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Gender Equality, Indigenous Knowledge Systems and Resilient Smallholder Agriculture for a Changing Climate: A Path to Sustainable Rural Development in Africa

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ABSTRACT

Background: Rural development is essential for global initiatives aimed at eradicating poverty, ensuring food security, and establishing sustainable livelihoods. However, existing research lacks a comprehensive understanding of the interconnections among various systems and subsystems within rural ecosystems.

Objective: This study introduces an intersectionality conceptual framework rooted in agro-based afrocentricity, emphasizing gender-inclusive rural development. It examines the intersections of gender inclusivity, indigenous knowledge systems, climate change, and resilient smallholder agriculture.

Methods: A conceptual framework analysis is employed, focusing on the intersections of gender, indigenous knowledge, climate change, and smallholder agriculture as drivers of rural development.

Results: The study underscores the importance of addressing gender inequality, climate change, low productivity in smallholder farming, and food and nutrition insecurity. These are identified as the most significant and interconnected socioeconomic and environmental challenges impeding rural development in Africa.

Conclusion: The study contributes to a more inclusive and sustainable approach to agricultural and rural development, highlighting the necessity of intersectionality and agro-based afrocentricity in fostering climate resilience and promoting sustainable rural development in Africa.

Implications: The findings have implications for policymakers, practitioners, and researchers in rural development, emphasizing the need for a nuanced understanding of the intersections among gender, indigenous knowledge, climate change, and smallholder agriculture for sustainable rural development.

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1. INTRODUCTION

Rural development is pivotal for eradicating extreme poverty, ensuring food security, and creating sustainable livelihoods (Vorobvovo and Bugal, 2019). It involves enhancing agricultural productivity, promoting non-farm employment, and reducing poverty and inequality. However, low-income countries face challenges in meeting the 2030 Agenda for Sustainable Development's socioeconomic and environmental goals (DeSa, 2021). Over half of the sub-Saharan African rural population lives in extreme poverty. To achieve the SDGs by 2030, rural development strategies must be rethought, focusing on technology, promoting circular and conservation practices, and investing in improved resource management (Assan, 2023). Research on these systems is limited by a lack of quantifiable data. This study introduces an intersectionality conceptual framework rooted in agro-based afrocentricity,

emphasizing gender-inclusive rural development. It examines the intersections of gender inclusivity, indigenous knowledge systems, and resilient smallholder agriculture to foster climate resilience and promote sustainable rural development in Africa.

In African countries, over 80% of the population resides in rural areas, leading to diverse smallholder farming systems (Zadawa, and Omran, 2020). These systems are vital for ensuring food security and supporting rural livelihoods, playing a significant role in poverty reduction and enhancing food security in developing nations. Smallholder farmers, who constitute 73% of the rural populace, are responsible for producing 70% of the continent's food consumption, contribute 15%-21% to GDP, and employ 60-80% of women (Bagheramiri and Keshvarz Shaal, 2020). Expanding and developing smallholder agriculture can increase agricultural production, reduce food prices, and raise incomes, thereby aiding in poverty alleviation.

Gender-specific strategies can facilitate resilient rural development in developing countries (Slavchevska et al 2024). However, gender inequality impedes progress in Africa, where women encounter heavy workloads and discrimination in resource distribution (Assan, 2014) Climate change poses a threat to women's economic independence, worsening gender power disparities. The FAO supports a gendered agri-food systems approach, which considers the trade-offs between livelihoods, environment, climate, and nutrition (FAO, 1998). Understanding the gender gap is essential for addressing income inequality and productivity loss in rural development.

Climate change presents significant obstacles to rural transformation, particularly in areas with high rural poverty (Yaduvanshi et al 2021). It affects crop yields, soil health, water resources, and regional food security, potentially hindering rural development due to its negative impact on smallholder farming systems (Yiridomoh, et al 2021). Climate change can lead to reduced economic growth, increased poverty, and fewer livelihood opportunities in rural regions (Piya, et al 2019). It also causes soil degradation, diminished water availability, and heightened competition for resources. Supporting smallholder farmers in adapting to climate change can promote climate-resilient development, reduce poverty and inequality, and ensure sustainable food security and nutrition (Assan, 2023). However, the lack of resilience and capacity to adapt and transform among smallholder farmers has resulted in worsening long-term welfare outcomes.

African indigenous knowledge, deeply embedded in specific cultures, is a vital resource for addressing climate change and achieving sustainable development (Leal Filho et al 2020). It covers various aspects of life, including ecology, climate, agriculture, animal husbandry, botany, linguistics, medicine, clinical psychology, and craft skills (Sullo, et al 2020). Indigenous education aims to contextualize this knowledge for users, promoting social justice, equity, student engagement, and identity. Integrating indigenous knowledge systems (IKS) into modern agricultural science is crucial for promoting rural development, particularly in smallholder agricultural systems. IKS offer context-specific solutions to local agricultural challenges, providing insights into climate-resilient agricultural practices (Khatun and Salian, 2020). They are low-cost and accessible, promoting self-sufficiency and reducing reliance on external inputs. However, IKS are often transmitted orally, necessitating efforts to document and codify them for broader dissemination and integration (Petzold et al 2020). The objective of the study is to introduce an intersectionality conceptual framework rooted in agro-based afrocentricity, emphasizing gender-inclusive rural development, and to examine the intersections of gender inclusivity, indigenous knowledge systems, climate change and resilient smallholder agriculture.

2. MATERIAL AND METHODS

This study uses scientific papers, books, and UN data to explore the interconnectedness of gender, indigenous knowledge, climate change, and smallholder agriculture for rural development in Africa. It focuses on a multifactorial approach that understands the intersections of gender inclusivity, indigenous knowledge systems, and resilient smallholder agriculture for climate resilience and sustainable development. This approach employs a four-dimensional Afrocentric intersectionality framework to understand sustainable rural development in smallholder agriculture within a changing environment.

3. AFROCENTRICITY MEETS INTERSECTIONALITY: A CONCEPTUAL FRAMEWORK FOR INCLUSIVE RURAL DEVELOPMENT

The discussion explores the connections between gender inclusivity, indigenous knowledge systems, and resilient smallholder agriculture in Africa, focusing on enhancing climate resilience and fostering sustainable rural development. Drawing from Haynes et al. (2020), an Afrocentric perspective on Africa's rural development agenda highlights culturally significant smallholder agriculture deeply embedded in the values, worldviews, and diverse histories of rural communities (Lateef and Balakrishnan, 2023). This approach utilizes a four-dimensional Afrocentric intersectionality framework to comprehend sustainable rural development in smallholder agriculture within a changing environment. Rural women and men have distinct roles, responsibilities, and opportunities, shaping their experiences of climate change and their capacity to adapt. Indigenous communities possess traditional knowledge and practices developed over centuries, offering valuable insights into sustainable natural resource management and climate resilience (Sullo, et al 2020). Climate change profoundly impacts rural livelihoods, exacerbating existing social, economic, and environmental vulnerabilities. It is crucial to understand the intricate interconnections between gender, indigenous knowledge systems, climate change, and smallholder agriculture to formulate effective rural development strategies (Roy et al 2024).

Nyahunda and Tirivangasi (2024) emphasize the importance of intersectionality in understanding the unique social, economic, and environmental contexts of African smallholder farmers, emphasizing intersectionality to address the specific needs and challenges faced by women and other marginalized groups. Asante (1991) and Traoré, R. (2007) described Afrocentricity as a way of thinking and acting where African interests, values, and perspectives are central. Diversity, equity, and inclusion in sustainable smallholder agriculture are precursors to understanding rural development and driving the pathway to the Excellence Framework Alignment in rural development amid a changing climate. MacKinnon (2013) argued that intersectionality provides a more comprehensive explanation for the convergence of dominating forces by highlighting specific details that are often overlooked or missed in typical analyses. In this context, there is a complex relationship between gender, indigenous knowledge systems, climate change, and smallholder agriculture that influences their impact on rural development.

Efforts to enhance women's access to agricultural resources have resulted in improved food security and women's well-being, positively sustaining the rural development agenda (Assan, 2014). Women, who traditionally manage various types of crops and animals and are responsible for animal care, have significant control over decisions about selling or consuming family animal products and how to use income from animal food sales to boost household income (FAO, 1998). This control can greatly influence the nutritional well-being of household members, thereby improving rural welfare.

1.1 Breaking Down Barriers: Gender Inclusive Approaches to Climate Action and Smallholder Agriculture for sustainable rural development.

Gender-specific pathways offer potential routes for fostering resilient and inclusive rural development in third world countries (Slavchevska, et al 2024). In Africa, gender inequality impedes rural progress, as women are primarily involved in smallholder farming, bearing significant workloads while facing discrimination in the allocation of agricultural resources (Assan, 2014). The effects of climate change threaten women's economic autonomy and rights in low- and middle-income countries, exacerbating gender power imbalances that can hinder rural development (FAO, 1998). Rural transformation may marginalize certain groups based on gender, further entrenching inequities in climate action.

The FAO (2023) advocates for a gendered agrifood systems approach to achieve resilient rural transformation, emphasizing the trade-offs between livelihoods, environment, climate, and nutrition from a gender perspective. Understanding the specific magnitude and drivers of the gender gap in each country is crucial, as it contributes to income inequality and overall productivity loss, affecting rural development. The productivity gap in smallholder agriculture, often caused by gender disparities such as inefficient resource allocation to women-managed activities, leads to significant productivity losses in the agricultural sector, contributing to income inequality between genders (Assan, 2015).

Gender roles and relations are of key importance, disadvantaged persons and groups are a priority in development initiatives, and participation is essential for sustainable development and climate change adaptation (FAO, 2012). Rural women's growing role in smallholder agriculture can significantly improve food production and security in a changing climate (Carvajal-Escobar, et al 2008). If they have equal access to agricultural resources, yields could increase by 20-30% and reduce hunger by 12-17% (FAO, 2011).

The study of gender, climate change, and rural development is crucial in understanding the role of gender differences and inequalities in smallholder agricultural livelihoods, given the environmental challenges posed by climate and gender inequality, and the current neoliberal policies and sustainability discourses. Socio-economic and gender analysis is crucial for gender-appropriate climate action and sustainable smallholder agriculture (Kristjanson et al., 2014), helping to understand the socially differentiated roles, responsibilities, priorities, and resources of producers at community and household levels and how to address climate change issues from a gender perspective (Meinzen-Dick et al., 2012).

1.2 Climate Change Climate Resilience in Rural Communities: An Integrated Approach to Adaptation and Mitigation to spur rural development

Climate change poses significant challenges to achieving resilient and inclusive rural transformation, particularly in high-rural poverty areas. It presents a major threat to global agriculture, impacting crop yields, soil health, water resources, and regional food security (Prajapati, et al 2024). The African Union (2023) highlights the importance of understanding the impact of climate change on African communities, as they heavily depend on their environment for survival. Climate change can result in reduced economic growth, increased poverty, and fewer livelihood opportunities in rural areas (Farajzadeh, et al. 2023; Ekoh et al 2023).

Climate change causes increased temperatures, altered rainfall patterns, and frequent extreme weather events, making it difficult for farmers to predict and prepare for optimal growing conditions (Hu et al 2024). Climate-related stresses can lead to decreased crop yields, food insecurity, and malnutrition, particularly among vulnerable populations (African Union, 2023). Disasters such as droughts and floods can also lead to livestock losses, reducing income and worsening poverty. Climate change can cause soil

degradation, reduced water availability, and increased competition for resources (Eekhout, 2022), further endangering smallholder farming systems. Building climate resilience requires an integrated approach to adaptation and mitigation, such as Climate-Smart Agriculture, which enhances productivity, improves resilience, and reduces greenhouse gas emissions. This component emphasizes the importance of adapting smallholder agriculture to the impacts of climate change through strategies such as climate-smart agriculture, agroforestry, and conservation agriculture.

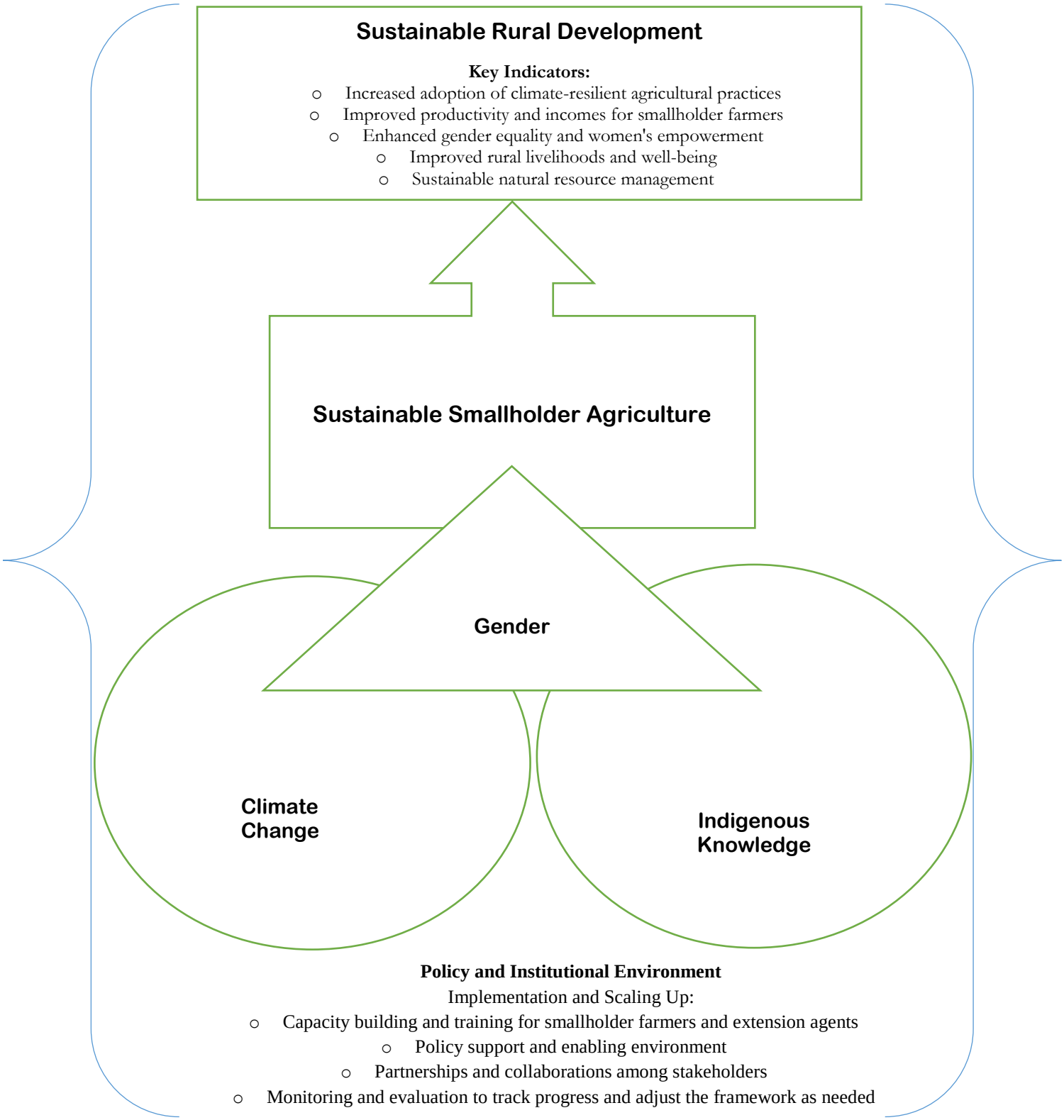
Sub-Saharan Africa is recognized as one of the region's most severely impacted by climate change (Maino and Emrullahu, 2022). The appearance of these changes in Africa was observed from approximately 1975 onwards, with subsequent temperature rises occurring at an average annual pace of approximately 0.03C (Hartmannetal, 2013). If these farmers fail to adapt to system-wide heat and water stresses, they will face reduced production prospects, altered natural resource bases, stressed traditional socio-economic safety nets, and potential for future agricultural development (Herrero, and Challinor, 2014). Effective climate resilience in rural communities requires a collaborative effort from governments, civil society organizations, and local communities. By working together, we can build resilient communities better equipped to adapt to the impacts of climate change.

1.3 Roots of Resilience: Indigenous Knowledge Systems for Sustainable Rural Development

African indigenous knowledge is a rich and diverse resource that can aid in sustainable development, particularly in smallholder agriculture (Adeola, 2020; IPCC, 2021; Leal Filho et al., 2022). It encompasses wisdom, techniques, strategies, skills, practices, norms, and ideologies, and is a crucial component of social, cultural, political, economic, scientific, and technical identity. Climate change is a global issue with complex impacts, making local knowledge valuable for its mitigation (Trisos et al., 2022). Indigenous knowledge systems (IKS) are valuable resources for rural communities, yet they have been underutilized for sustainable development (Gegeo, 1998). These systems encompass various aspects of life, including ecology, climate, agriculture, animal husbandry, botany, linguistics, medicine, clinical psychology, and craft skills (Shakoori, 2024). They include traditions, practices, beliefs, artifacts, languages, and farming systems.

IKS have been developed and refined over centuries, providing context-specific solutions to local agricultural challenges (Maunganidze, 2016). They often involve diverse agricultural practices, such as crop rotation, intercropping, and agroforestry, which can enhance biodiversity and ecosystem services. IKS adapt to local climate conditions, offering insights into climate-resilient agricultural practices (Turay, 2002). They are low-cost and accessible, promoting self-sufficiency and reducing reliance on external inputs. However, IKS are often transmitted orally, requiring efforts to document and codify them for wider dissemination and integration (Shakoori, 2024). By acknowledging the value of IKS, addressing challenges to their integration, and implementing strategies to promote their use, we can enhance the resilience, diversity, and productivity of smallholder agricultural systems (Maunganidze, 2016), ultimately contributing to sustainable rural development.

Figure 1. Agro Based Afrocentricity Meets Intersectionality: A Conceptual Framework for Inclusive Rural Development



2. Navigating the Nexus: The Two-Factor Interplay of Gender, Indigenous Knowledge, Climate Change and Smallholder Agriculture for Sustainable Rural Development

Rural development is a complex and multifaceted issue, influenced by a range of factors, including social, economic, environmental, and cultural considerations (Vorobyvov and Bugal, 2019). At the heart of this complexity lies the nexus of gender, indigenous knowledge, climate change and smallholder agriculture. Understanding the interplay between these four factors is critical to navigate the complexities of rural development in Africa. Understanding rural development dynamics is crucial for smallholder agricultural productivity, climate adaptation, gender equality, and integrating indigenous knowledge systems with modern science (Assan,

2023). It is also important to understand the two factor interplay such as: gender and climate change; gender and indigenous knowledge; gender and smallholder farming; and indigenous knowledge and climate change. It helps understand how these agents impact the organizational dynamics of rural development, affecting survival and livelihoods in the rural economy. This understanding opens up new opportunities for studies on upscaling rural development, allowing for a better understanding of individual factors, their interactions and the overall impacts.

2.1 Gender-Climate Change Intersection

Climate variability is causing a decline in agricultural productivity, impacting both men and women differently (Goh, 2012). Women's perception of climate and weather forecast information is influenced by limitations in time and spatial mobility, leading to concerns about losing access to rangeland and livestock resources. Climate change affects livelihoods and well-being, with women bearing more adverse effects (Awiti, 2022). Gender-based vulnerabilities are evident, with women disproportionately affected by their roles, rights, and opportunities, which are shaped by gender norms and socio-economic status.

Climate change is influenced by geography, socioeconomic groups, and gender, leading to a disproportionate impact on women (Huyer et al. 2021; Makina and Moyo (2016). Drought-induced shifts in herd composition result in women assuming more responsibility, increasing their labor and duties (Walker et al. 2022). This increased labor demand negatively affects girls' education, as they are often replaced by their mothers in gender-specific household tasks. Women have limited access to training, extension services, and technology for adapting to climate change, and barriers to technology adoption exist at various stages(Maertens and Swinnen, 2009).

Gender and social differences can influence investment needs, priorities, and access to weather and climate information among men and women(Oyetunde-Usman et al., 2021). Climate hazards impart disproportionate impacts based on gender and limited assets of disadvantaged communities, increasing their exposure and vulnerability (Assan, 2023). Access to water is crucial for women's economic performance and income, and variability in annual precipitation over the past 21 years has significantly affected water availability.

There are gender disparities in climate action, highlighting the need for women's local climate adaptation efforts to be part of a comprehensive national climate strategy for maximum effectiveness (Assan, 2014). Women are more vulnerable than men to the impacts of climate change in communities heavily reliant on nature (Lau et al 2021). Climate change is profoundly affecting African countries in numerous ways, including exacerbating water stress, damaging agricultural harvests, affecting lifestyles, and amplifying gender and other dimensions of inequality.

2.2 Gender- Smallholder Agriculture Intersection

Gender equality plays a pivotal role in advancing sustainable practices within the agricultural sector, particularly through the implementation of agri-environment-climate schemes (AECS) aimed at farm, agricultural, and rural development (Fertő and Bojnec, 2024). Achieving gender equality is essential for sustainable rural development, influencing the rural economy, green entrepreneurship, and societal structures through policy and governance. Empowering women in agriculture is vital for addressing gender-based challenges and fostering inclusive smallholder agriculture, which is crucial for rural development (Beuchelt, 2016). Traditional gender roles in smallholder agriculture often position women as primary food producers, yet they do not enjoy the same sociocultural status as men in terms of access to economic resources necessary for food production.

Gender significantly influences the growth of smallholder farming, especially in rural areas of developing countries where manual labor predominates (Assan, 2014). This variation and unequal gender participation have implications for agricultural rural development, particularly in sub-Saharan Africa, where farm productivity remains low compared to other regions. Integrating gender considerations into national policy processes is critical for enhancing productivity in smallholder agriculture. Gender disparities in smallholder agriculture adversely affect sustainable food security (Assan, 2015). Addressing these inequalities enhances food production and security, which are precursors to agro-based rural development.

Rural women are particularly vulnerable to the adverse effects of global climate change due to their limited access to agricultural resources such as land, extension services, and inputs (Nyahunda and Tirivangasi, 2020). Addressing gender inequality in agriculture necessitates a significant paradigm shift at institutional, policy, organizational, and resource allocation levels. Projections indicate that eliminating gender bias in access to agricultural resources could increase crop yields by 20-30% and reduce hunger by 12-17% (Li et al., 2025).Incorporating gender considerations into national policy processes is crucial for effective climate change adaptation in smallholder agriculture (Unay-Gailhard and Bojnec, 2021). Disparities in climate knowledge and livestock production negatively impact sustainable food security, necessitating a holistic approach to address these challenges and ensure food security (Assan, 2014). The micro-livestock sub-sector of animal agriculture has the potential to transform smallholder agrarian households and communities towards gender-inclusive climate change adaptation in agriculture, thereby reinforcing food security in Sub-Saharan Africa (Assan, 2022).

2.3 Gender-Indigenous Knowledge Intersection:

The intersection of gender and indigenous knowledge (IK) represents contemporary cross-cutting issues that require attention in mainstream smallholder agriculture and climate mitigation, alongside the recognition, preservation, and promotion of indigenous knowledge (Hinzo , 2016). These issues are central to current agricultural and climate discussions globally, including in Africa. In light of these considerations, this study critically examines and analyzes the integration of gender and IK into rural development, along with their intersection with smallholder agriculture for rural development. In the 1970s, policymakers recognized the crucial role of women in agricultural production, particularly in Africa, despite rural development projects primarily addressing men's needs (Fellstein and Poats, 1989). Initially, it was believed that providing women with technological alternatives and training could enhance their production capacity for local and national development. However, it became evident that women's interests, goals, and needs were not necessarily aligned with those of men. By the 1990s, it was recognized that women not only have the right to participate directly in decision-making processes but also possess unique insights, skills, and talents, especially in indigenous knowledge (Warren, 1989).

This discussion explores the unique approaches of indigenous communities to gender, gender roles, and sexuality, which differ from different rural community's perspectives. African communities' understanding of gender is reflected in their traditional social systems and governance, with men and women having distinct roles and spheres of influence linked to political power (Flavier, et al 1999). Gendered indigenous languages are included as an example of the connection between indigenous culture and gender construction (Magni, (2016).. Indigenous views diverge from the settler's binary of male/female, as many recognize the presence of third-gendered and multi-gendered individuals (Odora-Hoppers, 2001). However, colonization has led to violence against women and gender variant individuals, and the erasure of indigenous people from settler politics. The discussion supports the current notion aimed at revitalizing and reinstituting indigenous knowledge and views of gender.

The creation, adaptation, and application of knowledge and technology are shaped by the economic, social, cultural, political, and geographical contexts in which both genders live (Appleton, 1993). Gender is the primary social distinction among adult, economically active members of society, leading to responsibilities being distributed along gender lines (Assan, 2014). This results in specialization in these areas and the generation of knowledge that can be applied to future challenges. Some types of knowledge may be complementary, requiring both female and male systems to comprehend a particular aspect of production or decision-making. Other types of knowledge may be shared, but this cannot be assumed.

2.4 Indigenous Knowledge (IK)-Climate Change Intersection

Indigenous knowledge systems are utilized by local communities for gathering, predicting, interpreting, and making decisions related to climate variability and weather events, serving as the foundation for local-level decision-making (Petzold et al 2020). In recent years, communities across Africa are increasingly adopting a combination of indigenous and scientific knowledge systems to cope with climate change and extreme weather events (Assan, 2023). Case studies show farmers, livestock keepers, and fishermen using these methods to enhance their livelihood resilience to climate change impacts (Kanwal et al 2021). IK is the collective knowledge of local people, held by a defined community, developed through generations of living near nature, and an integrative system of perceptions, concepts, values, and beliefs (Mbah et al 2021; Khatun and Salian, 2020). It originates from a specific geographical area, is local, traditional, and unique, and is functional knowledge of native people inhabiting a particular ethnocultural and agroecological location or region. It encompasses perceptions, concepts, values, and beliefs that occur naturally among communities living in rural environments (Wheeler et al 2020).

Indigenous knowledge and climate resilience can be used to promote equitable and sustainable rural development outcomes for women and men (Adeola, et al 2024; Bang, 2022). This approach emphasizes the importance of integrating local knowledge, viewpoints, and choices of those directly impacted by climate uncertainties. There is a growing recognition and advocacy for a global shift away from market-based, individualistic methods towards a more sustainable and environmentally friendly Africa. An Afro-centric perspective in climate change adaptation and mitigation is needed. Indigenous practices in developing countries provide solutions for reducing disaster risks and adapting to climate change in vulnerable communities (Kanwal et al 2021) Indigenous practices, such as animal husbandry and crop cultivation, enhance community resilience to climate impacts, particularly by bolstering food security. Indigenous knowledge also focuses on managing natural resources and predicting weather patterns, aiding in lessening the impacts of floods and droughts (Petzold et al 2020).

The pertinent questions to consider include the role of indigenous knowledge in enhancing climate resilience for rural women and men, how it can be leveraged to support rural development, how rural women and men engage with indigenous knowledge, the pathways through which indigenous knowledge can enhance climate resilience, how to effectively access and utilize indigenous knowledge to improve their climate resilience and overall well-being, and how the intersection of indigenous knowledge and climate resilience can be harnessed to promote more equitable and sustainable rural development outcomes.

2.5 Climate -Smallholder Agriculture Intersection

Climate change is a significant challenge to agricultural development in Africa, with the unpredictable nature of weather systems causing additional strain on food security and rural livelihoods (File and Derbile, 2020). Smallholder agriculture is particularly vulnerable to stressors such as reduced rainfall, drought, dry spells, and high temperatures. As global temperatures rise and weather patterns become increasingly erratic, agriculture faces unprecedented challenges that threaten their livelihoods and the global food supply (Ahmed, 2020).

The impact of climate change on agriculture has both direct and indirect effects on four key dimensions of food security: crop failure, invasion of new crop pests and diseases, soil infertility, reduction in water-holding properties, economic growth, income distribution, and agricultural demand. Indirectly, agriculture will be affected by high prices of agricultural products and services due to the global economic crisis (Manzamasso, 2020; Sullo et al., 2020). Changes in climate elements will negatively affect crop yields and food supplies, affecting access to food due to agricultural production declines, high food prices, and decreased purchasing power (Feng et al 2021). Agriculture relies heavily on stable weather patterns for successful crop growth, but climate change leads to higher temperatures, more variable rainfall, and an increase in extreme weather events (Saytarkon, et al 2025).

The consequences of climate change on agriculture are far-reaching, including altered growing seasons, droughts, floods, heat waves, and storms, damage to crops and infrastructure, and increased pesticide use (UNESCO, 2025). However, there is hope for a more resilient and sustainable food system, with farmers emerging as key players in forging a sustainable future for agriculture and the planet. They can actively reduce emissions and promote ecosystem resilience by adopting sustainable farming practices (Mustonen, et al 2022).

3. CONCLUSION

This literature review explored the application of intersectionality across four dimensions—gender, indigenous knowledge, climate change, and smallholder agriculture—that drive sustainable rural development. The research presents a conceptual framework rooted in agro-based Afrocentricity, focusing on gender-inclusive rural development. It examines how gender inclusivity, indigenous knowledge systems, and resilient smallholder agriculture intersect to boost climate resilience and foster sustainable rural development in Africa. Significant socioeconomic and environmental challenges, such as gender inequality, climate change, low productivity in smallholder farming, and food and nutrition insecurity, obstruct rural development in Africa. The study delves into the complex interactions between gender inclusivity, indigenous knowledge systems, and resilient smallholder agriculture as a strategy to achieve sustainable rural development. Gender inequality hampers rural advancement in Africa, as women, who are primarily involved in smallholder farming, face discrimination in resource distribution. The relationship between climate change and agriculture is affected by gender, making strategies that overlook gender roles and responsibilities ineffective. Adapting to and mitigating climate risks in agriculture should include a gender perspective, and climate risk insurance should provide financial support to smallholder farmers. A systemic approach is essential to tackling climate change, which presents challenges like decreased agricultural productivity, food insecurity, and increased poverty, all of which negatively impact the rural development agenda.

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