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Dissemination of climate-smart agriculture practices in the Upper West Region of Ghana: insights from local stakeholders and institutions

Stephen Uwumbordo Nachibi [a], Abdul Wahid Arimiyaw[b], Eugene Muobom Ganee[c] and Anthony Kwame Morgan [d]

[a]School of Environmental Sciences, University of Hull, Hull, UK; [b]Department of Geography and Rural Development, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana; [c]Department of Sociology and Social Work, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana; [d]Department of Applied Social Sciences, The Hong Kong Polytechnic University, Kowloon, Hong Kong

ABSTRACT

Limited empirical evidence exist on local-level institutions' innovations and experiences in facilitating climate-smart agriculture (CSA) adoption. Qualitative interviews with farmers and local institutions supporting agriculture in Nandom, Ghana, were conducted. We found that local-level institutions employed (1) farmer-field schools (FFS) for capacity building to provide relevant knowledge for managing CSA practices; and (2) credit extension packages to reduce financial barriers to accessing inputs and technologies for CSA. We also found that sociocultural, financial, logistical, and technological constraints are the most important barriers hampering local-level institutions` ability to effectively facilitate CSA adoption. Furthermore, we observed that to encourage the uptake of CSA practices, particularly among vulnerable groups such as women, social power dynamics surrounding resource access and utilization must be addressed. For practice, the findings (1) serve as a case for learning different innovations that can be adapted in different contexts; and (2) give insights on how to overcome social barriers to CSA adoption and facilitation. We recommend that governmental institutions such as the Ministry of Food and Agriculture allocate resources and design policies that builds the of implementers. Training institutions must tailor contents to the needs and assimilation levels of target communities. Additionally, development partners should establish long-term funding mechanisms beyond grant cycles to provide sustainable financial support for CSA upscale.

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1. Introduction

Across the world, there is a consented agreement that without intentional transformation to adapt agriculture and make it resilient, the world will simply struggle to feed close to 10 billion people by 2050 (Food and Agriculture Organization [FAO], 2010, 2013; Taylor, 2018; World Bank, 2011, 2015, 2021). Several international organizations and researchers have acknowledged that climate variability and change, increasing population growth among several other environmental changes, present a pressing need for transitioning into the upscale of 'climate-smart agriculture' (CSA) (Chandra et al., 2018; FAO, 2010, 2013; Lipper et al., 2014; Taylor, 2018; World Bank, 2011, 2015, 2021). CSA gained popularity in agricultural development because of its potential to contribute to mitigating climate change, make agriculture resilient to climate change, and secure food for the growing world population (Barasa et al., 2021; Chandra et al., 2018; Lipper et al., 2014; Taylor, 2018; Totin et al., 2018).

CSA is variedly defined yet some keywords such as 'capacity building, sustainability, emission and

CONTACT Stephen Uwumbordo Nachibi uwumbordostephen@gmail.com School of Environmental Sciences, University of Hull, Hull, UK

vulnerability reduction, profit, food security, transformation, new knowledge, technology, and productivity' (Barasa et al., 2021, p. 2. See also Adesipo et al., 2020; FAO, 2010) characterize the concept. Although these keywords are not exhaustive, they represent the basic foundation of most CSA definitions. Building on these keywords, Barasa et al. (2021, p. 2) offered a comprehensive definition of CSA as a 'transformative and sustainable form of agriculture that aims to improve productivity in food security and production systems' by combining the 'key pillars of climate change (adaptation, resilience, and mitigation) with smart technological knowledge, thereby increasing profit, and reducing vulnerability through greenhouse gas emissions'.

In this paper, we define CSA as novel farming methods and agricultural technologies, such as agroforestry systems, conservation practices, and drought-tolerant crop types, to address three pressing issues of our time: adaptation to climate change, climate change mitigation, and food security (Ogunyiola et al., 2022). Due to these potentials, governments, including donor agencies, international organizations, and development partners have committed huge amounts of resources to facilitate the upscale of CSA in developing regions, particularly sub-Saharan Africa (Ogunyiola et al., 2022). The World Bank, for instance, invested US$ 3.8 billion between 2016 and 2018 on 83 CSA projects in 30 African countries to improve the climate resilience of small-scale farmers (World Bank, 2018). Realizing the significance of institutions in the successful implementation of agricultural development and transformation (Cloete, 2013; Dorward et al., 2009; Thorbecke & Morrisson, 1989), a significant amount of this support was dedicated to 'creating the necessary institutions for CSA implementation' (World Bank, 2018, p. ix). Institutions, structures, and actors are critical for promoting and facilitating the adoption of CSA practices and technologies (Campbell et al., 2014; Lipper et al., 2014). However, in most African settings, including Ghana, not much attention has been paid to the functionalities and challenges of these institutions in promoting agricultural transformation. Local-level institutions (farmer groups, non-governmental organizations [NGOs], government departments, and traditional authorities) can play a critical role in resources and inputs access, capacity building, and knowledge transmission for effective management of, and upscaling of CSA practices and technologies (Campbell et al., 2014; Ghimire et al., 2022; Lipper et al., 2014; Makate, 2020; Meinzen-Dick et al., 2012).

Despite the importance of these institutions, there are still limited studies on local-level institutions' innovations and challenges in facilitating CSA adoption (Ghimire et al., 2022; Makate, 2020; Totin et al., 2018). Through local-level institutions` initiatives and experiences in facilitating CSA adoption, there exists a potential for a better and deeper understanding of innovations, including the roles of local rules, historical legacies, and values, including social identities in the uptake of CSA practices (Gardezi et al., 2022; Nachibi et al., 2023). Learning from local-level institutions' experiences in facilitating CSA is critical for effective innovations and strategies to promote and facilitate the rapid adoption of CSA technologies and practices. Drawing on the experiences of institutional respondents and farmers in the Upper West Region of Ghana, this study contributes to knowledge by adding to the limited studies on local-level institutions` innovations and challenges in the upscale of CSA approaches. The study was premised on the question: 'What are the roles and challenges confronting institutional innovations in the upscale of CSA practices?' To achieve this, we present the study's conceptual framework, methodology, findings, discussion, strengths and weaknesses and conclusion in this sequence.

2. Conceptual framework

Local-level institutions include both 'formal and informal mechanisms that shape social and individual expectations, behavior and interactions' (Makate, 2020, p. 272). They are crucial when it comes to facilitating agricultural adaptation to climate change (Agrawal, 2008, 2010; Yaro et al., 2015). Agrawal (2010) identified the pathways through which local institutions affect local communities` resilience to climate change, including (1) structuring the impacts and the vulnerability to climate change; (2) acting as a mode of delivery of external support; and (3) governing access to key resources.

Institutions are critical for the realization of climate-resilient agriculture. They represent the conduit through which CSA practices at the local level are implemented and sustained (FAO, 2013). However, for effective identification of appropriate climate-smart farming practices that fit different localities, there is a need for a collaborative concerted effort between formal and informal institutions at the

local level since they shape people's vulnerability to climate change (Agrawal, 2010, 2008; Yaro et al., 2015).

Institutions shape people's access to resources and the amount they can access at a time, which in turn, influences their adaptive capacity to climate change (Agrawal, 2010, 2008; Yaro et al., 2015). Traditional institutions play a critical role that influences CSA practices an individual can adopt. For example, in Africa, gender access to resources (particularly land) is mostly determined by traditional institutions such as chiefs, clan leaders and family heads (Deininger et al., 2017; Udry, 1996). The traditional systems put land and other resources under the control of chiefs, clan heads and family heads (typically men) who define how much land a family member can have, and in most cultural settings, customary systems prevent vulnerable populations (women's) access to land (Deininger et al., 2017) giving them weak land tenure and security. Perceived land tenure security incentivises particularly marginalized smallholder farmers to adopt resilient and smart farming practices (Kehinde et al., 2023; Ziro et al., 2023). Thus, land access, tenure and security shaped by local-level traditional institutions, norms and values have a significant influence on the willingness of households to embrace climate-smart farming practices. Put differently, power relations shaped by local-level institutions influence the adoption of CSA (Bernier et al., 2013).

Local-level institutions are also vital in terms of facilitating policies, programs, capacity development, information provision and dissemination that take into consideration the interests of marginalized groups like women (Yaro et al., 2015). Institutions enact regulations and policies which may either reinforce or contradict socioeconomic and cultural conditions (bargaining power and asset control) that influence CSA facilitation and adoption (Bernier et al., 2015). They further frame CSA into themes such as 'gender research, weather and climate, CSA management and food security' (Gardezi et al., 2022, p. 1) through which empowerment is delivered in the form of capacity building. In addition, knowledge and information on CSA practices, including climate variability are other crucial resources that can facilitate CSA adoption. Local-level institutions are essential because they provide climate information and extension services to rural farmers. Through that function, they aid local farmers in overcoming critical resource constraints that are pivotal in managing CSA practices and technologies (Meinzen-Dick et al., 2012). Figure 1 depicts the role of institutions in influencing CSA adoption.

3. Methods

3.1. Study setting

The study was conducted in the Nandom District in the Upper West region of Ghana. The district is bounded to the South by Jirapa, to the East by Lambussie and to the North and West by the Republic of Burkina Faso. The total land area of the district is 394.9 km^2. The district comprises 88 communities with 86% of its inhabitants living in rural areas (Abass et al., 2018; Sam et al., 2020). The district's total population as of 2021 is 51,328 with males being 25,577 and females being 25,751 (Ghana Statistical Service [GSS], 2021). The Nandom District is in the Guinea Savana zone of Ghana and has annual mean temperatures ranging between 27°C to 36°C. The district has its rainy season from May to October with mean annual rainfall being 916–1246 mm (Sam et al., 2020). Agriculture is the principal economic activity, employing over 85% of the population (Abass et al., 2018; Sam et al., 2020). The major crops grown in the district include millet, groundnut, sorghum, maize, soybean, cowpea, and Bambara groundnut, including yam (Abass et al., 2018; Sam et al., 2020). The district has several local-level organizations such as Nandom Deanery Integrated Rural Development Program (NANDIRDEP), the district department of agriculture, including social enterprises such as Tieme Ndo that support agriculture development.

3.2. Study design

The study employed a phenomenological design. With this approach, participants' lived experiences about the topic under investigation are described offering the researcher a unique outlook about the topic (Creswell, 2014). Moreover, we followed the phenomenological approach to enable us to have a deep individual-level understanding of the local-level institutions` innovations and challenges in facilitating CSA in the local area.

3.3. Participants' recruitment and data collection procedure

Four institutions in the district were purposively sampled, and the heads of each institution were

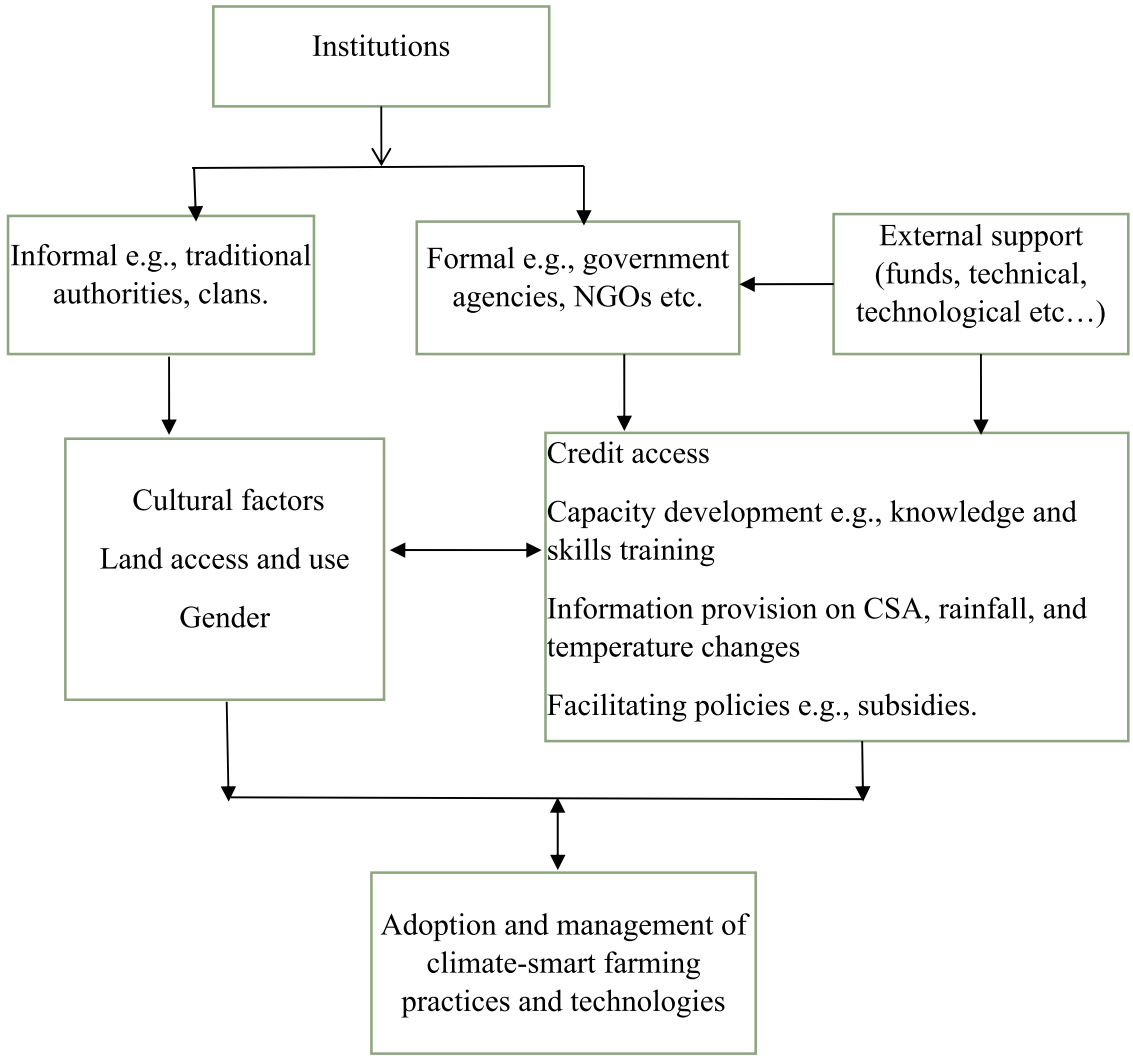

Figure 1. Institutions and CSA adoption influences.

Table 1. Study participants.

S/N	Participant	Code
1	Key informant	I-KN-1
2	Key informant	I-KN-2
3	Key informant	I-KN-3
4	Key informant	I-KN-4
5	Male farmer	I-MF-1
6	Male farmer	I-MF-2
7	Male farmer	I-MF-3
8	Male farmer	I-MF-4
9	Male farmer	I-MF-5
10	Male farmer	I-MF-6
11	Male farmer	I-MF-7
12	Female farmer	I-FF-1
13	Female farmer	I-FF-2
14	Female farmer	I-FF-3
15	Female farmer	I-FF-4

selected as key informants for interviews. These institutions primarily consisted of NGOs, social enterprises, and the district departments of agriculture and environment – whose operations focus on agriculture and environmental protection for development, particularly for rural households. In addition to institutional actors, 11 farmers, comprising 7 males and 4 females, were also conveniently sampled for the study (see Table 1). The interviews were guided by a semi-structured interview guide on how institutions: facilitate the adoption of climate-smart practices, the challenges they encounter, and the suggestions for improving institutions' effectiveness. The interviews were conducted at the participant's convenience.

For the farmers, the interviews were conducted at the participants' homes, usually around 1–5pm. Interviews were conducted in Dagara (a major local dialect in the study region) and English based on the participant's preference. The first author (SUN), who is a native speaker of the language, conducted interviews in Dagara. All the interviews were tape-recorded with the interviewees` consent and transcribed for analysis. Field notes were also taken to aid in the analysis.

3.4. Data analysis

Following the data collection phase, data analysis commenced promptly to prevent any risk of data loss. The analysis process encompassed several sequential steps and methodologies, all guided by a consistent set of principles. These steps included listening to audio recordings, transcribing interviews, examining field notes and transcript content, establishing a systematic data coding system, and connecting individual codes or data units to create overarching categories or themes, as outlined in Guba and Lincoln (1989). The transcripts and field notes were coded manually. We chose manual coding for practical purposes; it enabled us to break the data into smaller units and we felt the method gave us more insights into the data (Blair, 2015). After reading the transcripts numerous times, we noticed that line-by-line or sentence-level coding was meaningless, and paragraph-level contained a range of codes. So, we chose a meaning-making level in which text may be merged or split at various points, allowing 'a code to be made up of a line, sentence, or paragraph' (DeCuir-Gunby et al., 2011). So, we carefully read each transcript with attention to individual lines, sentences. And paragraphs while making judgements about their meanings and taking analytic notes. Thematic analysis was used to assess the codes as recommended by Braun and Clarke (2006). This entailed familiarizing oneself with the data (codes) to identify the extent, content, and trend of the interview responses (Braun & Clarke, 2006). We implemented a comprehensive data verification process, which involved a meticulous review of all coded data. This verification included thorough proofreading and comparison against the original audio recordings, ensuring the accuracy and high quality of the data utilized in the study. Additionally, to convey the participants' perspectives effectively, we incorporated direct quotations from them, providing key subjective insights from the individuals involved.

3.5. Ethics

Ethical standards were strictly followed. Participation in the study was strictly voluntary. Before their participation, participants were presented with informed consent forms and given the option to provide either written consent, in the form of a signature or thumbprint, or verbal consent, based on their individual preferences. Only persons who consented to participate were involved in the study. To ensure confidentiality and anonymity, codes were used to protect participants' identities (see Table 1).

4. Results

4.1. Thematic classification of findings

The analysis revealed several key themes regarding CSA facilitation. First, local-level institutions play a crucial role in promoting CSA practices; ensuring farmers receive the necessary support and resources. Second, farmers' perspectives highlight the importance of effective CSA facilitation, emphasizing the need for tailored approaches that resonate with their experiences and challenges. Lastly, institutional challenges such as limited resources, and inadequate training hinder the effective implementation of CSA. Together, these themes provide nuance and compelling evidence regarding how local-level institutions enhance the adoption and success of CSA among farmers in Ghana.

4.2. CSA facilitation and local-level institutions

The findings were very specific about the role of institutions in CSA facilitation within the district. The institutions actively promote and facilitate the adoption of a range of climate-smart farming practices through knowledge dissemination, and training farmers on CSA practices using farmer groups. First-hand demonstrations were employed to train the farmers through a decentralized process – although some farmers were not familiar with this approach. They also provided extension services and access to inputs via a credit system where 'earn as you pay' was deployed to reduce default rates. In this facilitation role, an institutional respondent had this to say:

> We work with the farmers to disseminate conservation agricultural practices. Key areas we usually engage in include training on zero tillage, and crop residual cover; offering extension services on planting methods, and chemicals application; providing farmers with

> weather information and helping them to understand it; and facilitating farmers' access to inputs (fertiliser and seeds). (I-KI-2)

Expanding more on how they have facilitated the CSA adoption process, another institutional respondent succinctly captures the elaboration of the narrative expressed by all institutional respondents, including farmers:

> We teach them water conservation practices such as zero or minimal tillage and residual cover. We also train them how to manage pests and diseases. You know, farmers are new to some of these new varieties of crops that mature early, some of these varieties that are not native to them. They need our support in terms of knowledge regarding their practices and management. (I-KI-1)

To facilitate CSA knowledge transmission, the institutions adopted field training to help farmers with first-hand experience. Two organizations, for example, adopted the 'Farmer-Field School' (FFS) model to train farmers on CSA practices such as zero tillage, crop residual cover, natural methods for pest and disease control and fertilizer application. Farmers in the operational communities are grouped, with their nominated representatives trained by the organizations for the FFS, such as pest and disease control, sustainable land management practices, soil and water conservation practices, and soil nutrient management, including fertilizer application. The trained representatives then serve as knowledge hubs, training and advising members of their farmer/community groups on what they have learnt during the FFS. For the institutions, the FFS is an effective model that enables them to disseminate knowledge on climate-smart farming practices, and extend their extension services to a large pool of farmers, as they said:

> The FFS is enabling us to reach out to several farmers regarding extension services. We do not have enough personnel when comes to the extension services. Therefore, we leverage the FFS model in knowledge dissemination on sustainable farming practices. That the method is helping. (I-KI-1)

> We are not many. The extension workers are very few. Therefore, through the FFS, we teach the people and train them on how to provide extension services to their group members. (I-KI-2)

The farmers confirmed that the institutions trained and offered them extension services on CSA practices. The farmers particularly emphasized how the FFS has been beneficial to them especially in helping them to adapt to limited water in the soil and improving their yields. The participants variously expressed such benefits as they said:

> The teaching they are doing is good. It is helping us a lot. You get to understand certain things we did not know from our traditional way of farming such as how to conserve soil water in the farm. (I-MF-1)

> To be honest, I appreciate the training a lot. They are empowering us with a lot of knowledge and skills and that is improving our farm yields through regular training and information on the appropriate timing of planting, and the crop varieties that can withstand drought. (I-FF-3)

> If you take the teachings seriously you will benefit from it. I have seen that my farms can somehow withstand drought spells. It helps in farm decision-making. (I-MF-5)

However, a section of farmers revealed that the FFS was not similar to their traditional farming practices, as they were technically demanding and time-consuming:

> How we used to do our farming practices is a bit different from the things they are teaching us. Because of that, I sometimes find it difficult to understand. I think they should blend it with the traditional practices that we are used to. That may help. (I-MF-2)

> I do not know whether is because I am old or what because I find some of the things they teach us to be somehow different from our traditional ways of farming here. Moreover, at my age, I am used to my traditional farming practices. (I-MF-7)

The institutions also facilitated access to inputs, thereby reducing the cost barrier to obtaining them. One organization, for example, adopted a 'Credit Extension Package' (CEP) model. The CEP is an asset-financing model that allows farmers to access inputs (e.g. improved seeds, pesticides, weedicides, and fertilizer) without any upfront cash deposit as a participant indicated:

> We acquire inputs like improved seeds, and fertilisers among others and sell them to farmers with zero upfront cash. The farmers only pay for the inputs after harvesting and selling the produce. (I-KI-2)

To reduce the risk of default payments and encourage and commit farmers to repay for the inputs accessed, the organization has a package known as the Commission on Repayment Deposit (CoRD). The innovative incentive package, CoRD, allows farmers to earn points for repaying for the input they acquired with no upfront cash. A farmer wins a point for every GHS6.00 ($\sim$ 0.5 USD) deposited with the organization to offset the cost of their inputs. The farmers can use

the accrued points to acquire additional inputs at no cost to them. The scheme, best described as 'earn as you pay', is intended to reduce a default rate from 15% to 0%. A respondent elaborated on how this works in practice:

> The Commission on Repayment Deposit earns farmers points on every minimum deposit for the input acquired. The accumulated points are converted to cash, and the equivalent of input of the farmer`s choice is given to him/her. It has encouraged farmers a lot and we have not had many issues with repayment. (I-KI-2)

The interviews also emphasized the significance of international programmes and funding in facilitating input access. For example, a key informant highlighted how externally funded projects have to some extent, helped them to facilitate the adoption of CSA:

> You see, the external projects have been instrumental in promoting the adoption of CSA. I would not mention the international organizations and donors involved but I can confirm to you that the "Climate Change Adaptation Programme" that is being implemented in the northern part of the country has helped us in making sure that farmers adopt CSA to make their farms resilient to climate change. (I-KI-3)

However, sentiments regarding the sustainability of externally funded projects were expressed. Organizations expressed concerns about how projects discontinue as soon as the funding for the projects ends. A participant expressed the following thoughts:

> We use donors' money to implement CSA farming practices. We do not have money on our own to do that. However, the problem with depending on external funding is that we are unable to continue the project when ends. Continuity is difficult. (I-KI-1)

This challenge was further illustrated when another key informant said:

> When the external funding for these climate change adaptation programmes expires, we are unable to continue. We do not have money to continue. (I-KI-3)

4.3. Farmers' perspectives for effective CSA facilitation by institutions

Local farmers' suggestions on how institutions can effectively promote and facilitate the adoption of climate-smart practices and technologies were intriguing. These perspectives span from the localization of CSA projects to the needs and priorities of the farmers, as against what the institutions think should be, through to inequality in resource access through the elimination of customary and social barriers in that regard. The findings demonstrate that without such an inequality dimension in CSA interventions, those worse off would be left behind in the innovation journey. Another dimension includes vigorously consulting with the farmers rather than assuming a 'know-it-all all' approach, which results in the dumping of ideas. For example, a male farmer said the following:

> I think the organizations both local and international championing the adoption of climate-smart practices have lost grasp of the reality. Projects are not localised and contextualised. Cultural elements are completely ignored in project design. They have forgotten that cultural values, norms, and other practices play a significant influence in people accepting or rejecting an innovation. (I-MF-1)

From the interviews, the usual modus operandi of institutions, which includes the identification and targeting of the most vulnerable with less adaptive capacity to climate extremes is useful but may not necessarily translate into the uptake of the practices if inequalities surrounding resource access and utilization are not addressed first. The customary practices, norms, and values, including other important social factors upheld by the traditional societies and institutions, were revealed fundamental to surmounting the social barriers to effective upscale and adaptation of CSA practises in traditional communities. A female farmer succinctly expressed this feeling in the following statement:

> I think the organizations operating in the field of agriculture in this area are making serious mistakes. When they come, they mostly focus on us the women. That is good and we like it, but there is a problem; going by the norms operating here, we do not have control over resources. It is our husbands who have such rights and so they determine what farming activity and practice we embark on at a particular time and on which land. (I-FF-4)

A male farmer who opined corroborated the above feeling:

> You see, these organizations both international and local are making serious mistakes and that is why the outcomes of their projects are sometimes disappointing. For me, I will say that climate change is real and if they want to reduce the impact on vulnerable people, I will suggest they should start incorporating social components to climate change projects to tackle and reduce the existing inequalities, particularly in land access. (I-MF-1)

Another participant buttressed this further when he said:

> You see, in every society, there are norms governing all facets of life. Social life is centred around social rules. So, what these organizations should do is come and ask us what norms and rules exist in our social setups regarding agriculture and how the implementation of climate change projects can be streamlined along such norms to facilitate adaption. (I-FF-3)

This opinion saw further emphasis and clarity in the contribution of yet another participant:

> There are delicate customs regarding land ownership. Do institutions consider that? We do not see that. (I-MF-2)

On another tangent, another participant relayed the important role of the institutions while emphasizing the need for a deeper contextual analysis. He said:

> We cannot do without them (institutional actors). They do help us a lot. They help us get input. They give us guidance on best farming practices. The problem I have with them is that they think they know it all. They do not consult us on anything. They only come to tell us what to do. I do not doubt that they know the best of the work they do, but I think any intervention anywhere will have maximum impact when local people are involved in the drawing up of the intervention. It situates the intervention within the local cultural systems. (I-MF-7)

4.4. Institutional challenges in facilitating CSA

The interviews revealed that the institution faced myriad challenges in facilitating CSA practices. Here, we put these challenges into internal (financial constraints, logistical constraints in terms of computers and motorbikes for research and mobility purposes and human resource deficits) and external challenges (apprehension towards the adoption of new knowledge and technology on the part of the farmers). In terms of the internal challenges, it was found that the institutions were financially and logistically constrained. Most of the organizations did not have adequate computers to facilitate their dissemination/training activities on the field as one of the participants said:

> How can you function effectively these days in your field without a computer? We do not have computers and it is making our job difficult. Even preparing a presentation and illustrating with pictures and diagrams to aid farmers in pictorial understanding of what is being discussed regarding CSA is a challenge. This has affected negatively our FFS training activities. (I-KI-2)

Information technologies such as computers are crucial for the efficient administration of any organization as they facilitate information sharing and other research and knowledge-seeking ventures. In addition to the above, the interviews revealed that the institutions did not have adequate motorbikes and those available were faulty and could not even be used. A participant concisely captured this challenge in the following excerpt:

> We do not have motorbikes to move around. We do not have computers to learn new things. In terms of finance, we are a local non-profit social enterprise, and we depend on donors. Most times, it is difficult for us to operate. Capacity-wise, we have a problem. Because we do not have these logistics, especially motorbikes, we are unable to reach most villages to provide them with extension services. (I-KI-2)

The research further found inadequate human resources with relevant competencies as another serious challenge facing organizations. An institutional participant succinctly captured this problem as he said:

> Our problems are too much. We want to do our best to help the farmers around, but we are not many. You cannot divide yourself to go to so many places in a day or week. It`s not possible. There are also no computers to help us learn to improve our competencies. All these boil down to finance. If we have money, we will hire more people, buy motorbikes and computers, and organize training to update our skillset through some of these in-service programs. (I-KI-1)

Externally, the informant revealed that farmers were apprehensive about adopting the new practices that they were teaching them. It was further revealed that such apprehensiveness is a result of the fear that they will be unable to manage new practices and technologies that they do not know of as reflected in the following excerpt:

> Sometimes the farmers are apprehensive about taking up some of the new techniques, all because they do not have the knowledge to manage it. It`s difficult to convince them to adopt practices that they know they don't know how to manage. (I-KI-3)

This opinion was further emphasized by another institutional respondent when he said:

> It is difficult to convince people to adopt the new practices that we teach them. I do not know what their problems are. We are teaching you things that will enable you to adapt well to climate change and environmental issues, yet you are adamant about taking it. (I-KI-1)

Furthermore, farmers collaborated and further emphasized these challenges highlighted by the institutional participants as they said:

> … the agricultural directorate in the district is handicapped if you ask me … They do not have a means of mobility. Look, I have been farming bananas, cassava and rice along the Black Volta. I have been going to the agric for them to come and visit my farms and advise me and up to date they have not come. They are limited to only a few farms because of logistical (mobility) constraints. So at the end of the year majority of the farmers will never see them. (I-MF-1)

5. Discussion

This paper aims to explore the role of local-level institutions in promoting the adoption of CSA and highlights key findings. Our investigation reveals that these institutions employ strategies like FFS and credit extension packages to enhance farmers' capacity and overcome financial barriers to CSA practices. However, logistical constraints emerge as a significant challenge, impeding the effective facilitation of CSA adoption by local-level institutions.

Institutions are critical to climate change adaptation (Agrawal, 2008, 2010) and the upscale of innovative practices. Their roles at multiple scales are acknowledged in the analysis and implementation of climate change adaptation and mitigation innovations. Similarly, in this study, we found that the institutions provide a range of services, including training on CSA practices, extension services and facilitating farmers` access to inputs. Farmer-Field-School (FFS) was adopted as an innovation to deal with the shortage of extension officers in providing relevant knowledge needed for managing CSA. The method, as revealed, is used to empower farmers with knowledge and skills for managing CSA practices. The finding is in line with other existing studies that have established that FFS training programs help farmers acquire relevant technical knowledge that is crucial for managing climate-smart farming practices (Davis et al., 2012; Gichuki et al., 2023) and for behavioural changes among farmers towards adaptive farming practices (Bakker et al., 2021). The finding points to the innovativeness of the institutions in providing the knowledge for CSA through FFS. Although the use of FFS is not new in agricultural knowledge dissemination and empowerment, it facilitates the transmission of knowledge and information, including skills development for managing CSA practices (Gichuki et al., 2023).

The use of the 'Credit Extension Package' was another innovation through which the institutions helped vulnerable and small-scale poor farmers to acquire inputs. Access to inputs plays a critical role in improving farmers' adaptive capacity. For resource-poor farmers, the cost of obtaining inputs can act as a significant barrier to the adoption of CSA. Local institutions, therefore, become key actors in facilitating poor farmers` access to resources, including inputs to enhance their adaptive capacity to climate change (Agrawal, 2008, 2010; Meinzen-Dick et al., 2012). Importantly, this finding shows an innovative strategy that local-level institutions can adopt to help poor farmers access critical inputs such as seeds and fertilizer (Lipper et al., 2014; Makate, 2020).

Conterminously, the study also showed that international and donor supports are critical lifelines in enhancing local-level institutions' ability to facilitate resources, knowledge, information, and input access, essential for CSA adoption. The finding is congruent with the argument by Kurgat et al. (2020), and Hellin and Fisher (2019) that (donor) agricultural programmes create an enabling environment for resource-poor farmers to effectively adapt to climate change. However, it was realized that most of the funding packages for agricultural sustainability are externally driven with limited government support. This puts the long-term sustainability of institutional operation and the upscale of CSA in a critical position. Often CSA projects cease to operate as soon as the donor funding period elapses. As Kurgat et al. (2020) argued, reliance on only donors to fund CSA projects is unhelpful because it is unsustainable and often reverses the impacts of projects. For example, we observed that local organizations and agencies that depended on external sources for funding were unable to execute programmes when donors did not support them. This affected the institutions' access to logistics such as computers and motorbikes which inherently hampered the capacity of institutions and extension officers in terms of knowledge dissemination and engaging in field practices and monitoring. Hence, there is a need for a shift in national and subnational policies toward making adequate financial packages available for local-level institutions that are involved in CSA dissemination for the longer-term development of resilient agricultural systems.

The study also revealed that farmers sometimes expressed reluctance when it came to adopting new climate-smart practices introduced by various institutions. This reluctance was particularly pronounced among female interviewees, who raised concerns

about their limited access to resources, notably land, and their lack of influence in deciding which climate-smart practices to adopt. Several factors, including age, lack of formal education, gender disparities, and inadequate alignment of climate-smart agriculture (CSA) concepts and practices with local contexts, contributed to this reluctance among some farmers. Efforts to promote CSA will have to be tailored to reflect the specific conditions of individual local communities (Knowler & Bradshaw, 2007).

Another notable challenge was that individuals selected from farmer groups to attend FFS training sessions were often older and lacked the literacy skills necessary to fully engage with the extensive training modules. Consequently, many of these trainees struggled to grasp the content presented to them, especially when it was not adapted to their specific farming contexts. This lack of alignment created apprehension among them regarding the CSA concept and practices. Therefore, it is essential to recognize the importance of understanding the local context when facilitating CSA initiatives. Selecting younger, literate, and more energetic individuals, while ensuring gender diversity among farmers participating in FFS, is pivotal for achieving a lasting impact when disseminating CSA innovations within local farming communities. Similarly, the power dynamics between men and women in Africa have historically been influenced by cultural practices, values, and norms, which, in turn, have shaped agricultural practices at the household level (Udry, 1996). Consequently, CSA projects must adopt a holistic approach that considers these significant social factors, identifies potential barriers to adoption early in the process, and addresses them effectively. This approach calls for the involvement of social institutions in the planning and implementation of CSA programs, recognizing the central role of social systems in both agriculture and climate change adaptation, as well as localizing and or contextualizing CSA projects so that local views, values, and norms are well recognized (Yaro et al., 2015).

6. Strengths and limitations

The strength of the study lies in the employment of an in-depth qualitative interview approach to explore innovations and strategies used by local-level institutions to facilitate CSA adoption. The in-depth qualitative approach enabled us to explore in depth the innovations and challenges, including local views for improving institutional effectiveness. The robustness of the coding method is another strength of the study that is worth nothing. It increases the trustworthiness of the results. However, the small sample size used is a limitation of the study and affects the generalization of the study findings. As such, transferring the findings to different contexts must be done cautiously. The limitation warrants further studies that employ a large sample size.

7. Conclusion

This study delved into the perspectives of local institutional actors and farmers regarding the dissemination of CSA practices. While the majority of farmers recognize the importance of CSA innovations in enhancing their farming practices and crop yields, there persist certain challenges negatively impacting the institutional implementers' ability to disseminate these innovations. These challenges include insufficient logistical support and a lack of sustainable funding. Furthermore, the FFS training sessions have not been effectively tailored to the local context, resulting in difficulties for some farmers in comprehending the content presented during these sessions. These findings hold significant scientific, policy, and practical implications in several respects. First, the study's findings underscore the need for policymakers and relevant authorities to address the challenges faced by institutional implementers in disseminating CSA practices. Policymakers and authorities such as the Ministry of Food and Agriculture should consider allocating resources and designing policies that support the training and capacity-building of implementers to ensure a more successful dissemination process. Second, policy and programme designers should invest in tailoring training content to match the specific needs and comprehension levels of the target farming communities. By doing so, FFS sessions can become more effective in conveying CSA concepts and practices. Third, Policymakers and programme managers should take note of the difficulties some farmers face in understanding and adopting CSA practices. This calls for innovative strategies to enhance farmers' engagement and participation in training sessions. Promoting interactive and participatory learning methods within FFS can lead to improved understanding and greater adoption of CSA innovations. Fourth, policymakers and agricultural development partners such as social enterprises, donor agencies, and financial institutions

should focus on establishing funding mechanisms that go beyond short-term projects and grant cycles. Sustainable funding models can help maintain the momentum of CSA dissemination efforts, ensuring that farmers continue to benefit from these innovations over time. This, in turn, can contribute to increased agricultural productivity and resilience in the face of climate change, with positive implications for food security and livelihoods in the region. Lastly, addressing the barriers presented by social and cultural power dynamics at the community level is crucial, especially for vulnerable groups like women, to ensure the successful uptake of CSA practices. However, it is worth noting that sociocultural power-related challenges are complex and require careful attention and consideration at every stage of CSA training events and interventions.

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No potential conflict of interest was reported by the author(s).

Data availability

The data is available with the corresponding author upon reasonable request.

ORCID

Stephen Uwumbordo Nachibi http://orcid.org/0000-0003-3318-7302
Anthony Kwame Morgan http://orcid.org/0000-0001-7904-9955

References

Abass, R., Mensah, A. M., & Fosu-Mensah, B. Y. (2018). The role of formal and informal institutions in smallholder agricultural adaptation: The case of Lawra and Nandom Districts, Ghana. *West African Journal of Applied Ecology*, *26*(SI), 56–72.

Adesipo, A., Fadeyi, O., Kuca, K., Krejcar, O., Maresova, P., Selamat, A., & Adenola, M. (2020). Smart and climate-smart agricultural trends as core aspects of smart village functions. *Sensors*, *20*(21), 5977. https://doi.org/10.3390/s20215977

Agrawal, A. (2008). *The role of local institutions in adaptation to climate change*. World Bank.

Agrawal, A. (2010). Local institutions and adaptation to climate change. In R. Mearns & A. Norton (Eds.), *Social dimensions of climate change: Equity and vulnerability in a warming world* (pp. 173–198). World Bank Publications.

Bakker, T., Dugué, P., & De Tourdonnet, S. (2021). Assessing the effects of Farmer Field Schools on farmers' trajectories of change in practices. *Agronomy for Sustainable Development*, *41*(2), 1–15.

Barasa, P. M., Botai, C. M., Botai, J. O., & Mabhaudhi, T. (2021). A review of climate-smart agriculture research and applications in Africa. *Agronomy*, *11*(6), 1255. https://doi.org/10.3390/agronomy11061255

Bernier, Q., Franks, P., Kristjanson, P., Neufeldt, H., Otzelberger, A., & Foster, K. (2013). *Addressing gender in climate-smart smallholder agriculture. ICRAF Policy Brief 14*. World Agroforestry Centre.

Bernier, Q., Meinzen-Dick, R. S., Kristjanson, P. M., Haglund, E., Kovarik, C., Bryan, E., Ringler, C., & Silvestri, S. (2015). *Gender and institutional aspects of climate-smart agricultural practices: Evidence from Kenya*. CCAFS Working Paper No. 79. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Retrieved December 15, 2019, from www.ccafs.cgiar.org

Blair, E. (2015). A reflexive exploration of two qualitative data coding techniques. *Journal of Methods and Measurement in the Social Sciences*, *6*(1), 14–29. https://doi.org/10.2458/v6i1.18772

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101.

Campbell, B. M., Thornton, P., Zougmoré, R., Van Asten, P., & Lipper, L. (2014). Sustainable intensification: What is its role in climate smart agriculture? *Current Opinion in Environmental Sustainability*, *8*, 39–43. https://doi.org/10.1016/j.cosust.2014.07.002

Chandra, A., McNamara, K. E., & Dargusch, P. (2018). Climate-smart agriculture: Perspectives and framings. *Climate Policy*, *18*(4), 526–541. https://doi.org/10.1080/14693062.2017.1316968

Cloete, P. C. (2013). Institutions and agricultural development: The case of the Northwest Province in South Africa. *African Journal of Agricultural Research*, *8*(27), 3495–3504. https://doi.org/10.5897/AJAR12.1604

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Sage Publications.

Davis, K., Nkonya, E., Kato, E., Mekonnen, D. A., Odendo, M., Miiro, R., & Nkuba, J. (2012). Impact of farmer field schools on agricultural productivity and poverty in East Africa. *World Development*, *40*(2), 402–413. https://doi.org/10.1016/j.worlddev.2011.05.019

DeCuir-Gunby, J. T., Marshall, P. L., & McCulloch, A. W. (2011). Developing and using a codebook for the analysis of interview data: An example from a professional development research project. *Field Methods*, *23*(2), 136–155. https://doi.org/10.1177/1525822X10388468

Deininger, K., Savastano, S., & Xia, F. (2017). Smallholders' land access in sub-Saharan Africa: A new landscape? *Food Policy*, *67*, 78–92. https://doi.org/10.1016/j.foodpol.2016.09.012

Dorward, A. R., Kirsten, J. F., Omamo, S. W., Poulton, C., & Vink, N. (2009). Institutions and the agricultural development challenges in Africa. In J. F. Kirsten, A. R. Dorward, C. Poulton, and N. Vink (Eds.), *Institutional economics perspectives on African agricultural development*. International Food Policy Research Institute.

Food and Agricultural Organization [FAO]. (2010). *"Climate-smart" agriculture: Policies, practices and financing for food security, adaptation and mitigation*. FAO.

Food and Agricultural Organization [FAO]. (2013). *Climate-smart agriculture sourcebook*. Retrieved January 5, 2020, from www.fao.org

Gardezi, M., Michael, S., Stock, R., Vij, S., Ogunyiola, A., & Ishtiaque, A. (2022). Prioritizing climate-smart agriculture: An organizational and temporal review. *Wiley Interdisciplinary Reviews: Climate Change*, *13*(2), e755. https://doi.org/10.1002/wcc.755

Ghana Statistical Service [GSS]. (2021). *Ghana 2021 population and housing census: General report, Volume 3A, population of regions and districts*. Retrieved December 8, 2023, from https://statsghana.gov.gh/gssmain/fileUpload/pressrelease/2021%20PHC%20General%20Report%20Vol%203A_Population%20of%20Regions%20and%20Districts_181121.pdf

Ghimire, R., Khatri-Chhetri, A., & Chhetri, N. (2022). Institutional innovations for climate smart agriculture: Assessment of climate-smart village approach in Nepal. *Frontiers in Sustainable Food Systems*, *6*, 734319. https://doi.org/10.3389/fsufs.2022.734319

Gichuki, C., Osewe, M., & Ndiritu, S. W. (2023). Dissemination of climate smart agricultural knowledge through farmer field schools (FFS): Analyzing the application CAS knowledge by smallholder farmers. *International Journal of Development Issues*, *22*(3), 399–417. https://doi.org/10.1108/IJDI-04-2023-0109

Guba, E. G., & Lincoln, Y. S. (1989). *Fourth-generation evaluation*. Sage Publications.

Hellin, J., & Fisher, E. (2019). Climate-smart agriculture and non-agricultural livelihood transformation. *Climate*, *7*(4), 48. https://doi.org/10.3390/cli7040048

Kehinde, M. O., Shittu, A. M., Oriade, O. A., & Edewor, S. E. (2023). Land tenure, land use antecedents, and willingness to embrace resilient farming practices among smallholders in Nigeria. *Frontiers in Sustainable Food Systems*, *7*, 999905. https://doi.org/10.3389/fsufs.2023.999905

Knowler, D., & Bradshaw, B. (2007). Farmers' adoption of conservation agriculture: A review and synthesis of recent research. *Food Policy*, *32*(1), 25–48. https://doi.org/10.1016/j.foodpol.2006.01.003

Kurgat, B. K., Lamanna, C., Kimaro, A., Namoi, N., Manda, L., & Rosenstock, T. S. (2020). Adoption of climate-smart agriculture technologies in Tanzania. *Frontiers in Sustainable Food Systems*, *4*, 55. https://doi.org/10.3389/fsufs.2020.00055

Lipper, L., Thornton, P., Campbell, B. M., Baedeker, T., Braimoh, A., Bwalya, M., Caron, P., Cattaneo, A., Garrity, D., Henry, K., Hottle, R., Jackson, L., Jarvis, A., Kossam, F., Mann, W., McCarthy, N., Meybeck, A., Neufeldt, H., Remington, T., … Torquebiau, E. F. (2014). Climate-smart agriculture for food security. *Nature Climate Change*, *4*(12), 1068–1072. https://doi.org/10.1038/nclimate2437

Makate, C. (2020). Local institutions and indigenous knowledge in adoption and scaling of climate-smart agricultural innovations among sub-Saharan smallholder farmers. *International Journal of Climate Change Strategies and Management*, *12*(2), 270–287. https://doi.org/10.1108/IJCCSM-07-2018-0055

Meinzen-Dick, R., Bernier, Q., Haglund, E., Markelova, H., & Moore, K. (2012). Identifying the institutions for climate-smart agriculture. In *Presented at the International Research Workshop on Institutions for Inclusive Climate-Smart Agriculture, Nairobi, Kenya, 10–13 September. Collective Action, Property Rights and Institutions (CAPRi) and Climate Change, Agriculture and Food Security Programs of the CGIAR*. http://www.capri.cgiar.org/wks_0912.asp.

Nachibi, S. U., Ganee, E. M., & Morgan, A. K. (2023). Influences of religious belief and cultural values and norms on climate-smart agriculture (CSA) adoption: Insights from Northern Ghana. *The Journal of Development Practice*, *8*, 31–46.

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. https://doi.org/10.1080/14693062.2021.2023451

Sam, K. O., Botchway, V. A., Karbo, N., Essegbey, G. O., Nutsukpo, D. K., & Zougmoré, R. B. (2020). Evaluating the utilisation of Climate-Smart Agriculture (CSA) technologies and practices among smallholder farmers in The Lawra, Jirapa and Nandom districts of Ghana. *Ghana Journal of Agricultural Science*, *55*(2), 122–144. https://doi.org/10.4314/gjas.v55i2.10

Taylor, M. (2018). Climate-smart agriculture: What is it good for? *The Journal of Peasant Studies*, *45*(1), 89–107. https://doi.org/10.1080/03066150.2017.1312355

Thorbecke, E., & Morrisson, C. (1989). Institutions, policies and agricultural performance: A comparative analysis. *World Development*, *17*(9), 1485–1498. https://doi.org/10.1016/0305-750X(89)90088-0

Totin, E., Segnon, A. C., Schut, M., Affognon, H., Zougmoré, R. B., Rosenstock, T., & Thornton, P. K. (2018). Institutional perspectives of climate-smart agriculture: A systematic literature review. *Sustainability*, *10*(6), 1990. https://doi.org/10.3390/su10061990

Udry, C. (1996). Gender, agricultural production, and the theory of the household. *Journal of Political Economy*, *104*(5), 1010–1046. https://doi.org/10.1086/262050

World Bank. (2011). *Climate-smart agriculture: A call to action*. World Bank Group.

World Bank. (2015). *Future of food: Shaping a climate-smart global food system*.

World Bank. (2018). *Scaling up climate-smart agriculture through the Africa climate business plan*.

World Bank. (2021). *Climate-smart agriculture*. Retrieved February 1, 2023, from https://www.worldbank.org/en/topic/climate-smart-agriculture

Yaro, J. A., Teye, J., & Bawakyillenuo, S. (2015). Local institutions and adaptive capacity to climate change/variability in the northern savannah of Ghana. *Climate and Development*, *7*(3), 235–245. https://doi.org/10.1080/17565529.2014.951018

Ziro, J. S., Kichamu-Wachira, E., Ross, H., & Palaniappan, G. (2023). Adoption of climate-resilient agricultural practices among the Giriama community in South East Kenya: Implications for conceptual frameworks. *Frontiers in Climate*, *5*, 1032780. https://doi.org/10.3389/fclim.2023.1032780