DESK-BASED REVIEW ON SMALLHOLDER AGRICULTURE CO-CREATION PROGRAMME

Study Report

Adaptation Research Alliance

SOUTH SOUTH NORTH

BILL & MELINDA GATES foundation

AFRICA RESEARCH & IMPACT NETWORK

UK International Development

Partnership | Progress | Prosperity

Authors:
Alphonce Agola Mollo and Joanes Atella from African Research & Impact Network (ARIN).

Date:
August 2023

Design:
Ink Design Publishing Solutions, Cape Town,
South Africa, www.inkdesign.co.za

Funders:
ARA funded by:

UK International Development
Partnership | Progress | Prosperity

ARA Secretariat hosted by:
SOUTH
SOUTH
NORTH

SCOPING STUDY: DESK-BASED REVIEW ON SMALLHOLDER AGRICULTURE CO-CREATION PROGRAMME

1 INTRODUCTION

To catalyse activities related to co-design and action-oriented research in support of the Smallholder Agriculture Co-creation Programme, it is imperative to establish co-creation spaces. Given the unique nature of the impacts of climate change, there is a pressing need for an escalated enhancement of action research and the monitoring of progress towards resilient smallholder agriculture. Currently, over 2 billion people depend on 550 million small farms for livelihoods. Despite the prevalence of high poverty rates, smallholders play a pivotal role in providing food for over 50% of the population in low- and middle-income countries (Dias et al, 2021).

Smallholder farmers are exceptionally vulnerable to the effects of climate change, particularly in Sub-Saharan Africa, where the consequences of the shifting climate are already being felt. Various interventions, either in standalone forms or integrated into policy frameworks, have been suggested and implemented. These interventions include digital technologies, policies like the Comprehensive Africa Agriculture Development Programme (CAADP), and the promotion of Climate-Smart Agriculture (CSA). However, it is important to note that these policies often exhibit a techno-centric and top-down approach, frequently failing to consider the aspirations and perspectives of smallholder farmers. The missing link in this equation is the opportunity to collaboratively co-design and co-produce knowledge, which can serve to fortify this agricultural system.

This desk-based review and scoping study have been developed by assimilating lessons and information gleaned from the broader agricultural and adaptation community, specifically focusing on issues pertaining to smallholder agriculture. Our approach involves a comprehensive examination of successful endeavors, failures, and their associated deficiencies. Through this analysis, we aim to offer critical insights that will inform recommendations aimed at enhancing smallholder agriculture in Africa. Our methodology included mapping out key stakeholders engaged in farmer-related activities across the continent, as well as assessing in-country stakeholders in Sub-Saharan countries. This assessment encompassed a thorough examination of their programmatic areas and evaluation of the challenges they encounter, forming the basis of a needs-based institutional assessment.

The review has been developed through extensive cross-consultation and communication between the Africa Research and Impact Network (ARIN) and the Adaptation Research Alliance (ARA) Secretariat. The review has delved into potential pathways for the future of smallholder agriculture, examining how it might evolve. This exploration has led to the identification of countries that offer promising opportunities as potential entry points for

enhancing smallholder agriculture. The countries of particular focus within the review comprise Burkina Faso, Ghana, Ethiopia, Kenya, Malawi, Mali, Mozambique, Nigeria, Rwanda, Uganda, and Tanzania. Additionally, it is suggested that the Gambia and Zambia be considered for inclusion in this list.

2 OBJECTIVES OF THE STUDY

The objective of the Smallholder Farmers Review Study was to conduct a Desk-Based Review (DBR) on smallholder agriculture adaptation issues and opportunities. This review aimed to provide insights into the thematic and geographical scope for the co-creation process. The DBR's primary goals were to identify potential research priorities within countries and regions to ensure that the identified activities could effectively bring together relevant stakeholders to achieve shared objectives.

Specifically, the scoping study aimed to achieve the following objectives:

- To provide some initial ideas and highlight challenges for future action research programs. These programs would be geared towards locally-led solutions, with additional themes focused on specific regions and countries.
- To effectively combine or bundle adaptation strategies and solutions to create a synergistic effect in reducing risk, lowering barriers to adoption, enhancing resilience, and increasing the likelihood of achieving scalability and sustainability.
- To integrate various forms of adaptation evidence and analysis, including economic, social/cultural, and biophysical aspects. This integration aimed to inform decision-making processes and expedite adaptation actions, especially in situations involving multiple stakeholders and disciplines.
- To support steps toward the transformation of livelihoods into more climate-resilient ones. This includes moving beyond incremental adaptations of existing agricultural systems when they fail to meet the needs of the people.

3 METHODOLOGY

The primary methodology employed for the Desk-Based Review on Smallholder Agriculture Co-Creation Programme Scoping was desktop research and literature review. The desktop review incorporated elements of both scoping reviews and rapid synthesis reviews, as outlined in the Cochrane methodology. This approach guided the process of identifying pertinent published and unpublished studies from various databases and selecting them for inclusion, while also assessing their strengths and limitations in accordance with priority research questions.

Furthermore, the findings derived from this review will be presented to a team of ARIN network members for thorough discussion and triangulation. This step was undertaken to ensure that the locally-led research and co-creation process would incorporate relevant and up-to-date information. Additionally, we conducted a stakeholder analysis, which involved the development of a stakeholder map. This map highlighted actors whose work focused on enhancing institutional capacity or conducting research related to smallholder agriculture and adaptation action.

In addition, we conducted a situational analysis with the aim of comprehensively understanding the smallholder agriculture landscape. This analysis involved a systematic examination of local, national, regional, and international organizations or stakeholders contributing to smallholder agriculture. Our objective was to assess their level of influence and areas of priority within this context.

To carry out this analysis, the study team employed relevant stakeholder mapping and analysis tools, including the stakeholder analysis (Excel) tool. Additionally, a matrix was utilized to position stakeholders based on their level of power and interest. The Excel tool played a crucial role in revealing landscapes of action, guiding policy frameworks, and assessing the potential of smallholder agriculture in terms of GDP, gender parity, mechanization, and input utilization. This allowed us to simulate the future of smallholder agriculture in each respective country.

ARIN also leveraged the research conducted for, *Accelerating Smallholder Agriculture through Meso-Level,* to identify regional stakeholders, including Southern African Confederation of Agricultural Unions (SACAU), Eastern Africa Farmers Federation (EAFF), Plateforme Régionale des Organisations Paysannes d'Afrique Centrale (PROPAC), Réseau des organisations paysannes et de producteurs de l'Afrique de l'Ouest (ROPPA), the members of Pan African Farmers Organisation (PAFO), and The Ecosystems-Based Adaptation for Food Security Assembly (EBAFOSA). The team also acknowledged the pivotal contributions of the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) and other key players, such as Bayer Africa in the area of farm field and yield productivity and protection, YARA for soil nutrition and the Association of Agricultural and Development practitioners as vital in co-creation processes.
Furthermore, the study delved into the critical frameworks of the Comprehensive Africa Agriculture Development Programme (CAADP) and Climate Smart Agriculture in the African Context, which were thoroughly reviewed as part of the study.

Further, we established criteria for the identification of opportune countries to enhance the precision of the geographical scope. To achieve this, we designed a matrix for assessing opportune countries. This matrix emphasized gender parity, conducted technology needs assessments, and incorporated Nature-based Cases

that integrated locally-led adaptation principles. Additionally, it considered the significance of the agriculture sector to GDP, reinforcing the imperative for co-creating processes that prioritize smallholders. Ultimately, our efforts are dedicated to the development of a Change Theory aimed at charting long-term objectives for smallholder agriculture co-creation.

4 DISCUSSIONS

Past Lessons, Current Status and Emerging Evidence.

4.1 DESK REVIEW AND SMALLHOLDER LANDSCAPE IN AFRICA

The desk review sheds light on the pressing issue of climate change, which currently stands as one of the most formidable developmental challenges confronting smallholder farmers in the African continent. This challenge amplifies the impacts of poverty, inequality, population growth, rapid urbanization, and environmental degradation while also disrupting national economies (Jameel et al., 2022), ultimately affecting the livelihoods of smallholder farmers in Africa. For smallholder farmers in Africa, the dual imperative of addressing climate change and enhancing their own well-being must be tackled concurrently, ideally in a synergistic manner. In Africa, smallholder farmers typically manage farms with holdings of less than two hectares. These farms are primarily operated by rural smallholder farmers who depend on them as a core livelihood strategy (Kamara et al., 2019).

Despite the recognition that climate change is exerting a profound impact on livestock, fisheries, and crops in Africa, the predominant focus on enhancing these sectors primarily revolves around policy effectiveness within the continent (Zougmoré et al., 2016). Traditional approaches persistently underpin the strategies employed to address the smallholder agriculture sector in Africa. These approaches, however, fall short of comprehending the full extent of the climate change impact and the necessity of informing adaptation measures and policies related to Climate-Smart Agriculture (CSA) on the continent. While regional policy initiatives aimed at promoting CSA in West Africa, such as ECOWAP/CAADP, do exist and provide platforms for knowledge-sharing and agro-meteorological support to bolster farmers' practices, there is still a crucial need for co-creation processes.

Smallholder farms play a significant role as a vital livelihood strategy, providing food, employment, and sustenance. A substantial portion of the produce harvested from these farms is consumed within the household (Gollin, 2014). However, the future of smallholder agriculture faces uncertainty, particularly considering emerging urban employment opportunities. In general, smallholder agriculture in Africa derives its strength from family labour, which is incentivized and well-managed with access to information. This labour-intensive approach often results in a perception of high productivity when compared to large-scale farms. The majority of smallholder farmers grapple with challenges such as limited access to credit, insurance, and information. Furthermore, they face a crucial hurdle in terms of economies of scale for marketing and transportation (Gollin, 2014).

The literature review presented here centres on several key aspects related to the persistence of poverty within smallholder farms in Africa. These aspects cover discussions on the concept of poverty traps, government preferences for investing in large farms at the expense of smallholder farms, the lack of capital as a rationale for the enduring poverty among smallholder farmers, the low level of mechanization, and a critical analysis of potential future trajectories for smallholder farms in Africa. Furthermore, we have put forth suggestions regarding potential areas for investment and identified critical stakeholders who play pivotal roles in guiding this process.

4.2 SMALLHOLDER FARMS, POVERTY AND FOOD SECURITY

It is worth noting that over 60% of the global arable land designated for agricultural production remains underutilized, with Sub-Saharan Africa (SSA) hosting a significant portion of this untapped resource. This fact underscores the pressing need to extend support to smallholder farmers in Africa, considering the immense potential of this arable land in their disposal. Leveraging this land resource can not only contribute to feeding the growing global population but also generate additional income and integrate advanced technologies, serving as a viable pathway out of poverty and a means to address Sustainable Development Goal 1 (Larson, Muraoka, and Otsuka: 2020).

Moreover, there is a noticeable disparity in labour income between smallholder farms and other sectors, emphasizing the necessity for improvement. The agenda for agrarian transformation posits that given the increasing urbanization trends and the rising demand for labour in alternative sectors, it may be imperative to re-evaluate development strategies with a renewed focus on Smallholder Agriculture in Africa. In contrast to Asia's Green Revolution, characterized by the adoption of new technologies, improved seeds, and mechanization, smallholder agriculture in Africa appears to be lagging or making slow progress across various indicators (Larson et al., 2020).

4.3 PROSPECTS AND RETURN ON INVESTMENTS

Most African farmers are smallholders, despite the apparent absence of economies of scale. In the context of the geopolitics and globalization of the food system, the practice of export-oriented crop production, such as coffee, cocoa, and oil palm, is often deemed unrewarding for farmers in Sub-Saharan Africa (SSA). This is particularly true when compared to countries that add value to the production system. The deficiency in economies of scale is attributed to dysfunctional institutions, which hinder farmers' access to technology and capital (Kos, 2022). Enhancing access to productive assets can potentially assist farmers in optimizing farm productivity and provide them with greater choices regarding what to produce, sell, or where to source financing.

4.4 SMALLHOLDER AGRICULTURE, TECHNOLOGY, INPUT AND MECHANIZATION

There is a need for the smallholder agriculture sector in Africa to embrace mechanization and deliberately intensify production to attain higher incomes while simultaneously addressing rural poverty and enhancing food security. Emphasis should be placed on improving the efficiency of land, water, and nutrient utilization. It is crucial to note that farm energy is also a significant consideration in this context, especially as government and private sector-funded initiatives for tractor hire, as well as animal and human labour, are on the decline due to rural-urban migration. Human labour, which disproportionately affects women, as they are often responsible for tasks such as threshing, shelling, and transporting heavy loads on their heads and backs, can be particularly strenuous and challenging.

The increasing energy demand on smallholder farms underscores the necessity for enhanced access to mechanization or the implementation of energy conservation techniques[1]. There is a growing need for pathways

[1] https://www.cimmyt.org/projects/farm-mechanization-and-conservation-agriculture-for-sustainable-intensification-facasi/

to provide cost-effective energy supply solutions on African farms, ideally bundled with other essential inputs. This approach can contribute significantly to addressing the challenges associated with energy demands while promoting agricultural efficiency and sustainability.

Technologies aimed at supporting the smallholder sector have demonstrated success stories through the increased adoption of high-yielding seeds in countries such as Malawi, Zambia, Lesotho, and Madagascar, with a specific focus on enhancing maize and high-yielding lowland rice varieties. Nevertheless, there remains a crucial necessity to enhance the genetic diversity of a wide range of crops and livestock. This expansion of choices for innovation and productivity is essential to shaping the future landscape of African smallholder agriculture.

African governments have undertaken initiatives in countries, such as Mozambique, Tanzania, and Zimbabwe to promote irrigated farming across the continent. These efforts are aimed at catalysing a transformation in agriculture. However, certain critical challenges persist, including insecure land tenure systems, unclear institutional arrangements, and limited market access, all of which act as significant barriers to the widespread adoption of irrigation. Furthermore, there are calls for the adoption and enforcement of harmonized seed regulatory systems within the Southern African Development Community (SADC) to facilitate access to high-quality seeds. Additionally, it is imperative to share market information with farmers and eliminate trade barriers that hinder the importation of essential agricultural equipment (Mwamakamba et al., 2017). To strengthen input and output market linkages for smallholder farmers engaged in irrigated agriculture, it is essential to establish a place for smallholder irrigation in terms of voice and farm management. This would facilitate more effective coordination and collaboration in addressing the challenges and opportunities within this sector.

Technology, inputs, and mechanization in Africa continue to encounter numerous barriers. The obstacles include financial constraints, age-related factors, gender disparities, limited access to extension services, difficulty in access to technology and farm sizes (Fadeyi et al., 2022). Moreover, it is crucial to acknowledge that solutions aimed at addressing these barriers must also consider the implications of climate change. For instance, the adoption of improved seed varieties may entail the simultaneous uptake of crop insurance. Additionally, efforts to enhance farm productivity may extend beyond rainfed agriculture to encompass the incorporation of irrigation practices. Comprehensive schemes, such as the cultivation of fruit trees, can play a pivotal role in both climate change mitigation and adaptation strategies (Magesa et al., 2023).

4.5 WOMEN IN SMALLHOLDER AGRICULTURE

Women play a distinctive and significant role in smallholder agriculture in Africa (Gollin, 2014). As more than half of the agricultural labour force, women are disproportionately engaged in this sector compared to others. Consequently, smallholder agriculture serves as the primary source of livelihood for nearly two-thirds of economically active African women, with a substantial majority involved in smallholder production.

However, it is important to acknowledge that women in smallholder farms often face disadvantages. Despite their substantial contributions, the labour provided by women is frequently undervalued, and in many cases, it goes unpaid or is underpaid. This underscores the importance of addressing gender disparities and promoting equitable opportunities within the smallholder agriculture sector.

- **Gender Gap and smallholder farmers**

The gender gap represents a significant impediment to agricultural development and growth (O'Sullivan et al., 2014). Even though women contribute most of the labour in smallholder agriculture, their productivity is hindered by gender disparities within the agricultural sector. For women to achieve upward mobility and experience transformative improvements in their productivity, livelihoods, and empowerment, there is a crucial need for financial inclusion. This inclusion should encompass access to and utilization of relevant financial products and services.

To address these challenges, it is essential to adopt approaches that focus on the demand side of financial inclusion, seeking to understand and mitigate the barriers that hinder women's access to financial resources within the context of smallholder agriculture (Ng'weno et al., 2018). Such efforts can help bridge the gender gap and unlock the full potential of women in this sector.

4.6 GREEN REVOLUTION AND SMALLHOLDER IN AFRICA

Efforts to usher in a new green revolution in Africa have placed a strong emphasis on the modernization of smallholder agriculture, particularly through the deployment of inputs and the adoption of mechanized technologies. In Ghana, this approach has given rise to what is known as a mechanization paradox, as identified by Kansanga et al. (2019).

The mechanization paradox in Ghana is characterized by two notable trends. Firstly, there has been an expansion in farm sizes, indicating a shift toward larger-scale agricultural practices. Secondly, there has been a transformation in cropping patterns, with a notable move away from traditional staple crops such as pearl millet and sorghum bicolour, towards market-oriented crops like maize, rice, and groundnuts. While these shifts are often viewed as adaptation strategies for climate change and modernization, they are also seen as having negative consequences for the cultural dimension of food security, social life, and climate adaptation strategies within the local context.

- **Intensification and forest destruction**

Smallholder agriculture intensification can benefit the climate if done sustainably. However, the drive to intensify and expand agricultural land to increase production and shift cultivation is causing deforestation in Africa and other developing countries. For example, in Zambia, land expansion by farmers is a leading cause of deforestation (Masikati et al., 2021). Agricultural intensification is also causing the loss of soil organic carbon and nutrients. This highlights the need to promote sustainable agriculture through conservation agriculture and other sustainable practices.

The land use and land cover changes by smallholder farmers, coupled with population growth and the expansion of cultivated land, significantly contribute to the increase in bare land and the decrease in vegetation cover (Ketema et al., 2020). Participatory land management systems are essential to ensure sustainable production in smallholder farms.

4.7 YIELD GAPS AND SMALLHOLDER AGRICULTURE

Smallholder Agriculture in Africa also suffers from a yield gap, which is part of the explanation provided for the

poverty trap in African agrarian societies (Abate et al 2016; Tittonell & Giller 2013). The gap between potential and actual yield for Sub-Saharan Africa is substantial. Efforts to minimise this gap through modern inputs such as fertilizers and seeds are at the forefront of government initiatives, such as those in Ethiopia, aimed at turning the tide.

These efforts involve micro-finance and cooperatives. While institutional financial services have promoted the adoption of technology by farmers, the yield gap remains persistent. This yield gap is pervasive in Africa due to soil fertility levels and nutrient availability. Additionally, fertilizer overuse and misuse also contribute to the yield gap (Tittonell & Giller, 2013). Furthermore, the limited water potential under rain-fed conditions represents a significant constraint in narrowing the yield gap.

- **Farm efficiency and productivity**

Smallholder farms are often perceived as more efficient and productive than larger farms. However, when we compare them, it becomes evident that small farms achieve lower output per unit of labour, primarily due to their yield advantage (Gollin, 2014). Small farms benefit from the inefficiencies in labour markets and land markets, with an oversupply of labour being a characteristic advantage. Conversely, small farms may encounter disadvantages when it comes to integrating with commercial marketing channels and supply chains.

4.8 PATHWAYS TO FUTURE AGRICULTURE IN AFRICA

Several adaptation solutions are available in smallholder agriculture as highlighted above. These solutions operate at various scales, ranging from the individual farmer level to the community/cooperative level, local jurisdiction, farming systems, value chains, national level, and even regional scale. These solutions are developed in response to the diverse sources of risk that agriculture faces, which include heat, drought, floods, pests, fires, storms, as well as price and market-related shocks, and conflicts. Farmers encounter a multitude of vulnerabilities at the individual farmer level, within the value chain, and across agricultural systems. Consequently, multifaceted adaptation strategies, or strategies that work at multiple scales, are often required to effectively manage these risks, and achieve impact beyond the pilot or demonstration phase.

Multifaceted approaches to adaptation are common, and there is evidence to suggest that some solutions are particularly effective when combined or bundled together. For instance, pairing drought-tolerant seeds with insurance can boost adoption rates, combining farmer training or field schools with policy changes can lead to better agricultural practices, and providing social protection support (either cash or in-kind) alongside extension services can drive changes in farming practices. Other examples exist, and these combinations are not limited to pairs; multiple strategies can be integrated effectively. As we outline stakeholders for the co-creation process, it is crucial to revisit the question of the future of smallholder agriculture in Africa. These underscores:

- What combinations of adaptation solutions/strategies are proving to be effective in specific geographies and farming systems?
    - What existing evidence is available about these combinations?
    - What additional evidence should be generated regarding their effectiveness?

- In which geographic regions or farming systems is there a need for further evidence and experimentation regarding bundled approaches to accelerate or scale adaptation in areas where some adaptation efforts are already underway?

    - What strategies could be explored, expedited, or scaled-up?
- In which geographic regions, farming systems, or on which topics are additional evidence required to understand economic, behavioural, and cultural barriers to scaling adaptation solutions and the corresponding strategies to address them?
- In specific geographic regions or farming systems, which bundled solutions should be further explored to incrementally enhance the resilience of existing systems in the short term? Alternatively, which barriers should be prioritized for resilience improvement?
- In specific geographic regions or farming systems, which bundled solutions should be investigated to fundamentally reduce livelihood risks over the long term (e.g., through transformative adaptation approaches)? Alternatively, which barriers to transformation should be prioritized?.

4.9 MOSAIC/MULTIVERSE APPROACHES TO FARMER-CENTRED CO-CREATION

African Agriculture still bears the marks of colonial policies and governance. The sector predominantly focuses on export-oriented and intensive utilization of energy and capital, with governments, research institutions, and extension service providers giving prominence to industrial agriculture (El Nour, 2021). Saker El Nour argues that the export-oriented industrial agriculture framework in North Africa may not effectively address climate change and environmental crises. The agricultural sector is diverse, and there is a need for a farmer-centred approach that promotes agroecology and regenerative farming practices. These approaches are essential for redefining agricultural, environmental, food, and energy policies.

4.10 CLIMATE SMART AGRICULTURE FOR SMALLHOLDER FARMING

Climate-smart agriculture (CSA) is gaining prominence in policy discussions, government agendas, and regional initiatives, such as the ECOWAS in West Africa, as a means for smallholder farmers to adapt to climate change. The CSA approach is lauded for its potential to help farmers effectively manage their farms. While there is documented evidence of CSA practices leading to improved income, their adoption remains low among African farmers (Abegunde & Obi, 2022). Barriers to the uptake of CSA, include institutional factors, climate and ecological conditions, farmers' characteristics, including their level of experience, and access to extension services.

There is a need to plan for agriculture in a way that considers both adaptation and mitigation, and this planning should be informed by decision-making processes. The success of CSA depends on stakeholder involvement, consensus building, and the integration of verifiable information for adaptation and mitigation that is informed by decision-making processes. The CSA framework[2] is explicit in targeting national-level stakeholders on CSA processes (Brandt et al., 2017).

[2] Brandt, P., Kvakić, M., Butterbach-Bahl, K., & Rufino, M. C. (2017).
This framework integrates quantitative, spatially explicit information such as vulnerability indicators (e.g. soil organic matter, literacy rate and market access) and proxies for CSA practices (e.g. soil fertility improvement, water harvesting and agroforestry) as well as qualitative opinions on these targeting criteria from abroad range of stakeholders.

The political economy of smallholder support policies such as climate-smart agriculture is driven by several factors, including the prevailing neoliberal agenda advocating for market-driven agricultural development; the need to diversify livelihood by the farmers; and competition for land and other productive resources. A closer examination of these policies underscores the need for social innovation and sustainability in farm-level practices that can make meaningful impact on smallholder farmers (Shilomboleni, 2022).

4.11 SMALLHOLDER FARMING AND SUSTAINABLE PRACTICES

Sustainable agricultural practices represent one of many pathways for smallholder farmers to enhance productivity and resilience, while simultaneously conserving natural resources. To effectively promote sustainable agricultural practices, particularly among resource-constrained farmers who lack access to credit and education, it is crucial to focus on raising awareness and building their capacity. These sustainable practices can include traditional methods like intercropping, mulching, and crop rotations, as well as innovative approaches such as cover cropping, minimum-tillage, tied ridging, and planting pits (Myeni et al., 2019). A key factor in advancing sustainable agricultural practices within the smallholder farming community in Africa is the role played by extension services.

4.12 THE KNOWLEDGE SYSTEMS

Efforts aimed at promoting the adoption of new technologies and policies, such as Climate-Smart Agriculture (CSA), by farmers should prioritize the incorporation of farmers' knowledge. Neglecting the wealth of local knowledge held by farmers has contributed to the low adoption rates of CSA among African smallholder farmers, despite its potential economic and environmental benefits (Ogunyiola et al., 2022). Barriers to scaling up CSA adoption include the diversity of farming systems, limited access to finance, input costs, and technology.

Climate variability and change are compelling smallholder farmers to leverage indigenous knowledge for adaptation (Apraku, A., Morton, J. F., & Gyampoh, B. A. (2021Morton, & Gyampoh, 2021). Among smallholder farmers, indigenous knowledge plays a crucial role in predicting seasonal weather, rainfall patterns, grain preservation, and farming practices, all of which are essential for mitigating the impacts of climate change on agricultural activities. Importantly, there is a growing recognition of the need to merge local indigenous knowledge with scientific knowledge to create a syncretic body of agronomical knowledge that empowers farmers to adapt to climate change (Apraku et al., 2021). Ethno-agricultural practices depict indigenous knowledge as culturally bound and form part of the socio-economic lifestyle of these farmers. On the other hand, scientific knowledge is viewed as tacit knowledge that can be applied. Small-scale farmers adopt a hybrid of local and modern farming practices (Apraku, et al., 2021).

4.13 THE DATA-DRIVEN INTERVENTION

While economies of scale might suggest that one-size-fits-all model interventions targeting smallholder farmers in Africa are possible, the diversities in farm sizes and farmers' characteristics make it impractical for such interventions to be effective or widely adopted (Hammond et al., 2020). There is a growing need to develop data-driven approaches for the smallholder sector in Africa, which consider these diversities and recognize the multiplicity of smallholder characteristics.

- **Blockchain technology**

There is an argument that technologies such as blockchain may provide financial resilience to smallholder agriculture. The nodes within the blockchain network have the potential to eliminate conventional transaction costs, essentially bypassing intermediaries (Bolt, 2019). While the adoption of blockchain in the agriculture sector is still relatively new, it demonstrates the potential for solving financial access issues for smallholder agriculture.

4.14 WOMEN IN THE PASTORALIST SYSTEM

Social differentiation and gender-specific roles within pastoralist communities highlight the vulnerability of women to climate change impacts. However, within the pastoral system, women's ownership, and access to small livestock, such as goats, sheep, and poultry present an opportunity to tailor adaptation practices that enhance the resilience of these livelihood strategies. Increasingly, the effects of climate change are driving pastoralists in East Africa to shift their focus to small stock, including goats, and sheep (PRISE, 2018). These productive assets, hold a significant cultural significance, placing women at the centre of their management and decision-making as they are traditionally regarded as household assets within traditional pastoral systems.

5 SUMMARY

5.1 SUMMARY ON TARGETING GEOGRAPHIES OR FARMING SYSTEMS: A LANDSCAPE OF ACTIONS

Geographical Focus:

1. **Central Africa (DR Congo, Rwanda, Burundi):** Emphasis on Restorative/Regenerative Agriculture in degraded Hills and Mountains, and Landscapes with Forests. Address the threat of expanding agriculture and activities like charcoal burning.

2. **Invisible Locations/Areas/Systems:** Recognize the gap in Research and Development on Shoats (Sheep and Goats) in Agropastoral Systems. These offer multiple benefits and gender inclusivity and can attract youth interest. Explore pastoralist potential in the Horn of Africa.

3. **Eastern Africa, Western Africa, and Parts of Southern Africa (e.g., Malawi):** Target mixed farming systems, focusing on Sustainable Intensive Agriculture. This includes agro-ecology, agroforestry, and integration with legumes. Recognize the nutritional value and significance of legumes and pulses for Women in Agriculture.

Country-Specific Potential:

Ethiopia, Tanzania, and Nigeria: Potential for smallholder farming return/growth, especially in crops like pulses and rice. Ethiopia's adoption of irrigation is increasing, and Nigeria and Ethiopia have a higher number of smallholder farmers ready for transformation. Research and Development in these countries may yield better results.

Key Talking Points for Co-Creation:

a) **Future of Agriculture in Africa:** Address climate change and adaptation needs, and explore the competitive advantage of systems like cocoa, coffee, and tea production. Consider diverse results, including traditional and modern approaches, and the evolving psychology of smallholder farmers.

b) **Emerging Middle Class:** Discuss the role of an emerging middle class willing to invest in agriculture, particularly in Zambia and Nigeria. Explore how the "missing middle" can fit into this landscape and meet their specific needs.

c) **Lessons for Disaster-Prone and Climate-Risk Ecosystems:** Share evidence and lessons on regenerative/restorative agriculture in regions prone to disasters and climate risks. Consider urban agriculture, vertical gardens, and hydroponics in shaping urban and agricultural landscapes, along with the involvement of youth in agriculture.

d) **Progress and Gaps in Evidence:** Evaluate progress in irrigation in Tigray, Ethiopia, wheat production in Sudan, and lowland rice cultivation in Malawi. Identify research gaps and potential solutions through

research and development.

e) **Complementary Solutions:** Explore the integration of climate and agro-weather data with input (seed and fertilizer) supply, as well as the possibility of minimum income/cash transfers for farming families. Assess the effectiveness of index-based insurance, cash transfers, or seed-based insurance for smallholder farmers.

f) **Addressing Cheese Shortages:** Investigate cheese shortages in regions like Kenya, considering milk tolerance and dietary behaviours. Evaluate the viability of dairy goats and cheese value chains in the face of climate change.

g) **Role of Cooperatives and Aggregation Centers:** Discuss the potential of cooperative and aggregation centers in addressing challenges in pulses, legumes, and alternative protein diets. Analyze the primary (production-focused), secondary (value addition and industrial processes), and market linkage needs for smallholder agricultural systems.

h) **Holistic Agriculture System:** Envision a complete, holistic, and transformative agriculture system that integrates forests, food, people, and fuel/energy. Explore the possibility of achieving net-zero emissions in future African agricultural systems.

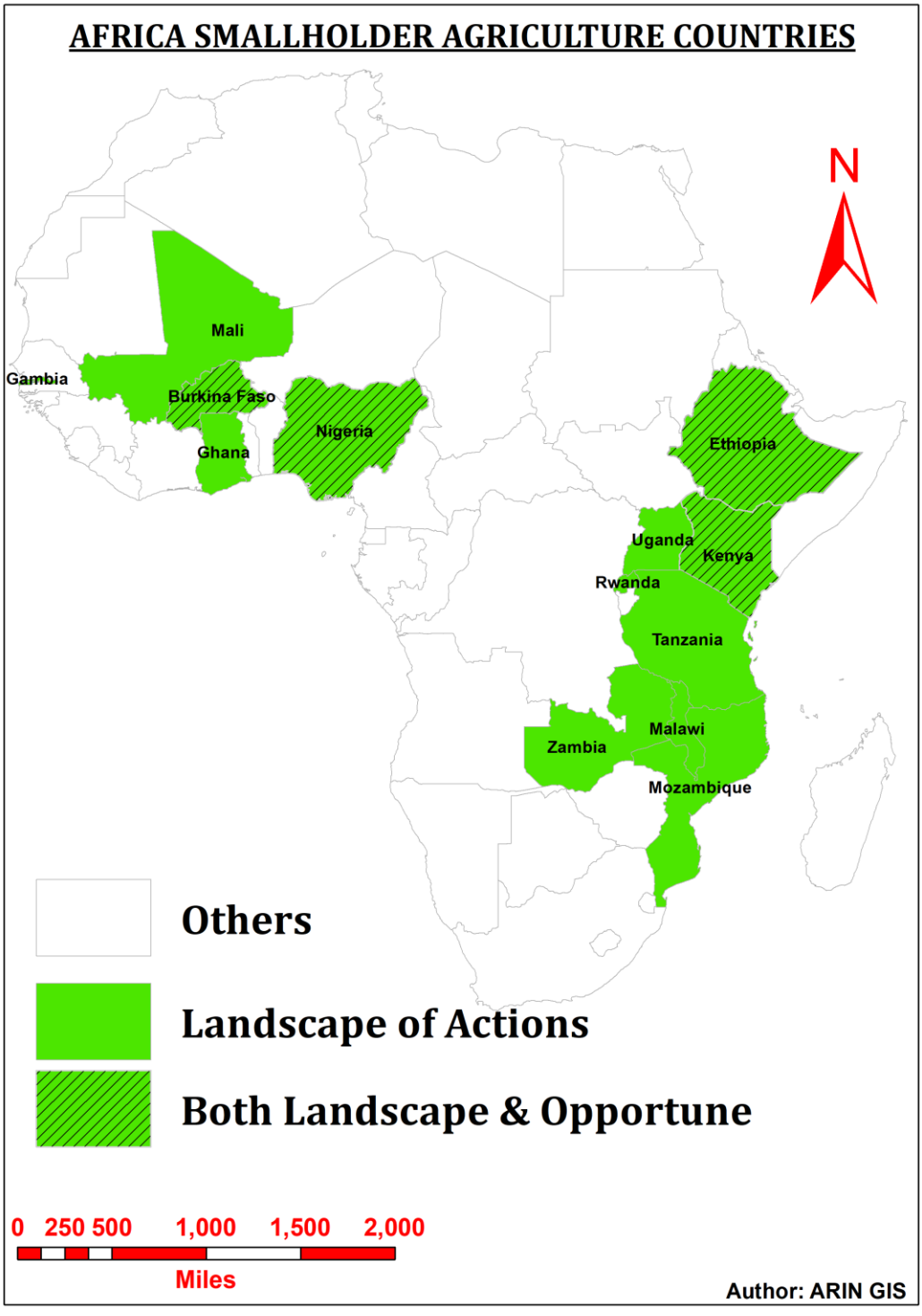
i) **Local Seed Systems:** Study and improve local seed systems, recognizing the importance of local knowledge and practices.

5.2 LANDSCAPE ANALYSIS OF ACTORS, AND OPPORTUNE COUNTRIES

Various stakeholders in smallholder agriculture are actively engaged in initiatives aimed at shaping the future of agriculture across the continent. These efforts encompass a wide range of activities, including capacity building to empower farmers in adapting to climate change, the promotion and scaling up of cutting-edge agricultural technologies, fostering youth engagement in agribusiness, advocating for the pooling and adoption of genetic resources, policy advocacy and forming strategic partnerships to drive agricultural transformation, championing regenerative agriculture and agroforestry practices, supporting entrepreneurial development among farmers, strengthening value chains and facilitating market linkages, promoting sustainable farm energy solutions like solar and biogas technologies, advocating for the establishment of mini-grids and biofuels, representing farmers' interests through professional farming associations, and actively contributing to research and development activities.

The actors involved in smallholder farming employ a variety of strategies to engage with farmers. These strategies include farm schools, cooperatives, and aggregation centres. They also utilize digital technologies and collaborate directly with government agencies and academic or research institutions. Many of these actors operate within the region and play a crucial role in disseminating essential information that can help reshape the future of agriculture in Africa. These key actors include organizations such as the Alliance for a Green Revolution in Africa (AGRA, the International Institute of Tropical Agriculture (IITA), the International Fund for Agriculture Development (IFAD), One Acre Fund, TechnoServe, FarmAfrica, Eastern Africa Farmers Federation, Pan African Farmers Organization, Southern African Confederation of Agricultural Unions (SACAU), the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), Eastern African Grain Council, BAYER Global Agriculture and

YARA. A comprehensive breakdown of roles and activities of these actors is available in the ARIN database.



5.3 STAKEHOLDER ANALYSIS

The stakeholder matrix developed in this scoping study serves as a valuable source of information regarding the various stakeholders involved in supporting smallholder farms across Sub-Saharan Africa. Data concerning these

stakeholders and their respective activities has been compiled from their websites as well as partner websites. It is noteworthy that some stakeholders have neglected to update their websites in the past five years, which may present a challenge in terms of accessing current information. The analysis of these stakeholders is centred on identifying potential opportunities that could shape the future of agriculture in Africa. The application of SWOT analysis has proven to be an instrumental tool in conducting this stakeholder analysis and in uncovering prospective opportunities for these stakeholders as they collaborate with smallholder farmers in Africa

5.4 POTENTIAL STAKEHOLDERS

In addition to the stakeholders directly involved with the smallholder farmers, it was necessary to consider those who contribute to completing the value chains for smallholder farms. This includes suppliers of soil nutrition and inputs such as improved seeds, as well as professional organizations working towards the improvement of smallholder agriculture in Africa. The matrix provides a country-specific list, drawing stakeholders from various sources such as:

- International agencies working towards the improvement of smallholder agriculture – IFAD.
- Regional and country-specific farmers' associations.
- NGOs and civil society groups.
- Universities and other academic institutions.
- Input companies and commercial fertiliser companies.

The four selected countries for Smallholder Co-creation activities include Nigeria, Ethiopia, Burkina Faso and Kenya. The potential stakeholders in each of the four selected countries are as follows:

NIGERIA

- Department of Geography and Environmental Management, Tai Solarin University of Education, Ijebu Ode
- Department of Geography, Obafemi Awolowo University, Ile-Ife
- Center for Geospatial Analytics, North Carolina State University
- Department of Geography and Planning, Lagos State University
- Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague
- Department of Ag Economics and Extension, Enugu State University of Science and Technology (ESUT), Enugu, Nigeria
- Department of Agricultural Economics and Farm Management, Federal University of Agriculture, Abeokuta, P.M.B. 2240, Abeokuta, Ogun State
- Department of Agriculture, Landmark University, Omu Aran, Kwara State
- Ahmadu Bello University
- The Federal University of Technology, Akure
- The Federal University of Technology, Minna
- Obafemi Awolowo University
- University of Calabar (Nigeria)
- International Institute for Tropical Agriculture (IITA)
- Small-scale Women Farmers Organization in Nigeria (SWOFON)
- Nigeria Young Farmers Network (NYFN
- Nigerian Association of Women in Agriculture (NAWIA)
- Nuru International

- Food for All International
- Agricultural Society of Nigeria (ASN)

BURKINA FASO

- Institut de l'Environnement et de Recherches Agricoles (INERA.
- Centre National de la Recherche Scientifique et Technologique (CNRST)
- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT
- World Agroforestry Centre (ICRAF)- Burkina Faso.
- University of Ouagadougou.
- Polytechnic University of Bobo-Dioulasso.
- University of Koudougou.
- Institut du Développement Rural (IDR).
- Institut du Sahel (INSAH).
- International Institute for Water and Environmental Engineering (2iE).
- Tree Aid
- The Union of Agricultural Marketing Groups of Boucle du Mouhoun (UGCPA / BM)

KENYA

- University of Nairobi Departments of Agriculture, Geography and Environmental Studies.
- Kenyatta University: Kenyatta School of Environmental Studies, and School of Agribusiness.
- Jomo Kenyatta University of Agriculture and Technology (JKUAT).
- Egerton University – Tegemeo Institute.
- Moi University: Moi University.
- Maseno University
- Dedan Kimathi University of Technology (DeKUT).
- Southeastern Kenya University (SEKU).
- Kenya Agricultural and Livestock Research Organization (KALRO).
- International Livestock Research Institute (ILRI).
- International Center for Tropical Agriculture (CIAT).
- World Agroforestry Centre (ICRAF) -Kenya.
- International Water Management Institute (IWMI) – Kenya.
- African Forum for Agricultural Advisory Services (AFAAS).
- African Agricultural Technology Foundation (AATF).
- Biovision Africa Trust.
- Alliance for a Green Revolution in Africa (AGRA).
- Kisima Farm.
- Farming Systems Kenya.
- Farm Africa.
- Kimaeti Farmers.
- Amani Community Based Organisation (ACBO).
- Women in Modern Agriculture CBO.
- Kenya National Farmers Federation.

ETHIOPIA

- Ethiopian Institute of Agricultural Research (EIAR).
- International Center for Tropical Agriculture (CIAT)- Ethiopia.

- International Livestock Research Institute (ILRI)- Ethiopia.
- World Agroforestry Centre (ICRAF)- Ethiopia.
- International Water Management Institute (IWMI)- Ethiopia.
- International Maize and Wheat Improvement Center (CIMMYT)- Ethiopia.
- Hawassa University
- Addis Ababa University
- Jimma University
- Mekelle Universit
- Bahir Dar University.
- Haramaya University.
- Wolaita Sodo University.
- Dilla University.
- CropLife
- Fintrac
- Farm Africa

Researchers in Smallholder Agriculture in Africa

- Dr. Esther Ngumbi: Dr. Ngumbi is a Kenyan-born entomologist and researcher who has worked on agriculture and sustainable development projects in Africa, including Nigeria.

- Dr. Charity Mutegi: she is an agricultural economist with expertise in resilience-building and food security in Sub-Saharan Africa, and her work could extend to Nigeria.

- Dr. Robert Zougmoré: Dr. Zougmoré is a climate change and agriculture expert with experience in scaling climate-resilient agriculture in Sub-Saharan Africa, which could include Ethiopia.

- Dr. Jens Andersson: Dr. Andersson is an agricultural economist and researcher who has worked on scaling up agricultural technologies and practices in Sub-Saharan Africa, and his work may involve Ethiopia.

- Dr. Jonathan Muriuki: Dr. Muriuki is an agricultural researcher and extension specialist who may have experience working on scaling up sustainable and climate-resilient farming practices in Kenya.

- Dr. Bernard Vanlauwe: Dr. Vanlauwe is a soil scientist and agronomist who has researched sustainable agricultural intensification and resilience in Sub-Saharan Africa, which may include Burkina Faso.

- Dr. Grace Muthoni Mwaura. African Centre for Technology Studies (ACTS), Kenya

5.5 DEBUNKING THE ORGANIZATIONS

The diversity of farmers' organizations varies across regions, with West and Southern Africa regional blocs demonstrating a more proactive stance compared to their counterparts in East and Central Africa. Additionally, we have emphasized potential threats, such as the climate crisis and the Russia-Ukraine War, which can have a significant impact on organizations involved in the marketing of cereals in Sub-Saharan Africa. The information has been organized into tables, with a focus on specific regions or organizations, highlighting potential

opportunities for engagement within each context. This approach allows for a tailored analysis of the unique opportunities and challenges faced by different stakeholders and regions.

The analysis of the database has positioned the opportune countries in the matrix below to delineate the landscape of actions and the imperative to collaborate with the actors in a co-creation process. Furthermore, in instances where bundled approaches are deemed advantageous, the involvement of actors operating in multiple countries becomes crucial for validation and the sharing of experiences. It is noteworthy that certain actors within the agriculture value chain, including Syngenta Foundation, Bayer, AGRA, and One-Acre Fund, have already established a significant ground presence in the opportune countries. This established presence facilitates effective tracking and cross-collaboration with farmers and farmers' groups, enhancing the potential for positive outcomes in these regions.

The dearth of research and development, coupled with an incomplete understanding of farmers' aspirations, information sources, and perspectives, presents a unique opportunity for closer collaboration with academia. Forums like RUFORUM offer a promising platform to bridge these gaps and facilitate a deeper understanding of smallholder agriculture in Sub-Saharan Africa. The robustness of this academic network also creates an avenue for fruitful North-South collaboration, enabling the collective effort to shape and advance smallholder agriculture in the region. This collaborative approach holds the potential to yield innovative solutions and drive positive change for smallholder farmers.

ANALYSIS FOR REGIONAL STAKEHOLDERS

S/N	ORGANIZATION	STRENGTH	WEAKNESS	OPPORTUNITY	THREATS
1	International Institute of Tropical Agriculture (IITA)	It is working directly with smallholder farmers in all the opportune countries. It is working towards improving traditional crops like cassava and other crops such as maize.	It is primarily focused on crop farming rather than livestock, although ideally, most smallholder farms integrate both systems into their operations	There is an opportunity to broaden the scope by including research on small livestock.	The climate crisis is a threat multiplier in SSA and may hamper the research by IITA
2	Alliance for a Green Revolution in Africa (AGRA)	AGRA is a farmer-centred, African-led, and partnerships-driven institution that is transforming Africa's smallholder farming and operating in all the opportune countries identified.	It is oriented towards improving crop farming. It is also input-oriented and techno-centric in approach.	There is an opportunity to co-create solutions with smallholders that encompass their social innovation.	Changing Policy environment
3	The International Fund for Agricultural Development (IFAD)	Working in all the opportune countries to encourage smallholder farmers to turn to newly developed varieties and breeds. Has an R4D agenda that encourages creating pro-poor technologies.	It has a top-down approach to improving the productivity of African farms.	There is a need to work more with local organizations in driving the R4D agenda in Africa.	Russia – Ukraine war is a threat to the global funding for Agriculture research especially in the global south.
4	One Acre Fund	Present in eight opportune countries. Works directly with farmers to obtain training, input, and boost overall productivity.	Oriented towards crop production. Impact so far positive with high input (organic fertilizer use) also having new invasive weeds spreading.	There is an opportunity for the social enterprise to engage in regenerative agriculture and technologies that control the spread of invasive species.	Most African countries are on the verge of defaulting to their international obligations, which could push both the middle-class and the poor into further poverty.
5	Techno-Serve	Promotes the development of cash crops and farm enterprises including the micro-enterprise held by smallholder farmers.	Oriented towards off-farm farm activities. May miss on social innovation done by smallholder farmers.	Need to identify social innovation and local capital mobilization by individual farmers.	Diversified portfolios have a reclusive effect on overall farm productivity.
6	Farm Africa	Working directly with over 700,000 farmers in East Africa to increase production and sales. Also promotes the sustainable management of fields, forests, grazing lands, and water resources. Already collaborating with pastoral women in Karamoja to raise dairy goats.	It is a social enterprise lacking the resources needed to scale up its work and reach a larger number of women. Farm Africa is overstretched programmatically in its efforts to make significant impact.	It has immense opportunity in promoting women-led small stock (shoats) ownership. Hay production potential targeting women in the pastoral communities.	Climate crisis may result in increased migration and mobility, affecting more women and youth, who are among the primary targets populations
7	Self-Help Africa	It is a charity working with small-scale farmers and growing family-farm businesses. Also involved in initiatives to improve water accessibility for smallholder farmers.	The organization is in its infancy with the potential for expansion. Also, it is overstretched to make a significant impact.	An opportunity to push for climate justice funding for smallholder adaptation and resilient projects.	Russia- Ukraine war is impacting funding arrangements by ODA.

			Campaigning to make Ireland commit a substantial budget to ODA.		
8	Practical Action	Currently targeting young framers through the Resilient Agriculture that Works for Young People (RAY) project to make a difference. Also working to make renewable energy accessible.	. The organization's work is influenced by the availability of funding	Farm schools and incubation labs/youth café to promote resilient agriculture is an emerging opportunity. Also linking farm energy needs by smallholder farmers is an opportunity	Rural-urban migration and youths in transition may affect the programs.
9	Eastern Africa Farmers Federation	A member of PAFO, representing the voices of farmers in East Africa. Vital in understanding the overall landscape of smallholder agriculture in East Africa.	Lacks the technical capacity to conduct in-depth action research.	Bundled approaches to incorporate sustainable use of water, forest, and land. Need to encourage irrigation.	The climate crisis and the 5-year failed rain season are a threat to smallholder agriculture in the region.
10	Pan African Farmers Organization (PAFO)	Represent farmers' voices in Africa. Has a rich history as a Pan-African Farmer's organization.	Lack of technical capacity to drive farmer-centered action research.	There is an opportunity to invest in research, database, and technology to encourage production.	Member countries have own unique opportunities.
11	Regional Platform of Farmers' Organizations of Central Africa (PROPAC)	Promote family farms that constitute the key system of agricultural, forestry and pastoral production in Central Africa.	Lacks technical capacity to drive farmer-centred research in central Africa.	There is an opportunity to invest in regenerative agriculture and forest production.	Years of protracted wars in the region affect smallholder farmers.
12	Network of farmers 'and producers' organizations in West Africa (ROPPA)	It is an initiative specific to West African farmers' organizations and agricultural producers. It boasts 13-member national farmer organizations including Burkina Faso, Gambia, Ghana, Mali, and Nigeria. Promotes family farms. Has developed a framework for fishing, livestock breeding, Cereals and Rice.	Family farms/ smallholder agriculture faces the challenge of market penetration.	Promote research on small-stock and crop production. Promote the production of improved cotton.	Insurgency in the Sahel region is a threat to the farming activities of ROPPA members.
13	Southern African Confederation of Agricultural Unions (SACAU)	Representing interests of farmers and organizations in the Southern African Development Community countries and boast of presence in 12 countries with 16 national farmers' union/association members as members. Actively engages farmers' organizations in UNFSS processes.	The focus is dairy, cotton and land governance which may make members miss out on other opportunities in regenerative agriculture.	Continued investment in research on lowland rice, pulses, and maize offers promise to change and promote food security in the region. Need for a comprehensive regional seed policy.	Climate crisis with intense cyclone a threat to agriculture in the region.
14	African Association of Agricultural Economists	As a professional body, it has a running journal -the African Journal of Agricultural and Resource Economics (AfJARE)- focused on research on African agriculture and interaction with local and global economic systems.	Currently, Africa is experiencing constraints in funding research which in turn limits the potential of the organization.	There is an opportunity for collaborative research between the Global South and North as well as among countries within the Global South, to explore the future of smallholder agriculture.	Policy landscape in funding agricultural research in Sub-Saharan Africa.

15	African Conservation Tillage Network	The organization is fast growing and working towards regenerative agriculture through sustainable utilization of land and water to improve productivity. Has experience working in Kenya, Tanzania, and Burkina Faso.	Activities depend on the availability of funds.	There is an opportunity to be part of a larger research consortium and promote collaborative learning.	Policy landscape in funding agricultural research in Sub-Saharan Africa.
16	Eastern African Grain Council	Representatives of organizations involved in the grain trade in Eastern Africa addressing distributions and market constrain.	Oriented toward market supply and access of grains and may undermine local supply chains.	Explore the local markets for grain supply. Call for an improved policy environment to encourage cross-border trade.	Russia – Ukraine war affects the members
17	Regional Universities Forum for Capacity Building in Agriculture (RUFORUM)	Has a rich network of 147 members drawn from universities in the region with technical expertise in smallholder agriculture. It has members in all the opportune countries identified.	Currently, universities in Sub-Saharan Africa are facing funding constraints. There are demands that universities develop market-responsive courses.	There is an opportunity for collaborative research between the global south and North and between the global South on the future of smallholder agriculture.	Policy landscape in funding agricultural research in Sub-Saharan Africa.
18	Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN).	FANRPAN is a policy network focusing on food, agriculture and natural resources policies that was formed through a call by agriculture ministers from East and Southern Africa. Has the goodwill of the government to carry its mandate.	Most of the activities are in line with government plans leaving limited room for innovation.	Promote Research on smallholder Agriculture and future landscape to inform Ministerial policies.	The government prefers investing in large-scale agriculture projects/programmes including research.
19	YARA	Common products which assist smallholder farmers in most of the opportune countries with agronomic knowledge, digital tools, and premium products.	Farmers' knowledge of soil testing and acidification due to misuse of the products is common.	An opportunity for field trials and control while working with university forums or directly with farmers.	Farmers benefit from diverse knowledge systems which may limit the research.
20	BAYER Global Agriculture	Bayer's agriculture division offers customized solutions for farmers to plant, cultivate, and safeguard their crops while conserving land, water, and energy. They are actively engaged in promoting farming technologies, including regenerative agriculture	Integrating with traditional input systems like the seed system in Africa may be a challenge in addressing the yield gap.	Work towards integrating and identifying common seed practices and systems in smallholder agriculture.	The climate crisis may affect anticipated yields.
21	Unilever	Has developed various codes to encourage regenerative agriculture and traceability along its supply chain.	Smallholder farmers may not be aware of the codes limiting their market access.	Need to incorporate technology in smallholder farmers' value chain for traceability.	Climate crisis a threat to the smallholder value chain.
22	Forum for Agricultural Research in Africa (FARA)	Is the apex continental organization with a rich continental network working with African Union, TAAT, SARECA, SADC-FANR, PARI, and CORAF to Integrated Agricultural Research for Development (IAR4D).	May not work directly with farmers as it targets to influence Agricultural Research at the Continental level.	There is an opportunity to work with farmers directly to understand the smallholder farmers' landscape and pathways in Africa through research.	Changing policy environment and specific country preference.

LANDSCAPES OF ACTION IN OPPORTUNE COUNTRIES

COUNTRY	LANDSCAPE OF ACTIONS			
	Restorative Agriculture (Targeting Degraded Landscape for restoration)	**Invisible Systems (Pastoralism/agro-pastoralism/"orphaned crops")**	**Sustainable Intensive Agriculture (Agroecology/Agroforestry)**	**Potential for Growth High, Medium Low plus Reason**
Burkina Faso	Drought and floods are a threat to agricultural systems. Food insecurity and livelihood resilience are challenged by climate change. Use NbS to control flooding.	The influx of refugees from Mali is a threat to the agricultural system in Burkina Faso. Promoting fodder production is an opportunity to support the Pastoralists.	Intensification can be achieved by having mixed crops, livestock, legumes and trees to restore the landscape.	A high Potential for improvement in cotton and other cereals through R&D is desirable.
Ghana	3 million hectares of degraded landscapes, in the Northern Savannah Zone and the cocoa forest landscape offers an opportunity for regenerative agriculture. Also, the fishing industry is under threat of offshore gas and oil investments with R&D required.	The farmer-herder conflict in the Sahel region is forcing farmers to migrate to the south exerting further pressure on the forestscape.	Maize production replacing traditional foods like pearl millet. Opportunity for maize and legume intercropping.	High potential considering the recent adoption of maize farming. Local seed system has been effective in adapting to climate change yet undocumented as farmers now shift to maize farming.
Ethiopia	The coffee-producing highlands facing threats of degradation	Government advocating for land tenure systems reforms to settle pastoralists. Ethiopia offers an opportunity for irrigated agriculture	Sustainable intensification could be achieved through input use and improved seed. Opportunity for improvement due to supportive government policies.	High potential considering increased spending by the government on the sector, also irrigation projects are being implemented.
Kenya	Arid and semi-arid landscapes which are nearly 80% of the country face the challenge of land degradation and invasive species. Four-year multi-year drought is a threat to the livelihood in arid and semi-arid lands. Conflicts over waters are exacerbated by climate change.	Women within the pastoral system have an opportunity to own and participate in sheep and goat production	Food security and recurrent drought are a threat to livelihoods. Agro-pastoral systems emerging as alternatives in the ASALs. Opportunity to improve seeds and small stock breeds.	Medium potential considering the policy support environment, and advancement in R&D
Malawi	Soil degradation due to diminishing soil organic carbon, a decline in critical soil micronutrients, and increased soil acidity resulting from the extensive use of inorganic fertilizers on small plots of land.	Elders have access to land, yet the holding registers low production. Youths, who constitute the majority less engaged in production yet would like to explore sustainable intensification practices.	Threats of tropical cyclones and extensive flooding. Success story with the improved lowland rice an opportunity for seed improvement	High Potential through R&D to improve seed and technologies. Malawian population is expected to double, which will affect access to land and land holding sizes
Mali	Land degradation is prevalent and leads to environmental and humanitarian crises. This is further compounded by climate crises in the Sahel region	Pastoralists- farmer conflict is a problem in the Sahel, coupled with Climate change and insurgency.	Sustainable Agriculture is an opportunity for the restoration of degraded landscape	High Potential through peace-building institutional processes.
Mozambique	Tropical cyclone and forest degradation coupled with climate change calls for attention and investment	The potential to produce cassava a highly adaptable crop.	Agroforestry systems will help improve the degraded landscape	The sector holds immense potential due to unused arable land amounting to 36 million hectares

Nigeria	Land degradation and the prevalence of poverty are driving young people to migrate from rural to urban areas. In Nigeria, the savannah is expanding into the tropical rainforest ecosystem because of increased space for agricultural systems, the demand for fodder, and the movement of pastoralists further south	The potential of local food systems and cassava as an adaptation strategy. Pastoralism, livestock keeping, and poultry remain invisible yet important to families in Nigeria	Sustainable intensification is possible in Nigeria through intercropping maize with legumes	High Potential as R & D and technology will improve production. The increased agricultural output could result in trade for the smallholders in Nigeria
Rwanda	Faces a threat of degraded landscapes, landslides, and surface water pollution.	Beekeeping is an emerging activity for families. Bananas and beans are a success story with little research and development provided.	Policy environments point to preparedness for the uptake of sustainable intensification. There is an opportunity for R & D for the sustainability of the practice.	Medium potential considering the policy support environment.
Uganda	Rural livelihoods in Uganda are confronted with the dual challenges of escalating land degradation and the impacts of climate change. Landslides, ecosystem degradation, and deforestation are prevalent issues in smallholder areas across Uganda	Uganda has prioritized improving the pastoral system by decarbonizing the pastoral corridor. Gender-responsive climate action is one of the critical components of NAPs in Uganda	Mixed farming practices that incorporate agroforestry practices are needed in Uganda. Rangeland restoration and carbon projects are needed in livestock corridors in Uganda.	High Potential. Uganda is food secure. With one of the highest population growths globally and a youthful population, there is a need to increase agricultural productivity through R&D.
Tanzania	Inadequate farming practices, deforestation, and overgrazing call for investment to restore the landscape.	The government of Tanzania working towards improving the irrigation potential though there are challenges in the land tenure system which has led to the dispossession of pastoralists.	Sustainable intensified agriculture potential. Rice can be a leading export in the East African region through R& D)	High potential yet Farmers and stakeholders face challenges in exports and value-added processing, Land acquisition hurdles; technological gaps, inadequate storage facilities, markets, and credit in access
Zambia	The landlocked country is prone to both drought and floods, over-cultivation, and land degradation.	There is potential to grow cotton. However, in-accessible quality seeds and fertilizer, lead to low cotton productivity.	There is an opportunity for mixed maize and legumes. Agro-ecology research desired to reverse land degradation.	Medium potential as poverty is widespread, farmers lack access to markets and credit and improper storage. The country also suffers from the scourge of HIV/AIDS as the highest HIV rate continues to affect the labour force.
The Gambia,	Floods and drought with climate variability affect agriculture in the Gambia. Despite its low population, the country is heavily reliant on relief aid from WFP. The gender gap persists in the agriculture sector. Youths are identified as having the potential to revolutionize the agriculture sector.	The success of groundnut/peanut production is undocumented. More research and development are needed for the crop to be competitive internationally.	Through Irrigation, Sustainable intensification is possible. Technology adoption is still low.	High potential as cycles of low investment and inputs and low output, with persistent gender inequalities in access to water, post-harvest losses, inadequate storage, limited value-addition, and weak marketing affect the sector.

REFERENCES

Abate, G. T., Rashid, S., Borzaga, C., & Getnet, K. (2016). Rural finance and agricultural technology adoption in Ethiopia: does the institutional design of lending organizations matter? *World Development*, *84*, 235-253.

Abegunde, V. O., & Obi, A. (2022). The role and perspective of climate-smart agriculture in Africa: a scientific review. *Sustainability*, *14*(4), 2317.

Apraku, A., Morton, J. F., & Gyampoh, B. A. (2021). Climate change and small-scale agriculture in Africa: does indigenous knowledge matter? Insights from Kenya and South Africa. *Scientific African*, *12*, e00821.

Baributsa, D., Lowenberg-DeBoer, J., Murdock, L., & Moussa, B. (2019). Profitable chemical-free cowpea storage technology for smallholder farmers in Africa: opportunities and challenges. *Gates Open Res*, *3*(853), 853.

Bolt, J. (2019) Financial resilience of Kenyan smallholders affected by climate change, and the potential for blockchain technology. CCAFS flagship climate-smart technologies and practices incentives and innovative finance for scaling climate-smart agriculture up and out. *Wageningen Environmental Research*

Brandt, P., Kvakić, M., Butterbach-Bahl, K., & Rufino, M. C. (2017). How to target climate-smart agriculture? Concept and application of the consensus-driven decision support framework "target CSA". *Agricultural Systems*, *151*, 234-245.

El Nour S. (2021) Towards a just agricultural transition in North Africa

Fadeyi, O. A., Ariyawardana, A., & Aziz, A. A. (2022). Factors influencing technology adoption among smallholder farmers: a systematic review in Africa.

Gollin, D. (2014). Smallholder agriculture in Africa: an overview and implications for policy

Hammond, J., Rosenblum, N., Breseman, D., Gorman, L., Manners, R., van Wijk, M. T., ... & Schut, M. (2020). Towards actionable farm typologies: Scaling adoption of agricultural inputs in Rwanda. *Agricultural Systems*, *183*, 102857.

https://www.cimmyt.org/projects/farm-mechanization-and-conservation-agriculture-for-sustainable-intensification-facasi/

Jameel, Y., Patrone, C. M., Patterson, K. P., & West, P. C. (2022). Climate-Poverty Connections: Opportunities for synergistic solutions at the intersection of planetary and human well-being.

Kamara, A., Conteh, A., Rhodes, E. R., & Cooke, R. A. (2019). The relevance of smallholder farming to African agricultural growth and development. *African Journal of Food, Agriculture, Nutrition and Development*, *19*(1), 14043-14065.

Kansanga, M., Andersen, P., Kpienbaareh, D., Mason-Renton, S., Atuoye, K., Sano, Y., ... & Luginaah, I. (2019). Traditional agriculture in transition: Examining the impacts of agricultural modernization on smallholder farming in Ghana under the new Green Revolution. *International Journal of Sustainable Development & World Ecology*, *26*(1), 11-24.

Ketema, H., Wei, W., Legesse, A., Wolde, Z., Temesgen, H., Yimer, F., & Mamo, A. (2020). Quantifying smallholder farmers' managed land use/land cover dynamics and its drivers in contrasting agroecological zones of the East African Rift. *Global Ecology and Conservation*, *21*, e00898.

Kos, D. (2022). *The long walk to economic freedom: smallholder farmers' access to technology and capital* (Doctoral dissertation, Wageningen University).

Larson, D. F., Muraoka, R., & Otsuka, K. (2020). Rural development strategies and Africa's small farms. *The Role of*

Smallholder Farms in Food and Nutrition Security, 45-77.

Magesa, B. A., Mohan, G., Matsuda, H., Melts, I., Kefi, M., & Fukushi, K. (2023). Understanding the farmers' choices and adoption of adaptation strategies and plans to climate change impact in Africa: A systematic review. *Climate Services*, *30*, 100362.

Masikati P, Sisito, G., Chipatela, F., Howard Tembo H., & Winowiecki L. A. (2021). Agriculture extensification and associated socio-ecological trade-offs in smallholder farming systems of Zambia, International Journal of Agricultural Sustainability, 19:5-6, 497-508, DOI: 10.1080/14735903.2021.1907108

Mwamakamba, S. N., Sibanda, L. M., Pittock, J., Stirzaker, R., Bjornlund, H., van Rooyen, A., ... & Kashaigili, J. J. (2017). Irrigating Africa: Policy barriers and opportunities for enhanced productivity of smallholder farmers. *International Journal of Water Resources Development*, *33*(5), 824-838.

Myeni, L., Moeletsi, M., Thavhana, M., Randela, M., & Mokoena, L. (2019). Barriers affecting sustainable agricultural productivity of smallholder farmers in the Eastern Free State of South Africa. *Sustainability*, *11*(11), 3003.

Ng'weno, A., Oldja, L., Hassan, M., & Kapoor, P. (2018). Financial Inclusion for Women in Entrepreneurship and Smallholder Agriculture.

Ogunyiola, A., Gardezi, M., & Vij, S. (2022). Smallholder farmers' engagement with climate-smart agriculture in Africa: role of local knowledge and upscaling. *Climate Policy*, *22*(4), 411-426.

Shilomboleni, H. (2022). Political economy challenges for climate smart agriculture in Africa. In *Social Innovation and Sustainability Transition* (pp. 261-272). Cham: Springer Nature Switzerland

Tittonell, P., & Giller, K. E. (2013). When yield gaps are poverty traps: The paradigm of ecological intensification in African smallholder agriculture. *Field Crops Research*, *143*, 76-90.

Zougmoré, R., Partey, S., Ouédraogo, M., Omitoyin, B., Thomas, T., Ayantunde, A., ... & Jalloh, A. (2016). Toward climate-smart agriculture in West Africa: a review of climate change impacts, adaptation strategies and policy developments for the livestock, fishery and crop production sectors. *Agriculture & Food Security*, *5*(1), 1-16.

https://www.bing.com/images/search?view=detailV2&ccid=bDcfn7RL&id=641017BE1B3B70D5709AD930B296BF3AAEEAF2EC&thid=OIP.bDcfn7RLFBzAN9S-7lYJxQHaGh&mediaurl=https%3a%2f%2fvignette2.wikia.nocookie.net%2fthefutureofeuropes%2fimages%2ff%2ff8%2fMap_of_africa_with_flags.png%2frevision%2flatest%3fcb%3d20160508144104&cdnurl=https%3a%2f%2fth.bing.com%2fth%2fid%2fR.6c371f9fb44b141cc037d4beee5609c5%3frik%3d7PLqrjq%252flrIw2Q%26pid%3dImgRaw%26r%3d0&exph=1546&expw=1754&q=africa+map+with+country+flag&simid=608007541019123244&FORM=IRPRST&ck=333A11B8BD36FAECC8B8694A68A61C78&selectedIndex=0&ajaxhist=0&ajaxserp=0.

Desk-based Review on Smallholder Agriculture Co-creation Programme

Authors:
Alphonce Agola Mollo and Joanes Atella from African Research & Impact Network (ARIN).

August 2023

For more information on the Adaptation Research Alliance (ARA) please visit:

www.adaptationresearchalliance.org

ara@southsouthnorth.org

@Adapt_Alliance

Adaptation Research Alliance

This document is an output from a project led by the Adaptation Research Alliance (ARA), primarily funded by the UK Government's Foreign Commonwealth and Development Office (FCDO) for the advancement of research for impact for adaptation to climate change. However, the views expressed and information contained in it are not necessarily those of, or endorsed by the ARA or FCDO, which can accept no responsibility for such views or information or for any reliance placed on them. This publication has been prepared for general guidance on matters of interest only, and does not constitute professional advice. You should not act upon the information contained in this publication without obtaining specific professional advice.

Adaptation Research Alliance

UK International Development
Partnership | Progress | Prosperity