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Gendered impacts of conservation agriculture: Evidence of empowerment and constraint from Northwestern Ghana

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ABSTRACT

Across sub-Saharan Africa, women serve as key actors in smallholder agricultural production. However, they face gendered inequalities in land access, knowledge, labor, and farm and household decision-making, which continue to impede their capacity to benefit from innovative agricultural interventions such as conservation agriculture (CA). This research assesses how women are empowered through resource access, household decision-making power, workload dynamics, control of income, food security, and psychosocial achievement through their participation in the Ghana Agricultural Sector Investment Programme's Conservation Agriculture (GASIP-CA) in northwestern Ghana. The study employed a mixed-method research approach, comprising a survey of 180 beneficiary women farmers, 6 focus group discussions, and 10 key informant interviews. The study found that GASIP-CA has significantly improved women's access to resources through capacity-building training on CA principles and access to labor-saving technologies. But structural challenges such as insecure land access persisted. There have been improvements in women's agency in household and community decision-making dynamics, as many reported training men on CA principles. Women also made significant achievements in terms of improved income and savings, food security, self-esteem, soil fertility, and household cohesion. Therefore, it was concluded that CA interventions can play a central role as a multidimensional empowerment pathway for addressing gendered disparities in land access, household decision-making dynamics, and labor dynamics. Agricultural policies and programs should target secure land and other resource access, leadership, and capacity-building opportunities for women as a basis for their empowerment.

Contribution/Originality: This study contributes to the limited empirical literature on gender and Conservation Agriculture in West Africa, particularly Ghana, by providing mixed-methods evidence on women's empowerment outcomes. It offers new insights into how resource access, agency, and livelihoods are simultaneously enabled and constrained within community-based agricultural interventions.

1. INTRODUCTION

Women play a very important role in the agricultural economy in sub-Saharan Africa, contributing a large share to food production and processing, as well as household nutrition (Muzari, 2016). However, the productivity and welfare of women remain limited by persistent gender disparities in terms of access to land, labour, inputs, extension services, and influence over production and household decision-making (Muzari, 2016). These structural inequalities constrain women's agency in agriculture and limit their ability to access emerging opportunities presented by climate-smart and sustainable agriculture intensification strategies. Conservation Agriculture (CA), which is based on minimal soil disturbance, permanent soil cover, and crop diversification, has been widely advocated as the way to

restore soil fertility, improve yields, and increase smallholder resilience in the face of increasing challenges due to climate change across Africa (Corbeels, Thierfelder, & Rusinamhodzi, 2015; Kassam, Friedrich, & Derpsch, 2019). As agriculture interventions across sub-Saharan Africa, including the Ghana Agricultural Sector Investment Programme (GASIP), are widely promoting CA as a climate-smart agriculture strategy, it is imperative to understand its gendered impacts.

Evidence suggests that CA is not gender-neutral with respect to either its accessibility or beneficial outcomes. A review of the literature in sub-Saharan Africa reveals that women face more constraints in CA adoption arising from insecure tenure of land, labour constraints, poor capacity-building opportunities, and exclusion from extension services (Wekesah, Mutua, & Izugbara, 2019; Zulu-Mbata & Chapoto, 2016). Farnworth et al. (2016) make a similar assertion that CA schemes often neglect household power relations, disregarding the fact that men and women do not enjoy equal decision-making roles due to deep-rooted gender norms. This means that more of the labour-intensive practices of CA, such as residue maintenance and weeding, are often given to women without necessarily ensuring any returns in terms of income or decision-making roles (Farnworth et al., 2016).

These observations are also confirmed by country-level evidence. In Zambia, for example, Zulu-Mbata and Chapoto (2016) indicate that while CA enhanced productivity and food security, the benefits were largely reaped by male-headed households, who own the land as well as control the sales of farm products. Carney and Carney (2018) also note that while CA trainings led to a shift in household expenditure towards women's preferred goods, they also reconfigured farm labour dynamics, increasing the labour hours required for women. Studies in Malawi indicate that, despite clear improvement in the women's household decision-making power, status, and competence, there is still much to be done in bridging the entrenched gender gaps (Hove & Gweme, 2018; Kunzekweguta, Rich, & Lyne, 2017; Maher, Wagstaff, & O'Brien, 2015). Moreover, Tsige, Synnevåg, and Aune (2020) find that women in Ethiopia are hindered by gender-specific constraints such as inadequate land user rights and credit access, limited access to training and extension services, and restricted access to farmer-groups, which influence their ability to adopt climate-smart agriculture strategies. These studies clearly indicate that CA operates with existing gender-based agrarian structures that sometimes enable women's empowerment but mostly constrain their empowerment. Evidence from Asia also confirms this situation. In Nepal, research reveals that empowering outcomes in women's CA participation are hindered by sociocultural barriers, such as household chores, and knowledge and resource constraints (Maharjan & Gonzalvo, 2025; Maharjan, Singh, & Gonzalvo, 2023).

Studies from the Ghanaian context offer an important foundation for understanding CA's gender outcomes. Gender roles in agriculture are still strongly polarised, with men dominating access to farmland, key production decisions, and crops of high value, while women are responsible for labour-intensive activities and less-secure plot for production (Mensah & Fosu-Mensah, 2020). Moreover, a more recent study on cocoa farmers clearly indicates that women have less control over decision-making and resources such as land, capital, and agricultural tools, which are important factors that determine agricultural outcomes and household well-being (Amoako et al., 2025). Within the broader context of climate-smart agriculture, evidence from northern Ghana indicates that women's adoption of climate-smart practices such as CA is conditioned by their negotiation power within the household, age, marital status, and tenure security of their farmland (Antwi & Antwi-Agyei, 2023). Meanwhile, agronomic studies explicitly indicate that CA enhances productivity gains and reduces input costs, though they did not address who controls the benefits within the household (Adam & Abdulai, 2022; Dalton, Yahaya, & Naab, 2014; Issahaku & Abdulai, 2020; Setsoafia, Ma, & Renwick, 2022). Notably, these studies indicate the effectiveness of CA in improving yields and income, but its empowerment outcomes remain understudied in Ghana.

There is a convergence of literature on three key findings on CA across sub-Saharan Africa. Firstly, CA adoption and impacts are strongly determined by gender disparities in land access, labour, knowledge, and decision-making power. Secondly, women's empowerment through CA systems depends on their resource access, intra-household support, and the authority to control benefits, which are not necessarily inherent in CA interventions. Thirdly, CA

benefit distribution is determined by existing agrarian structures, indicating that technical agronomic technologies do not necessarily generate transformations of gender disparities without broader institutional or social change.

Despite these findings, considerable gaps in the understanding of CA gendered impacts continue to exist, especially in West Africa. Currently, research works that discuss the effects of CA on women's empowerment in Ghana are limited or non-existent, and no study seems to combine quantitative indicators with qualitative insights about women's empowerment under CA interventions. Furthermore, very little research appears to focus on the extent to which CA shapes women's resilience mechanisms or intra-household dynamics. These gaps are important since initiatives such as GASIP are increasingly promoting CA as a means of improving smallholder livelihoods, yet there is a dearth of evidence on whether, how, and for whom empowerment occurs. Therefore, this study fills these gaps in the literature by investigating the gendered impacts of CA on women who participated in the GASIP-CA in Northwestern Ghana. The study examines the impact of CA on women's access to resources, decision-making authority, income control, agricultural productivity, workload dynamics, food security, and empowerment perceptions. This paper extends the literature on CA impacts to include women's empowerment and provides relevant policy recommendations for designing and implementing CA interventions that are equitable and gender-transformative.

2. THEORETICAL FOUNDATION: KABEER'S EMPOWERMENT THEORY

Kabeer (1999) defines empowerment as the process by which people who are denied the ability to make strategic life choices achieve that ability. She identifies three closely intertwined dimensions of empowerment: resources (the context in which the choices are made), agency (the ability to set goals and pursue them), and achievements (the outcomes of these decisions). Resources are more than just material assets; they also include human and social resources that enhance the ability to make informed choices. Agency is revealed in overt forms of decision-making and more subtle forms of resistance, negotiation, or 'voice'. Achievements, on the other hand, refer to the extent to which changes in resources and agency are transformed into well-being outcomes for people's livelihoods.

A number of subsequent studies have operationalised this triad in various empirical applications. Huis, Hansen, Otten, and Lensink (2017), for instance, reinterprets (Kabeer, 1999) framework into a three-dimensional approach that focuses on micro (personal), meso (relational), and macro (societal) levels of empowerment, with each level combining resource, agency, and achievements. Their study reveals that interventions may gradually alter the personal beliefs of individuals, such as their self-efficacy, which can lead to the reconfiguration of intra-household decision-making and subsequently, the restructuring of gender norms (Huis et al., 2017). This conceptualisation highlights Kabeer's argument that empowerment is a dynamic and non-linear process, rather than a static state.

In agricultural research, the Women's Empowerment in Agriculture Index (WEAI), which is grounded in Kabeer's framework, create a multidimensional index that measures empowerment through the compilation of data related to resources, agency, and achievements in five areas: production decision-making, resource access and decision-making power over their use, authority over income use, community leadership, and allocation of time (Alkire et al., 2013). The index also measures women's achievements relative to men in the household. Sraboni, Malapit, Quisumbing, and Ahmed (2014) utilise the WEAI among women in Bangladesh and find that women's empowerment in agriculture is positively related to dietary diversity and per capita calorie availability, establishing a link between women's agency in decision-making regarding production and income and tangible achievements of food security. In Northern Ghana, Malapit and Quisumbing (2015) indicate that certain dimensions of women's empowerment, such as credit control, have a significantly positive association with dietary diversity as opposed to weight outcomes, highlighting that various resource-agency combinations can produce diverse achievements despite being in the same setting.

In this study, Kabeer's theory is used as the analytical lens to examine women's empowerment outcomes as a result of participating in the GASIP-promoted CA intervention in Northwestern Ghana. As presented in Figure 1,

resources are conceptualised as women's access to land, group membership, CA training and extension, as well as physical resources like farm tools and inputs. Agency, on the other hand, is operationalized through women's self-reporting of their decision-making power in their households, their authority over farm income use, perception of change in their workload, as well as the qualitative reports of their lived experiences regarding land access negotiations and household power dynamics. Finally, the achievement dimension is operationalized to involve tangible livelihood and wellbeing outcomes, including changes in soil health, farm productivity and yields, food security indicators, financial inclusion, psychosocial wellbeing, and their perception of overall empowerment. Therefore, the study synthesizes both quantitative indicators and qualitative narratives and maps them through Kabeer's framework of resources–agency–achievements triad, which allows for the investigation of how and to what extent GASIP-CA shapes the real choices available to women participants and the empowerment outcomes of those choices.

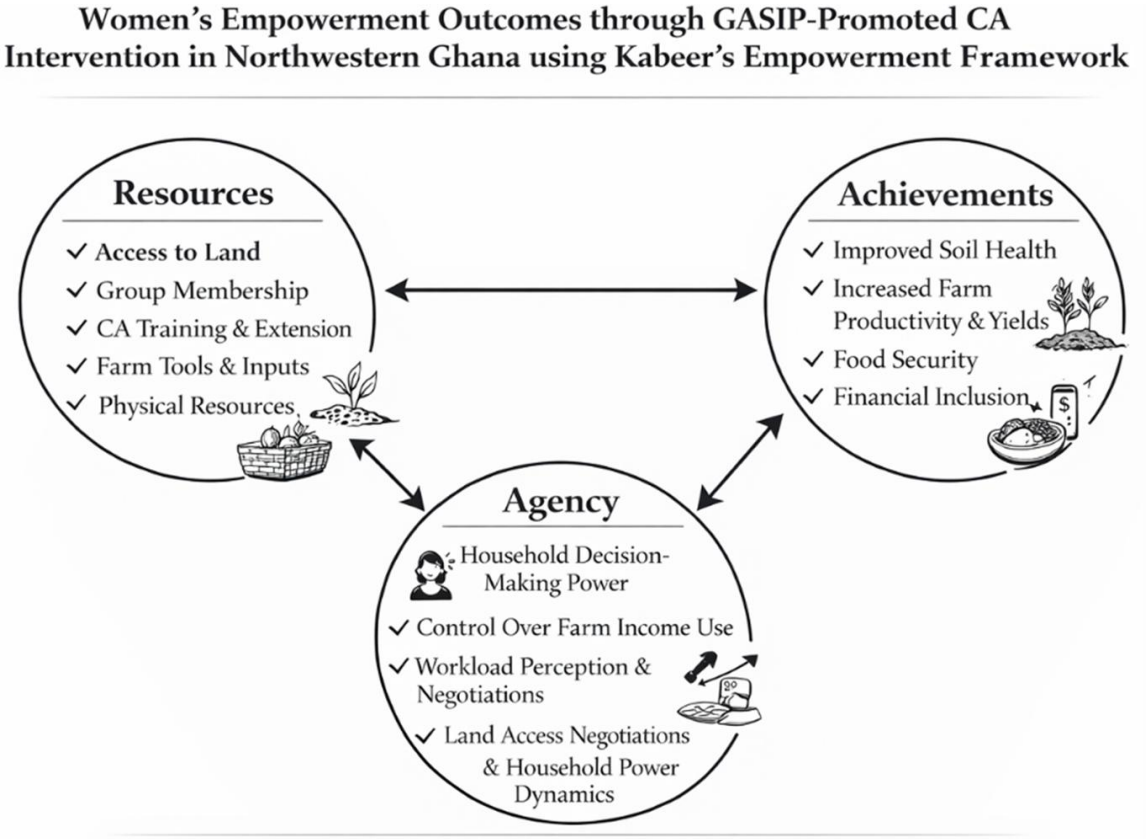

Figure 1. Women's Empowerment under GASIP-CA Intervention.

3. MATERIALS AND METHODS

3.1. Research Design

The study employed a convergent mixed methods design, which allows for the concurrent quantitative and qualitative data collection and analysis to provide a more complete understanding of women's empowerment outcomes under CA interventions. The mixed-method design is deemed appropriate for investigating complex social phenomena like gender relations, decision-making, or empowerment that cannot be comprehensively assessed by a single methodology (Creswell & Clark, 2017; Tashakkori & Teddlie, 2010). The quantitative strand enables the measurement of the indicators of empowerment from a representative sample of women participants, while the qualitative strand provides a deeper contextual understanding of power relations in households, land negotiations, and the lived experiences of women beneficiaries regarding empowerment under GASIP-CA.

3.2. Study Area and Population

This study was conducted in the Wa West District and Jirapa Municipality in the Upper West Region of Ghana, where the GASIP-CA program was implemented from 2015 to 2023 through farmer training, group mobilisation, extension, and input support. These areas are characterized by smallholder rainfed agriculture systems with high climate variability. The participants in the study include women who benefited from the GASIP-CA intervention.

3.3. Sampling, Participants, and Data Collection

For the quantitative phase, a total of 180 women CA farmers were selected using a simple random sampling technique from official lists of beneficiaries obtained from the district agricultural offices. Using random sampling gave each participant an equal chance of being selected for the study, which minimised the risk of sampling bias and enhanced the generalizability of the result (Bryman, 2016). A survey was conducted using face-to-face interviews with a structured research questionnaire.

To complement the survey, the study employed purposive sampling to collect qualitative data, since it is the right sampling technique for gaining in-depth, context-specific qualitative insights (Creswell & Clark, 2017). Following that, a total of 6 Focus Group Discussions (FGDs) were conducted with women CA farmers, as well as 10 Key Informant Interviews (KIIs) with agricultural extension officers, GASIP district coordinators, and implementation staff. This ensured triangulation of data at both the household and community levels. Using a semi-structured questionnaire, all discussions were audio-recorded (with consent), transcribed verbatim, anonymised, and supplemented with field notes to provide contextual and non-verbal information.

3.4. Data Analysis

The quantitative data were analysed using SPSS software (version 31). Key variables were summarised using descriptive statistics, including means, frequencies, and percentages. On the other hand, qualitative interviews were analysed using (Braun & Clarke, 2006) six-phase framework for thematic analysis, which included familiarisation with data, initial coding, developing candidate themes, identifying and refining themes, defining them, and report writing. Dedoose software was used to aid the analysis. Coding followed both inductive (emerging from narratives) and deductive (guided by Kabeer's (1999) empowerment framework) approaches. In line with convergent mixed-methods principles, findings were drawn from both quantitative and qualitative data. Quantitative results and qualitative themes were compared to identify areas of convergence and divergence in order to understand not only what empowerment outcomes occurred, but also how and why they emerged.

3.5. Ethical Considerations

Ethical approval was obtained from the institutional review board at the University of Business and Integrated Development Studies. Participation in the study was entirely voluntary, with all respondents providing verbal informed consent. Confidentiality and anonymity were ensured, and participants were assured of their right to skip questions or withdraw from the study at any time without penalty.

4. RESULTS

4.1. Socio-Demographic Characteristics of Respondents

The study involved a total of 180 smallholder women farmers. From Table 1, the majority of them were middle-aged, with 61.2% falling between 35 and 49 years of age, while 18.5% were youthful between 23 and 34 years old, and 20.2% were 50 years old and above. Regarding marital status, a large proportion of the participants were married (79.4%), while only 17.8% were widowed. Those who never married accounted for only 2.2%, and 0.6% were either separated or divorced. The results also indicate a generally low educational status for most respondents, as 72.2% never attained any formal education. While 18.9% attained basic education, 4.4% attained secondary education, and

only 1.7% attained tertiary (higher) education.

With regard to household size, the majority (55%) were from medium-sized households of 6 to 10 members, followed by 35% from small-sized households of 1 to 5 members, while a minority (7.2%) were from large-sized households of 11+ members. The average household size was 6.88 persons, which has implications for household food requirements and farm labor supply. Land allocated to CA was relatively small in size. Most participants (59.4%) allocated between 1–2 acres, followed by 3–4 acres (36.1%), while only 4.5% cultivated above 5 acres. The average farm size was 2.51 acres. Overall, these socio-demographic characteristics show these beneficiaries as a group of low-educated, largely married women in their middle age who engaged in smallholder farming systems.

Table 1. Socio-demographic characteristics of women CA beneficiaries.

Variables	Number of respondents	Percentage (%)
Age		
Young (23–34 years)	33	18.5
Middle-aged (35–49 years)	109	61.2
Older women (50+ years)	36	20.2
Missing	2	1.1
Marital Status		
Married	143	79.4
Never married	4	2.2
Widowed	32	17.8
Separated/Divorced	1	0.6
Level of Formal Education		
No formal education	130	72.2
Basic education	34	18.9
Secondary education	8	4.4
Tertiary education	3	1.7
Other	5	2.8
Household Size		
Small (1–5 members)	63	35.0
Medium (6–10 members)	144	55.0
Large (11+ members)	13	7.2
Mean household size = 6.88		
Land Size Used for CA (acres)		
Small plots (1–2 acres)	107	59.4
Medium plots (3–4 acres)	65	36.1
Large plots (5+ acres)	8	4.5
Mean land size = 2.51 acres		

4.2. Resource-Related Empowerment: Access to Land, Inputs, Knowledge, and Social Support

Participation in GASIP-CA resulted in a significant improvement in women's access to the resources for the adoption and sustainability of CA. There was widespread training among participants, which enhanced their knowledge and skills. From Table 2, 98.3% of the women were trained in CA techniques, while 88.9% were trained in farmer group dynamics, and 68.3% on agricultural marketing, which indicates a broad range of capacity building beyond agronomy. Participants reported a significant improvement in knowledge and mastery of CA practices. While 53.3% reported high mastery of CA skills, 44.4% reported average CA skills, and only 2.2% felt that their comprehension levels were low. These levels of CA knowledge and skills suggest that access to training and extension capacity building has effectively enhanced women's knowledge and practical skills.

Access to social resources in the form of group membership is also high. Almost all participants (96.7%) reported being active members of CA-based farmer groups, which provided an avenue for social support (labour sharing and peer-to-peer learning) and financial inclusion (saving mobilisation). These patterns were corroborated during the FGDs in which one participant mentioned that *'we get so much help from this group through collective learning, labour support, and access to credit through our savings.'*

Participants, through the GASIP-CA intervention, gain access to farm tools such as jack planters, which ease their farm workload and reduce drudgery. A participant explained that 'instead of using our cutlasses or hoes to plant, we are now using the jack planters. We are no longer complaining of waist pains.' However, the changes in workload resulting from the intervention paint a more complex picture. Although most (61.7%) reported decreased workload pressures due to less ploughing and soil disturbance, over a third (37.2%) experienced increased workload pressures for tasks like herbicide or weedicide spraying. Such mixed experiences indicate that CA, in this context, redistributed women's workloads rather than simply reducing or increasing them.

Table 2. Descriptive statistics of women's resource access.

Variable	Category	Number of respondents	Percentage (%)
Training received on CA practices	Yes	177	98.3
	No	3	1.7
Training on farmer group dynamics	Yes	160	88.9
	No	20	11.1
Training on produce marketing	Yes	123	68.3
	No	57	31.7
Level of mastery/Understanding of CA technologies	High	96	53.3
	Average	80	44.4
	Low	4	2.2
Membership in a farmer group	Yes	174	96.7
	No	6	3.3
Effect of GASIP-CA on women's farm workload	Reduced	111	61.7
	Increased	67	37.2
	Static	2	1.1
Land access challenges	Yes	23	12.8
	No	157	87.2

The most constrained resource was land access, despite only 12.8% of women reporting challenges in accessing land. Evidence from qualitative narratives highlights that women do not have independent land rights. They only gain access to land for farming through negotiations with their husbands or other male relatives, reflecting deep-rooted, biased customary land tenure norms in the districts. One participant explained.

We do not have our own farmlands. We begged our husbands, and they gave part of their lands to us… When GASIP asked us to cultivate two acres each, I told him, and he gave me the land. The produce I get is for both of us.

Another emphasized,

Our husbands gave us the lands on which we are farming. We do not have lands of our own. As we are farming, the produce is not being sent to our paternal homes. Our husbands see it as a way of help from us. This is why they gave us potions of the land to farm.

Overall, these results showed that GASIP-CA had a positive effect on women's access to human, social, and technological resources, serving as an important step towards their empowerment. However, land access is limited, showing that women's empowerment has to be negotiated with customary gender power dynamics.

4.3. Agency-Related Empowerment: Decision-Making Power, Income Control, and Voice

Generally, the results demonstrated that GASIP-CA had a substantial positive impact on the agency of women in different aspects, including control of income from CA plots, household decision-making power dynamics, and having a voice in the wider community issues. Table 3 presents these improvements. An overwhelming majority (98.3%) of the participants indicated that their participation in both household and the broader community decision-making had improved. This reflects a major change, which could be attributed largely to their improved knowledge in CA agronomy, increased production, and increasing support for household livelihood.

Qualitative evidence corroborates this trend, emphasising that the CA knowledge they gained through the

capacity-building training translated into increased power and recognition. Participants narrated how they helped their husbands and other men in the community who asked for their expertise on CA farming. A participant noted that *'Even as a woman, sometimes a man would come to me to teach him how to plant in rows and other CA practices, and I teach him how it is done.'* Their capacity to teach men, who are customarily recognised as experts in farming, indicates a significant shift in gender knowledge dynamics and an expanding sphere of influence for women that extends beyond their own households.

Table 3. Decision-making participation and income control among women CA beneficiaries.

Variable	Category	Number of Respondents	Percentage (%)
Effect of GASIP-CA on women's participation in decision-making (household and community)	Improved	177	98.3
	Decreased	1	0.6
	Static	2	1.1
Do women have full control over income from GASIP-CA farms?	Yes	157	87.2
	No	23	12.8

Regarding the control of income, about 87.2% of participants, according to Table 3, indicated that they have complete control over income generated from their farms, signifying a significant improvement. However, the qualitative evidence indicates that they do not have individual agency over their income but rather relational agency, requiring them to consult their husbands. For instance, a participant stated that 'After selling my produce, I present the income to my husband… we decide together on how to spend it,' and another confirmed that:

I cannot spend this income without the prior approval of my husband. Even if he doesn't need the money when I present it to him, he will take something small from it. Afterwards, I can then do whatever I wish with the remainder.

These testimonials show that agency-related empowerment is often negotiated through cooperation within households but not outright autonomy.

Notably, the agency of women extends into the broader community. The participants narrated teaching CA practices to their immediate communities and other neighbouring communities, which shows the expansion of their voice, influence, and status in society. One participant described that *'When we go to other communities, we educate them on the benefits and teach them how to practice CA… I have taught many people in Zanko, my paternal home.'* This shows how participants have become community resource persons and authorities in agriculture, extending from their immediate households.

These results indicate that GASIP-CA contributed meaningfully towards improving women's agency in household decision-making, negotiating the use of farm income, and exercising their influence outside the household, despite cultural norms still influencing some aspects of income control.

4.4. Achievement-Related Empowerment: Livelihood Outcomes

GASIP-CA has contributed to improved achievement-related empowerment across several livelihood dimensions, including increased food security and farm income, improved psychosocial well-being, strengthened intra-household relations, and positive ecological impacts. Table 4 presents the survey results, which indicate a remarkable improvement in household food access after practising CA under GASIP. Before GASIP, 83.3% of households reported eating one or two meals per day, while after adopting CA, 87.2% now have three or more meals per day.

Furthermore, before the GASIP interventions, 81.1% of households experienced at least one month of food shortage per year, while 38.3% of them experienced four to six months without food. However, after adopting CA

under GASIP, the majority of them (62.2%) experienced zero months of food insecurity, while the remaining households experienced just 1-2 months of food insecurity. Almost all respondents (99.4%) reported an improved status of food security.

Qualitative accounts supported these trends. Many participants reported an increased availability of food and ascribed it to higher yields through CA. In comparison to years before the GASIP-CA intervention, one of the women said.

What I want to say is that I have worked with the agriculture officers for a long time, and before GASIP, you could cultivate maize and get three (3) to four (4) bags. However, after following GASIP training and practices, I usually harvest between ten (10) and twelve (12) bags of maize from my farm. This is the benefit of CA.

Another woman confirmed.

This time is better than those days. Don't joke! It was not easy for us at all. By this time, my husband would have gone to the south (Southern Ghana) to borrow maize and send it to us, and then worked for the owner until he paid off the debt. GASIP came to save us. We now have enough food for almost all year round.

Regarding income and savings, 99.4% and 96.1% of participants indicated an improvement, respectively, which they attributed to the sale of their farm produce. High income and saving capacity serve as a financial buffer, increasing their resilience against shocks.

Participants narrate how group marketing of their produce under the GASIP-CA intervention has boosted their income as they are now able to sell an entire truckload of maize. A participant said.

In one of the years, when we were only 20 members in the GASIP group, we loaded a full truck of maize to Down South (Southern Ghana). This earned us huge money, which we used to meet our personal expenses. Before GASIP, we had never had this amount of income from our farms because we used to get very low yields.

Additionally, women's psychosocial well-being and intra-household cohesion showed remarkable improvement as a result of the GASIP-CA intervention. The survey shows that 98.9% of respondents experienced improved self-esteem and happiness, while 98.3% reported strong harmony in their households. These results are corroborated by qualitative accounts from the participants who highlighted improvements in food availability and farm income, translated into strengthening marital relationships, as there is less tension over lack of food in the household. A participant noted,

'This (food availability) has caused the affection and bond to increase in my family. These days, my husband loves me more.' The participants also experienced increased social status as they were able to help their neighbors during periods of food scarcity. A woman explained that 'We still have some of our produce stored… If someone from the community comes to buy out of hunger, I sell to him/her.'

Most importantly, the results highlight profound outcomes for empowerment, as all participants (100%) expressed a sense of empowerment as a result of participating in the GASIP-CA intervention, due to their mastery of agronomic knowledge, and their ability and confidence to teach others. One of the women explained.

I feel empowered by GASIP. Even men ask how I can plant and get very good yields while he gets low yields. So, I teach him how it is done. Even if someone who is quarrelling with me asks for guidance, I do it wholeheartedly so that he can also get food. We also help our fellow women who are not members of our group to get food to eat. As of now, generally, there is hunger in the community. We still have our produce from our GASIP farms stored in our houses. If someone from the community comes to buy from me out of hunger, I sell to him/her. Currently, the community market day is closed. So, if someone needs food, it will be difficult to get it to buy in this community. But we do sell our GASIP produce to people who are in need in these difficult times.

These women viewed empowerment in terms of improved livelihood outcomes, but more importantly, as their ability to help others and break traditional gender roles.

Table 4. Livelihood outcomes and empowerment among beneficiaries.

Variables	Category	Number of respondents	Percentage (%)
Meals per day before joining GASIP	0–1 meal	20	11.1
	2 meals	130	72.2
	3 or more meals	30	16.7
Meals per day after joining GASIP	2 meals	23	12.8
	3 or more meals	157	87.2
Months of food insecurity before GASIP	0 months	34	18.9
	1–3 months	78	43.3
	4–6 months	69	38.3
	7–9 months	4	2.2
Months of food insecurity after GASIP	0 months	112	62.2
	1–2 months	47	26.1
	3–6 months	21	11.7
Perceived improvement in overall food security	Yes	179	99.4
	No	1	0.6
Crop farm income after GASIP	Improved	179	99.4
	Static	1	0.6
Savings capacity after GASIP	Improved	173	96.1
	Static	6	3.3
	Decreased	1	0.6
Changes in self-esteem and happiness	Improved	178	98.9
	Static	2	1.1
Changes in household cohesion	Improved	177	98.3
	Static	3	1.7
Do you feel empowered by GASIP-CA?	Yes	180	100.0
Do you plan to continue CA after the project ends?	Yes	180	100.0

Altogether, these results show a reinforcing cycle of empowerment whereby gains made in food security, income, savings, psychosocial well-being, and ecological health expanded their confidence and status, leading to an enhancement of their agency and dedication to CA practice. These outcomes can be seen not only as material successes but as a great improvement in their capacity to achieve self-defined goals.

5. DISCUSSION

5.1. Resource Access Amid Structural Constraints

The study shows that there are major contributions of CA to women smallholder farmers' resource access, specifically human, social, and technological resources. The majority of participants reported gaining satisfactory knowledge and skills after participating in capacity-building training related to CA, farmer-based group dynamics, and produce marketing. Previous studies have emphasized that women's access to extension services and other capacity-building trainings are important determinants for the successful adoption of CA and other climate-smart agricultural methods (Tsige et al., 2020; Wekesah et al., 2019). While this study found a wide range of access to capacity-building training and group membership, other studies found limited knowledge of CA practices among women due to a lack of access to extension services and farmer cooperatives, which negatively impacts their level of adoption (Beuchelt & Badstue, 2013; Farnworth et al., 2016; Hove & Gweme, 2018; Maharjan et al., 2023; Wekesah et al., 2019). This contradiction seems to arise from the participants of the studies, since women in this study were specifically targeted to promote CA adoption, which comes with extension, input, and group membership support.

Access to technological resources, like jack planters, enhanced the efficiency of planting and decreased physical strain. This result supports (Farnworth et al., 2016) when they argue that CA adoption among women can be more effective when labour-saving technologies are integrated, specifically targeting workload challenges faced by women. However, the findings in this study highlight contradictions in CA's impacts on women's workload. Although most

participants indicated a reduction in workload, a large minority reported an increased workload in managing weeds and herbicide application. This is reflected in the literature, in which some studies find a reduction in their workload (Baudron, Corbeels, Monicat, & Giller, 2009; Farnworth et al., 2016; Nyanga, 2012) while others find an increase (Beuchelt & Badstue, 2013; Hove & Gweme, 2018; Wekesah et al., 2019). This highlights that gendered workload is rather redistributed and not just decreased or increased in CA adoption, and for the most part, women may carry increased workload roles as a result of gender roles in managing crops and residues (Wekesah et al., 2019).

Land access appears as the most entrenched structural constraint for women. While the participants indicated minimal land access constraints in the survey, the FGDs reveal that they do not have outright land ownership and have to gain access to land from their spouses and other male relatives, which aligns with the patriarchal landholding practices in Ghana and broadly in the SSA (Amoako et al., 2025; Mensah & Fosu-Mensah, 2020). Consistent with some studies, women, in the absence of outright and secure land rights, remain reliant on men in their households, affecting their ability to make decisions regarding production and benefits (Tsige et al., 2020; Zulu-Mbata & Chapoto, 2016) Therefore, GASIP-CA significantly improved women's access to resources, such as production knowledge and skills, networks, and tools, although this happened in the context of existing inequalities in land access and labour dynamics.

5.2. Women Agency: Negotiated Power, Shared Decision-Making, and Emerging Voice

The study also reveals positive contributions of CA to the agency of participating women. Nearly all participants demonstrate greater involvement in household decision-making, and a large majority demonstrate full or joint control over CA farm income. These findings support studies that argue that agricultural projects can expand the boundaries of decision-making for women when they improve their knowledge, income, and visibility (Hove & Gweme, 2018; Kunzekweguta et al., 2017; Maher et al., 2015). However, the type of agency that these women developed is often negotiated and not autonomous. They would often report their income to their husbands, and they would jointly decide what to use it for. This is consistent with studies in Malawi and Zambia, which have noted that agency is often developed not through their own autonomy, but rather through relational bargaining (Maher et al., 2015; Zulu-Mbata & Chapoto, 2016). In line with Kabeer's (1999) theory, agency sometimes exists within social relationships and not outside of them.

Conversely, the study found that women exercise agency beyond their immediate household into the broader society. Many of these women share CA knowledge and practices, among other farmers, including men, in their immediate and neighbouring communities, and they sometimes offer food loans to community members in need. This shows a trend towards a form of agency that is public, where these women serve as key community agricultural experts, teaching men who are traditionally considered experts in agriculture. This kind of public agency for women, as a result of CA intervention, is rarely discussed in the literature. Therefore, the combination of relational household agency and community leadership extends the literature by illustrating the potential of CA to enable empowerment across multiple dimensions, including at the household and community levels, when the expertise and contributions of women are recognised.

5.3. Achievements: Livelihood and Well-Being Outcomes

On achievement-related empowerment among women, the study found major gains across several livelihood outcomes that are attributed to participation in CA. On food security, the majority of women reported improvement from eating just one or two meals per day to eating three full meals a day regularly, and food insecurity reduced dramatically. These results confirm earlier studies demonstrating the positive impact of CA on crop productivity, improving food security even under the stress of climate change (Adam & Abdulai, 2022; Naab, Mahama, Yahaya, & Prasad, 2017; Setsoafia et al., 2022). Moreover, almost all the women observed improvements in income and savings capacity, which aligns with previous evidence that CA improves farm income and economic resilience (Makate et al.,

2025; Naab et al., 2017; Setsoafia et al., 2022; Wekesah et al., 2019). Soil fertility improvements found in this study further support the agronomic advantages of CA (Teng et al., 2024). An important contribution of CA is the psychosocial well-being experienced by women, which is rarely discussed in the literature. They reported enhanced self-esteem and improved marital relationships and community approval, mirroring the assertion that empowerment encompasses not just material benefit but also relational well-being and improvement of social status and confidence (Alkire et al., 2013; Huis et al., 2017; Kabeer, 1999). These outcomes represent a cumulative process of empowerment where women's access to resources improves their agency, agency leads to achievements, reinforcing their self-esteem, household bargaining power, and community prestige.

6. CONCLUSIONS

The study establishes that CA interventions can serve as a powerful pathway to improve women's empowerment across the three dimensions conceptualised by Kabeer (1999). The results demonstrated that GASIP-CA improves women's access (sometimes negotiated) to critical resources, such as knowledge, group membership, tools, and land. In terms of agency, CA contributed to improved women's household decision-making power, control of farm income, and community leadership. Through improvement in household food security, income, and psychosocial well-being, CA contributed to achievement-related empowerment. At the same time, the study highlights the significance of the notion that empowerment is not an automatic or universal process. The entrenched gendered barriers, especially regarding women's access to land, workloads, and gendered household power dynamics, still influence the empowerment processes in CA systems. These findings reinforce the broader literature showing that agronomic innovations alone cannot transform gender relations without addressing the structural inequalities embedded in agrarian systems. Therefore, policies and programs should focus on ensuring women's access to secure land rights, advancing gender-transformative approaches that deliberately challenge entrenched gender-biased social norms that are restrictive to women, and providing technologies that reduce instead of redistribute workloads. Development workers are therefore encouraged to strengthen farmers' groups as avenues for savings mobilization, knowledge sharing, social support, and collective action. Agricultural institutions should promote women's leadership in governance, extension, and advisory systems. Finally, it is essential to integrate agronomic technologies with broader social transformation, as addressing gender inequality in access to resources, workloads, and household decision-making power will enhance the ability of CA interventions to achieve equitable and sustainable development outcomes for women.

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Transparency: The author states that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
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