Integrating Climate Smart Agri-Innovative Technology Adoption and Agribusiness Management Skills to Improve the Livelihoods of Smallholder Female Cocoa Farmers in Ghana

Abstract

Environmental and climate change issues combined with low income and productivity for female cocoa farmers has highlighted gender equality gap in Ghana's cocoa industry with negative implications for livelihoods. This research focuses on how harvesting cocoa waste enabled the creation of a sustainable micro enterprise to offer alternative employment, reverse inequality, improve climate resilience and soil fertility and encourage further adoption of shaded cocoa production to generate biomass (waste) for organic compost production. The study followed a prescribed training programme for female cocoa farmers who practice shaded cocoa farming in Ghana on organic compost production and agribusiness managing skills by a combined team of climate, agroforestry, agribusiness, cocoa research and extension experts. Results from the analysis of project notes during training and field construction and management of compost chambers in the two selected communities as well as the follow up observation records and interviews indicate that the knowledge and skills provided engendered motivation for a continuous and expanded adoption of climate smart agri-innovation of shaded cocoa production. Further, the results show evidence of a positive social and environmental, cultural and economic impacts and favourable prospects of improved livelihoods for female cocoa farmers. These insights have implications for climate action (SDG13) and gender equity (SDG5) scholarship, climate mitigation and adaptation strategy and policy and agroforestry and cocoa production practice.

Keywords: SDG13-climate action, SDG5-gender equity, climate smart cocoa agroforestry, livelihood empowerment, smallholder female cocoa farmers

Introduction

Environmental and climate change issues combined with low income and productivity for female cocoa farmers has highlighted gender equality gap in Ghana's cocoa industry (Hiscox and Goldstein, 2014; Friedman et al., 2019; Alston, 2014). This has negative implications for livelihoods since the cocoa sector is highly sensitive to climate variability (Peprah, 2015). For instance, historical data shows a progressive rise in temperature and decrease in mean annual rainfall in all the six agro-ecological zones of Ghana; with projection of drastic decrease of climatic suitability for cocoa in current growing regions by 2050 (Läderach*et al.*, 2013; Eastin, 2018). Current projections are that higher temperatures and lower rainfall in parts of Africa combined with a doubling of population will lead to a 43% increase in food insecurity (Funk and Brown, 2009). It is worth noting that cocoa constitutes 10% of Ghana's GDP, with about 25-30 % of the population (6.3 million) depending on the sector for their livelihoods (Peprah, 2015).

Interestingly, women are key labour force for the industry but their income and productivity levels are 25-30% below those of their male counterparts due to climatic instability, environmental degradation and gender opportunity gap (Hiscox and Goldstein, 2014). For instance, Adzawla and Kane (2019) indicated that observable impacts of climate change and variability have led to an increase in gender welfare gap among farm households in Ghana. In addition, previous studies by Alhassan et al. (2019) and Mersha and Laerhoven (2016) have suggested that the observed difference are as a result of gender barriers and not a preferred decision by men and women, suggesting that, climate change adaptation is either low for females than males or the strategies adopted by males is different from that adopted by females.

This study was designed to develop a knowledge sharing partnership among cocoa agroforestry and agribusiness management researchers and cocoa farming communities in the Ashanti Region of Ghana; to facilitate female cocoa farmers' engagement with cocoa waste management as an alternative source of income for livelihood empowerment. It focused on providing female cocoa farmers knowledge and training on organic compost production and agribusiness managing skills; to create a sustainable and resource-rich industry for a multi-dimensional benefit of offering alternative employment/livelihood, reversing inequality, improving climate resilience and promoting soil fertility for sustainable production and securing community and national development.

In Ghana, during the lean cocoa season when there is no cocoa harvest, farmers seek to identify viable alternative or additional income sources to maintain their livelihoods (Agyei-Manu et al., 2020). Such coexistence can provide a buffer against climatic variations and economic shocks, thus conferring stability and sustainability to rural livelihoods (International Labour Organization, 2011 report, Peprah, 2015). Therefore, it is envisaged that empowering female cocoa farmers to produce organic compost for personal use and/or sell for extra revenue, during the non-pod harvesting period of cocoa (lean season) will consequently promote the attainment of the 2030 agenda for Sustainable Development Goals (SDG) of ending poverty (SGD 1 – see for example, Matthew et al., 2019); ending hunger and promoting sustainable agriculture (SDG 2 – see, Mollier, et al., 2017); taking action to combat climate change and its impact (SGD 13 - Tumushabe, 2018). In addition, it will encourage further adoption of shaded production method of producing cocoa to generate biomass (waste) for organic compost production (SDG 15-conserving and restoring the use of terrestrial ecosystems such as forest – see Bridgewater, et al., 2015). It is a study that integrated SDG13 that calls for urgent climate action (Campbell et al., 2018) with SDG5 that places emphasis on gender equity (Odera and Mulusa, 2020).

Without a doubt, the adoption of shaded cocoa production is climate smart agri-technology practice and is a more sustainable and environmentally-friendly method of cocoa production (UNDP report, 2011). Indeed, no shading cocoa production (full sun) provides higher yields in the short term but yields declines significantly in the mid to the long term and also requires the application of higher amount of inorganic fertilizers (UNDP report 2011; Yamoah et al. 2020), and this contributes to reduced income and worsens the livelihood of female farmers.

It is envisaged that the adoption of climate smart agri-technology practices (Adamides, 2020) such as organic composting and (agroforestry) shaded cocoa production (Utomo et al., 2016, Gomes et al., 2015) and coupled with agribusiness management skills like training (Lachaud et al., 2018), comprising organizing resources, product development, building a business plan, marketing (labelling, packaging, pricing and distribution), record keeping, performance review and scaling up planning; cocoa production would be more sustainable, secured and profitable for improved livelihood, especially to the female cocoa farmer.

2.0 Methods

The study adopted a three-stage action and participatory research method to facilitate the effective engagement, selection and training/capacity building of the Female and other cocoa farmers from the targeted communities (Figure 1). This approach included cocoa project research questions, participatory research methods (focus groups discussion and multi stakeholder meetings, participatory inquiry) and field visits to farms where cocoa agroforestry systems are adopted and compost chamber could be constructed. These methods enabled us to evaluate how climate smart cocoa agroforestry adoption and cocoa waste compost production impact on the environmental, economic, social and cultural wellbeing of Female cocoa farmers in Ghana (Figure 1). In addition, the project was designed to develop a partnership to share knowledge between researchers and cocoa farming communities to facilitate female cocoa farmers' engagement with cocoa waste management as an alternative source of income for livelihood empowerment.

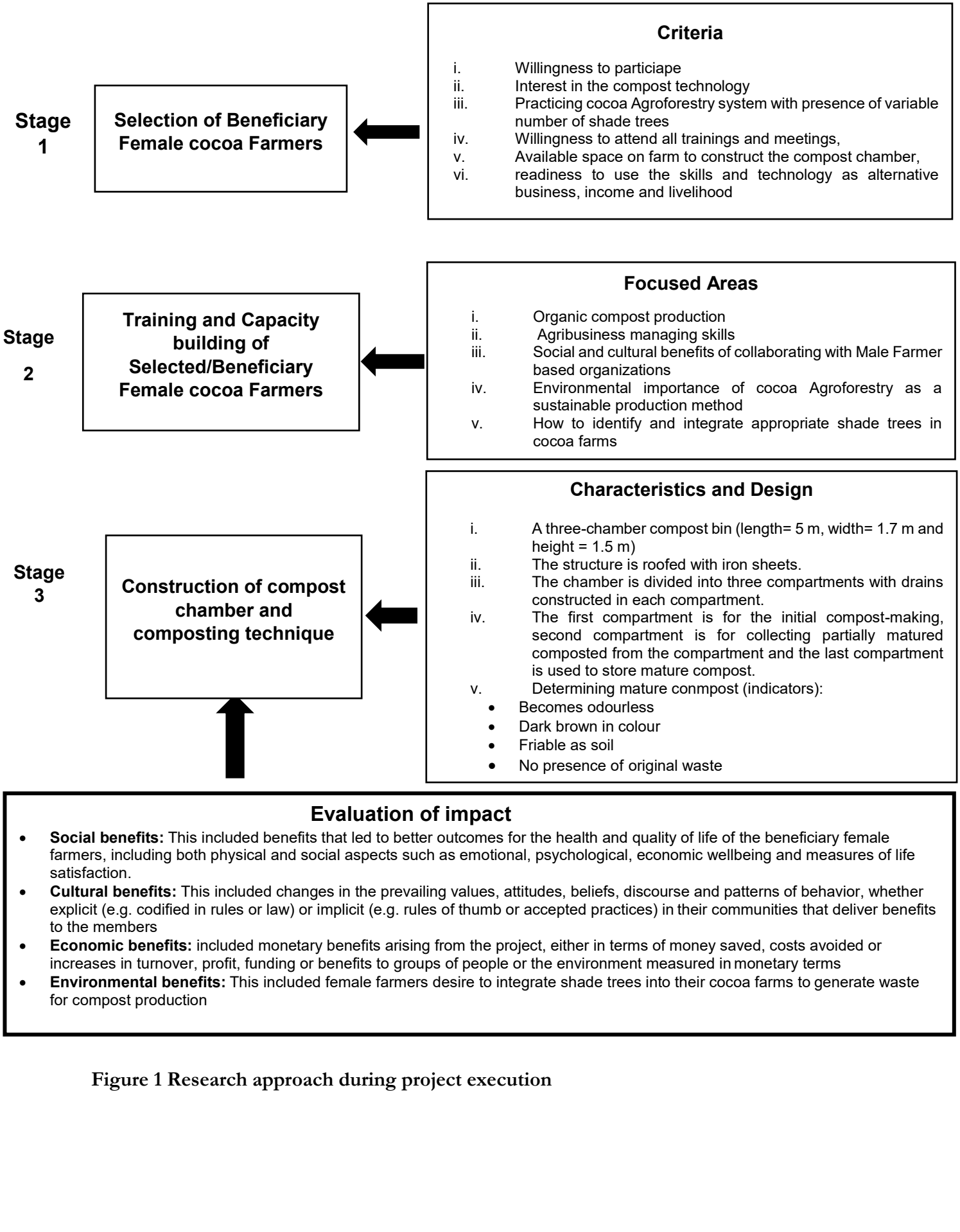

Figure 1 Research approach during project execution

2.1 Description of study Area

The project was executed in two communities (Banko and Woraso) in the Sekyere Kumawu District of the Ashanti Region of Ghana. The Sekyere Kumawu District is located between Latitudes 0° 20 and 1° 20 North and Longitudes 0° 45 and 1° 15 West. (Figure 2). The Sekyere Kumawu District (formerly Sekyere Afram Plains District) was established in 2008. The district has a population of 65,402; with females constituting 52.6 % and males represent 47.4 % and about 52.8% of the population is rural (Ghana Statistical Service, 2014 report). About 83 % of households in the district are engage in agriculture. The vegetation is semi-deciduous forest; however, parts of the district are fast degenerating into secondary forest due to large scale clearing. The District has a monthly mean temperature of 24°C and experiences bimodal rainfall pattern, where the minor season comes in March-April and the major one in June-October. The District has relatively high humidity. The major economic activities in the district are crop farming (food and cash crops such as cocoa, maize, palm nut), wood carving and agro processing.

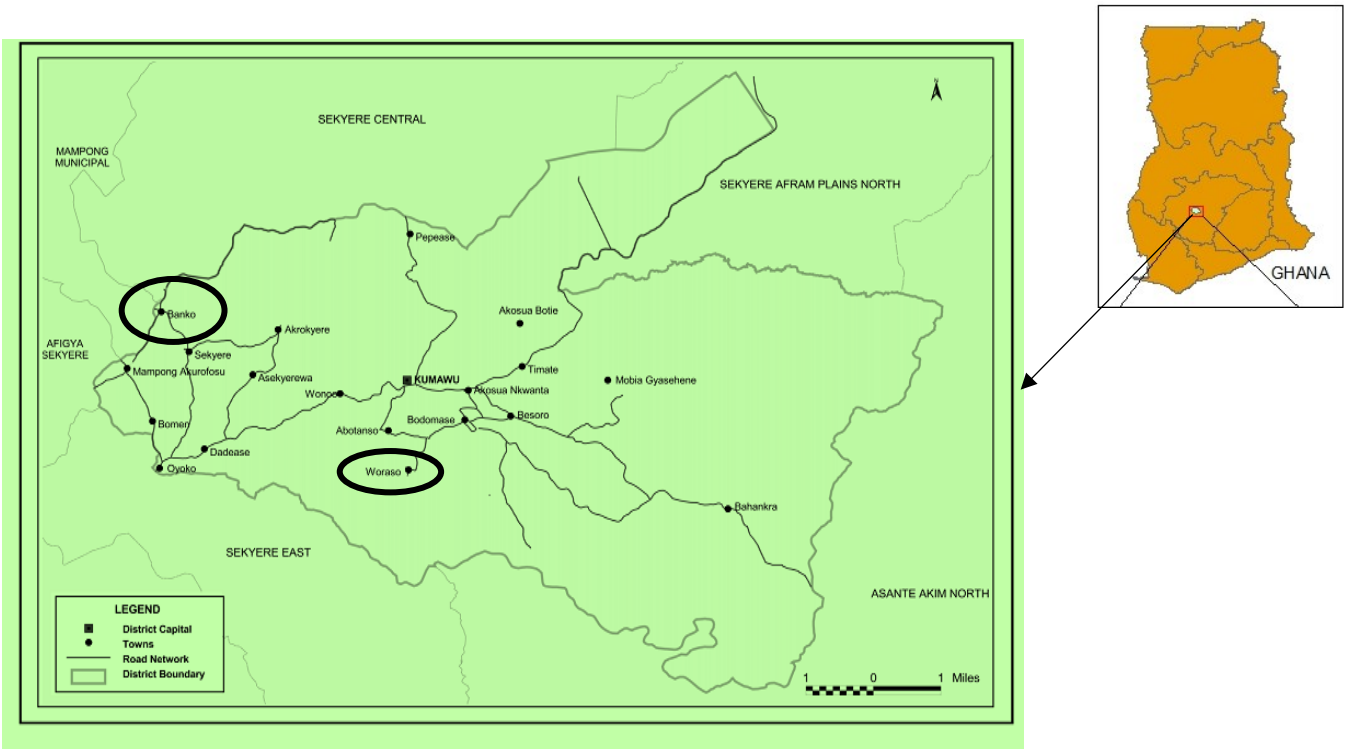

Figure 2 Map of the study district showing the selected communities in circle

2.2 Selection of communities and beneficiary female cocoa farmers

Two cocoa growing communities were selected from the Sekyere Kumawu District of the Ashanti Region of Ghana. Four numerators were hired for two weeks to help collect a baseline data on cocoa farmers for the selection of beneficiaries using focus groups discussion (Figure 3). Cocoa extension officers from the Cocoa Research Institute of Ghana and scientist from the Agroforestry department of KNUST led the team for the baseline survey and the selection of the communities and beneficiary female cocoa farmers. Among the criteria used to selected the two communities was the presence of female cocoa agroforestry farms, the type and amount of waste from cocoa farms, and the willingness of the female cocoa farmers in the communities to participate in the project. In addition, the female cocoa farmers from the two selected communities were selected based on their interest in the compost technology, willingness to attend all trainings and meetings, available space on farm to construct the compost chamber and their readiness to use the skills and technology as alternative business, income and livelihood (Figure 1). A total of twenty female cocoa farmers and six male cocoa farmers were selected for the training and capacity building.

Figure 3 Female cocoa farmers during focus group discussion to select beneficiary farmers at Banko and Woraso Communities in the Sekyere Kumawu District of the Ashanti Region of Ghana

2.3 Project Activities (training, stakeholders' sensitization and capability building)

A sensitization and capability building workshop on compost production was organized at the Faculty of Renewable Natural Resources, KNUST for the twenty beneficiary female farmers, six male 6 cocoa farmers (three from each community) four cocoa extension officers (2 from each selected community) and two Assembly members from the two communities (Figure 4).

The training and capacity building also seek to improve the livelihoods of female cocoa farmers in Ghana by providing knowledge and training on agribusiness managing skills, to enable them reverse inequality, improve their welfare and by extension promote global prosperity.

Figure 4 Training and capacity building workshop on compost production of cocoa extension workers, Assembly men and selected female cocoa farmers at the Faculty of Renewable Natural Resources, KNUST, Ghana

During the capacity building, Female cocoa farmers were provided with two sets of skills training to build their capacity and capability: 1) Organic compost production training which involves understanding the importance of anaerobic respiration, identifying the right leguminous shaded trees to be combined with cocoa waste, compositing architecture (layout in the composting chamber), compost turning techniques, compost maturing determination skills and how to efficiently use, manage and maintain the three-chamber compost bin 2) The Agribusiness management skills training comprised: organizing resources, product development (organic

composting), building a business plan, marketing (labelling, packaging, pricing and distribution), record keeping, performance review and scaling up planning.

These two sets of skills trainings were to enable them produce their own organic compost for both personal use and commercial benefit, using free and easily accessible raw material (cocoa waste and leguminous biomass from shaded trees) on their farms, as a source of alternative livelihood during the non-pod harvesting period (lean season) of cocoa. It is envisaged that empowering female cocoa farmers (SDG 5) to produce organic compost for personal use and/or sell for extra revenue, during the non-pod harvesting period of cocoa will consequently promote the attainment of the 2030 agenda for Sustainable Development Goals (SDG) 1, 13 and 15.

3.0 Results and Discussion

3.1 Project Notes, Plenary Discussions and Visits Observations Analysis

The analysis of the project notes during training on composting and agribusiness and field construction and management of compost chambers in the two selected communities indicate that the knowledge and skills provided engendered motivation for a continuous and expanded adoption of climate smart agri-innovation of shaded cocoa production.

Firstly, prospective beneficiary female farmers expressed keen interest at the onset of the study during the selection of participant's stage. This was amply reflected in the high number of female cocoa farmers that enlisted for inspection of their shaded cocoa farms to be selected for the study. Indeed, out of the 172 female farmers from the two communities that expressed interest the research team had to scale the number down to 20 females and 4 males using the qualifying criteria of 2 heactres being the standard requirement for a smallholder cocoa farmer (Ameyaw et al., 2018; Nyambo et al., 2019) under shaded cultivation system. Almost all female farmers contacted were interested to participate and the two most common attractions of the project to them were the 1) employment/income generating opportunity in the lean cocoa season 2) the lack of access to inorganic fertilizers and delays in their delivery 3) the chance to turn cocoa waste into raw material for compost production and 4) ready access to compositing and agribusiness management training. These findings affirm some of the major assertions of Yamoah et al. (2020) and reinforce the key findings of Essougong, et al. (2020).

Secondly, all the beneficiary farmers' participants maintained excellent attendance and participation for the entire period of the training and practical demonstration exercise and activities, a testament of their commitment to obtain the requisite knowledge and skills to take advantage of cocoa waste from shaded cocoa cultivation to generate supplementary income. Review and context analysis of the recordings on the scheduled discussions on shaded cocoa agroforestry reveals the recurrent theme of the various benefits of shaded cocoa cultivation and a heighten commitment to explore cocoa waste. A unanimous notable response to the discussions on their plans for shaded cocoa cultivation clearly shows that any future expansion of their farms will follow shaded cocoa agroforestry to increase their raw materials for organic compost manufacturing on their cocoa farms.

Thirdly, a careful review of the recordings on the final plenary session at the end of the workshops revealed that all 20 beneficiary female cocoa farmers affirmed their commitment to shaded cocoa cultivation having realised the enormous opportunity composting cocoa waste offer them to circumvent the annual income shortage during the lean cocoa season with its attendant social and domestic challenges that seasonally threaten their livelihoods.

Fourthly, an important trend that emanated from the analysis of the post training community visit observations and interviews was the level of awareness that had been created in the two communities of Banko and Woraso in the Sekyere Kumawu District of the Ashanti Region of Ghana after the training of the beneficiary female farmers within a relatively short time. The analyses show that female farmers from the two participating communities have since the training raised awareness among their cocoa farming communities about the advantages of shaded cocoa cultivation. This was evident in the number of other non-beneficiary farmers that were supplying cocoa waste to the beneficiary farmers who were producing compost for a fee or receiving returns in terms of a proportionate organic compost.

A number beneficiary farmers visited and interviewed two months after the end of the training reported they have since completing the training started producing their own compost using waste generated from their shaded cocoa farms with extras from adjoining cocoa farms as they take turns to use the compost bin constructed in their respective communities. Some of the highlights statements includes:

a) "I am excited to be expecting my own compost ready in the next month – the first in my life as a cocoa farmer…a beneficiary cocoa farmer at Banko in the Sekyere Kumawu District of the Ashanti Region of Ghana.

b) "Composting myself has given me the opportunity for the first time to start dry season carrot cultivation alongside my cocoa farming" - a beneficiary cocoa farmer at Woraso in the Sekyere Kumawu District of the Ashanti Region of Ghana.

c) "Now that I know how to use my shaded cocoa waste to produce my own compost for personal use and also sell the excess for extra income, I am also happy that I can keep my cocoa farm clean and I am no more anxious of reptiles that used to hide in the cocoa waste on my farm and also avoid bad smell of rotten cocoa husk on the farm" - a beneficiary cocoa farmer Banko in the Sekyere Kumawu District of the Ashanti Region of Ghana.

3.2 Review and Content Analysis of Follow Up Observation Records and Interviews

The review and content analysis of observation records and interviews (post project) show evidence of a positive social and environmental, cultural and economic impacts and favourable prospects of improved livelihoods for female cocoa farmers.

3.2.1 Social and environmental impact

By establishing a community-based Women smallholder cocoa farmer groups in each of the two selected communities their activities in terms of advocacy and education on the importance of practicing shaded cocoa agroforestry system in their respective communities engendered social cohesion and collective interest. This was evident in the way the beneficiary farmers from the two different communities bonded and easily interacted with each during the entire project. There is also an indication post training that they have maintained their participation in the group's activities. They also met to support each other in important social programmes. A classic case of positive social impact was observed at one of the stakeholder meetings with beneficiary female cocoa farmers where they attended together reroute to a community funeral at the end of the section (see figure 3 photo 1 for female beneficiaries in mourning cloths,-black or red colour, for the meeting). The project further trained individuals as group leaders who are providing leadership roles in conflict management and mentorship. In addition, we have trained cocoa farmers, cocoa extension officers and community contact men (indigenes) from each of the communities on climate-smart cocoa agroforestry practices, composting and shade trees integration and this has increased the awareness of farmers on climate change impact on cocoa production.

The analysis further indicated that all the 20 female beneficiary farmers are committed to maintain their shaded cocoa cultivation and this amounts to a minimum of 40 heactres and they are also committed to continue the shaded practice for any cocoa farm expansion they undertake in future. The size of cocoa farms represented is negligible compared to the national figures but the fact that these female beneficiary farmers are not opting for full-sun and also creating awareness is a significant step to half the detrimental effects of full-sun cultivation. Furthermore, planting under shaded cultivation has the environmental benefit as slashing and burning that produce emissions and smoke is also avoided. Another environmental benefit is the protection of biodiversity in terms of keeping trees and incorporating intercropping with leguminous plants. Additionally, replacing or reducing the use of inorganic fertilizers on these cocoa will help reduce the environmental impact of inorganic fertilizers (see Elmore, 2011, Duveskog et al., 2003 and Al-Rumaihi et al., 2020).

3.2.2 Cultural impact

There is an indication of a positive cultural impact of the project based on the work done by the trained three men from the two selected communities as key contact people in the research areas. The study observational notes and post training interviews suggest improved working relationship between the women cocoa farmers and their male counterparts and as well as other men-based farmer groups which hitherto did not exist because the men did not find it culturally comfortable discussing business with the females' cocoa farmers as earlier attested to by Barrientos and Bobie, 2016). In addition, the analysed observation notes and the post training interview and discussions indicate that female cocoa farmers now appreciate the role of trees in climate mitigation, they now appreciate the need to continue the traditional method of cocoa farming, which generally involves integrating shade trees in their cocoa farms.

3.2.3 Economic impact

The constructed compost bins on farmers' farms are currently been used to produce compost that will generate additional income for beneficiary female farmers in the two communities. Despite lack of specific data on volumes of compost expected to be produced from these communities and potential incomes to be generated, there is a ready market for organic compost and the COCOBOD Ghana is on record to buy farmers' compost that is used for raising cocoa seedling and sometimes for other cocoa farmers. In addition, farmers now have access to less costly environmentally friendly organic fertilizer (compost) which has reduced the need for inorganic chemical fertilizers which are usually of high cost and inaccessible.

Furthermore, the adoption of agroforestry and compost is expected to make the soil resilient to climate change, improve organic matter and fertility; hence more sustainable cocoa yield and income for farmers under environmental stresses occasioned by climate variability and change. Finally, it is expected that the beneficiary farmers will sell any excess compost to generate income, or diversify into vegetable production to generate extra income during the lean cocoa season.

Conclusion

Environmental and climate change issues related to land degradation and deforestation, combined with low income and productivity for female cocoa farmers has highlighted gender equality gap in Ghana's cocoa industry with negative implications for livelihoods. This study focussed on the provision of on the field organic composting skills and training on micro enterprise agribusiness management for beneficiary female cocoa farmers in two communities in the Ashanti region of Ghana undertaking shaded cocoa cultivation. The main aim of the study was to harness female cocoa farmers' knowledge and skills to enable them benefit from alternative source of income during the lean cocoa season to minimise vulnerability, reverse inequality and promote climate resilience. Selected beneficiary female cocoa farmers were provided with two sets of skills training to build their capacity and capability on organic compost production and agribusiness management skills training comprising organising, product development (organic composting), building a business plan, marketing (labelling, packaging, pricing and distribution), record keeping, performance review and scaling up planning. Results from the analysis of project notes during training and field construction and management of compost chambers in the two selected communities as well as the follow up observation records and interviews post training, indicate that the knowledge and skills provided engendered motivation for a continuous and expanded adoption of climate smart agri-innovation of shaded cocoa production. Further, the results show evidence of a positive social and environmental, cultural and economic impacts and favourable prospects of improved livelihoods for female cocoa farmers.

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