implementation and agricultural system resilience differ substantially across regional contexts.

The importance of regional specificity is further illustrated by Kirui et al. (2020), who establish that value chain participation effects vary significantly across different agricultural systems in north-west Mt. Kenya. Their analysis reveals that beef value chain participants experience higher food insecurity compared to wheat and dairy value chain participants, suggesting that commodity selection and market characteristics substantially influence food security outcomes. Furthermore, Bentze et al. (2024) document considerable heterogeneity in productivity trends across six SSA countries, with Niger achieving positive growth (29%) whilst Nigeria and Malawi experience substantial declines (-4.8% and -3.5% respectively). This variation suggests that national policy contexts, agricultural investment strategies, and environmental conditions create differentiated outcomes requiring tailored interventions.

However, some common patterns emerge across regional contexts. Mandaza and Asare-Nuamah (2020) demonstrate that Ghanaian smallholder farmers experience food anxiety and inability to access preferred food

quality and quantity, patterns consistent with findings from other SSA contexts. Their analysis reveals that adaptation strategies including improved crop varieties, agrochemical application, and livelihood diversification contribute to enhanced food security across different agroecological zones.

The Role of Conflict and Political Economy Factors

None of the 29 studies included in this review explicitly examined conflict, political instability, or governance failure as determinants of smallholder food security, despite the prominence of these factors in the wider food security literature and in major international assessments of food insecurity in SSA (IMF, 2022; Wudil et al., 2022). This is a notable gap: several of the review's included studies were conducted in, or drew samples from, countries that have experienced significant conflict or political instability during the period covered by the search (2000-2025), yet none analysed conflict exposure as an explanatory variable alongside the structural, technological, and institutional factors discussed above.

The wider literature on conflict and food security establishes several channels through which conflict is likely to interact with the challenges and opportunities identified in this review. Conflict and displacement disrupt agricultural production directly, through loss of land access, labour, and productive assets, and indirectly, through the breakdown of input and output markets, extension services, and rural financial institutions on which the interventions reviewed here depend. Nchanji and Lutomia (2021) provide a partial illustration of this dynamic in the context of COVID-19-related market disruption, finding that Southern and Eastern African bean producers experienced more severe temporary food shortages than their Western and Central African counterparts, a pattern consistent with the broader observation that shocks to market access compound existing vulnerabilities unevenly across contexts. Where conflict additionally disrupts governance and institutional capacity, the extension services, credit schemes, and multi-actor platforms identified in this review as important enablers of adoption (e.g., Bjornlund et al., 2020; Nyagumbo et al., 2021) may be substantially weakened or entirely absent, limiting the transferability of intervention models developed in more stable settings to conflict-affected areas.

These considerations carry direct implications for humanitarian and development programming. Interventions of the kind reviewed here—sustainable intensification packages, digital and IoT-based technologies, and formal credit schemes—typically presuppose a baseline level of market functioning, physical security, and institutional continuity that may not hold in conflict-affected areas. Programming in such contexts is therefore likely to require integrated approaches that combine immediate food assistance with longer-term resilience-building measures, adapted to weaker or intermittent institutional and market access rather than assuming the conditions documented in the stable settings that dominate the current evidence base. Future research explicitly incorporating conflict and governance indicators alongside the structural and technological factors examined in this review would help clarify how far the challenges and opportunities identified here extend to conflict-affected smallholder populations.

Overall Synthesis and Assessment

This systematic review reveals that food security enhancement amongst smallholder farmers in SSA requires multifaceted approaches addressing structural, technological, social, and institutional dimensions simultaneously. The evidence demonstrates that single-intervention approaches are inadequate for addressing the complex challenges facing smallholder farmers. Furthermore, the literature reveals significant methodological limitations including heavy reliance on cross-sectional designs, limited longitudinal analysis, and insufficient attention to nutritional quality dimensions of food security.

The convergence of findings across multiple contexts suggests that whilst regional variations exist, certain fundamental challenges including land scarcity, climate vulnerability, market access constraints, and institutional weaknesses are pervasive across SSA. However, the literature also reveals considerable opportunities for enhancement through integrated technological adoption, women's empowerment, climate adaptation strategies, market participation, income diversification, and institutional support mechanisms. Critical gaps in the literature include limited analysis of nutritional adequacy outcomes, insufficient examination of social protection mechanisms, inadequate attention to conflict and political economy factors, and limited evaluation of

intervention sustainability and scalability. Furthermore, most studies focus on immediate outcomes rather than long-term resilience building, limiting understanding of food security system transformation requirements.

Limitations of the Review

As Table 1 illustrates, the evidence synthesised in this review is geographically uneven, with Ghana and Nigeria together accounting for almost half of the 29 included studies, and with Central Africa, the Horn of Africa, Lusophone Africa, and much of Francophone West Africa entirely unrepresented as a primary study context. This concentration limits the generalisability of the review's conclusions: the challenges and opportunities identified here are best understood as most directly applicable to the Anglophone West, East, and Southern African contexts from which the evidence is drawn, and should be extended to other sub-regions with caution. Because the search strategy was restricted to English-language publications indexed in PubMed, Web of Science, Scopus, and Agricultural and Environmental Sciences databases, it is likely that relevant studies published in French or Portuguese, or in regional and grey-literature sources with limited coverage in these databases, were systematically less likely to be identified, which may partly explain the near-absence of Francophone and Lusophone contexts from the final sample. Future systematic reviews on this topic would benefit from multilingual search strategies and the inclusion of regional databases and grey literature to establish whether the patterns identified here also hold in currently under-studied sub-regions.

As noted in Section 3, quality appraisal in this review was informed by criteria adapted from established instruments (e.g., MMAT, JBI checklists) rather than through formal application of a single standardised tool, and screening and appraisal were conducted by a single reviewer without a second rater or a calculated measure of inter-rater agreement. No formal assessment of publication bias was undertaken. These are recognised limitations of the review process: they mean that the quality of individual studies could not be reported in a standardised, quantified form, and that the generally positive pattern of findings regarding technology adoption, sustainable intensification, and market participation may partly reflect a tendency for studies with favourable results to be more readily published and therefore more likely to be captured by the search.

Finally, as discussed above, the included studies provide only partial coverage of the nutritional quality dimension of food security and no direct evidence on the role of conflict and political economy factors. Both gaps constrain the review's ability to speak to household-level nutritional adequacy, as distinct from calorie-based food security status, and to the applicability of its findings in conflict-affected settings. Addressing these gaps—through multilingual and grey-literature searches targeting under-studied regions, nutrition-focused supplementary searches, and the explicit incorporation of conflict and governance indicators—represents a priority for future systematic reviews of smallholder food security in SSA.

CONCLUSION AND POLICY RECOMMENDATIONS

Conclusion

This systematic review examined the challenges and opportunities for enhancing food security among smallholder farmers in SSA, revealing that food insecurity stems from interconnected structural, technological, environmental, and institutional constraints requiring comprehensive solutions. The evidence demonstrates that structural constraints fundamentally limit outcomes, with farm sizes under one hectare creating barriers to food self sufficiency while productivity declined 3.5% annually despite localized yield improvements of 24-69%. Furthermore, technological innovation presents transformation opportunities through sustainable intensification, digital solutions, and IoT applications, yet adoption remains constrained by financial barriers and inadequate infrastructure. Additionally, gender dynamics emerge as critical determinants, with women's empowerment through commercialization offering viable pathways despite complex relationships where formal empowerment may not automatically improve outcomes. Similarly, climate adaptation strategies present both challenges and opportunities, with farmers relying on indigenous knowledge and diversification for resilience, while market access offers income generation potential despite persistent barriers. The analysis reveals that income diversification proves essential for resilience, with spousal contributions accounting for significant household food expenditure during distress periods, while institutional support remains fundamental yet faces quality and accessibility challenges across the region.

Policy Recommendations

Based on the systematic analysis of challenges and opportunities, comprehensive policy interventions targeting multiple stakeholder groups are essential for enhancing food security among smallholder farmers in SSA. National governments should prioritize integrated agricultural transformation strategies addressing land tenure reforms, technology adoption support systems including subsidized digital technologies, and gender-inclusive policies targeting women's access to credit and markets. Furthermore, regional economic communities including Economic Community of West African States (ECOWAS), Southern African Development Community (SADC), and East African Community (EAC) should coordinate cross-border initiatives harmonizing climate adaptation strategies and establishing regional food security monitoring systems. Additionally, international organizations particularly FAO, World Bank, and International Fund for Agricultural Development (IFAD) should redesign interventions toward comprehensive livelihood-based frameworks integrating agricultural productivity, income diversification, and institutional capacity building. Similarly, agricultural extension services must transform operational models incorporating participatory approaches combining scientific innovations with indigenous knowledge systems while establishing farmer-to-farmer networks. The evidence indicates that financial institutions should develop innovative credit mechanisms with flexible repayment schedules and collateral-free lending models, while private sector actors should be incentivized through public-private partnerships to develop affordable, scalable solutions addressing cost barriers limiting technology adoption across smallholder farming communities.

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