working paper
CBMS-2020-06

Does Addressing Gender Inequalities and Empowering Women Improve Development Program Outcomes?

The Case of the "Cassava: Adding Value for Africa" Project in Ghana

Paul Boadu
Wilhemina Quaye
Asafu-Adjaye Nana Yamoah
Adelaide Agyeman
Mavis Akuffobea

April 2020

PAGE
policy analysis on growth and employment
IDRC CRDI
pep
UKaid

Does Addressing Gender Inequalities and Empowering Women Improve Development Program Outcomes? The Case of the "Cassava: Adding Value for Africa" Project in Ghana

Abstract

We surveyed twenty communities and 2,716 households in the Atebubu-Amantin District, Ghana, using a Community-Based Monitoring System (CBMS) to assess the effect of the "Cassava: Adding Value for Africa" project. We incorporated questions on gender and women's empowerment, income, participation in decision-making, and access to market. We found that C:AVA raised participants' annual income by an average of GHC 981.71. This increase represents about 50.4% of the average annual income of non-C:AVA respondents. The incomes of members of women-headed households increased by 2.2% over the average to GHC 2,167.75. Factors such as household size, farming experience, educational level, religion, and income were found to influence market access, and C:AVA participants were 23.1% more likely to have access to market than non-participants. Furthermore, respondents' collective decision-making regarding the use of such household production resources as land, seeds, extension services, fertilizer, tractor services, irrigation services, and credit increased more than 10% after they participated in C:AVA. Further, C:AVA empowered women by increasing their income and their participation in household decision-making. We recommend the adoption of CBMS methodology by the government of Ghana to provide data to aid in the planning of development interventions and to assess outcomes for improved livelihoods.

JEL: D13; Q19; Z13

Keywords: Gender, Women's empowerment, Poverty, Market access

Authors

Paul Boadu
CSIR-Science and Technology Policy Research Institute
Accra, Ghana
boadu@myself.com

Wilhemina Quaye
CSIR-Science and Technology Policy Research Institute
Accra, Ghana
quayewilhemina@yahoo.com

Asafu-Adjaye Nana Yamoah
CSIR-Science and Technology Policy Research Institute
Accra, Ghana
amaagyeman@gmail.com

Adelaide Agyeman
CSIR-Science and Technology Policy Research Institute
Accra, Ghana
amaagyeman@gmail.com

Mavis Akuffobea
CSIR-Science and Technology Policy Research Institute
Accra, Ghana
mavisakuffobea@gmail.com

Acknowledgements

The study was undertaken with financial and technical support from the Partnership for Economic Policy (PEP). In particular, we would like to acknowledge the contributions of Dr. Celia M. Reyes and Jasminda A. Quilitis; the entire CBMS Network team at Manila, the Philippines; Thomas Atibilla (Atebubu-Amantin District Assembly); and Nash Ansu (C:AVA project coordinator). We are grateful to the people of Atebubu-Amantin District for receiving us and making time to respond to the survey instruments.

Contents

List of tables

List of figures

1 Introduction

1.1 Context of the study

As of 2017, Ghana had a population of twenty-nine million and an estimated population growth rate of 2.2%. Although Ghana was a lower-middle income country, it struggles with issues of poverty, unemployment, a housing deficit, equity, and inclusive growth, among others. For 2017-2024, Ghana launched its Coordinated Program of Economic and Social Development Policies, an agenda aligned with Sustainable Development Goals (hereafter, SDG), for increasing jobs and creating wealth and equal opportunities for all. Ghana has also aligned its 2018-2021 Medium-Term Development Planning Framework indicators with continental targets, Malabo Targets, and SDG. Ghana's National Gender Policy 2015 sought to include gender-equality concerns into national development processes with attention to the social, legal, civic, political, economic, and sociocultural conditions of Ghanaians, particularly women, girls, children, and the vulnerable. Efforts to tackle inequalities by successive governments have included promotion of education for girl children and skills training for young girls, Free Senior High School Education, the Ghana School Feeding Program, free prenatal and neonatal services, Livelihood Empowerment Against Poverty (LEAP), Planting for Food and Jobs in the Agriculture Sector, and the pursuit of industrialization, among others.

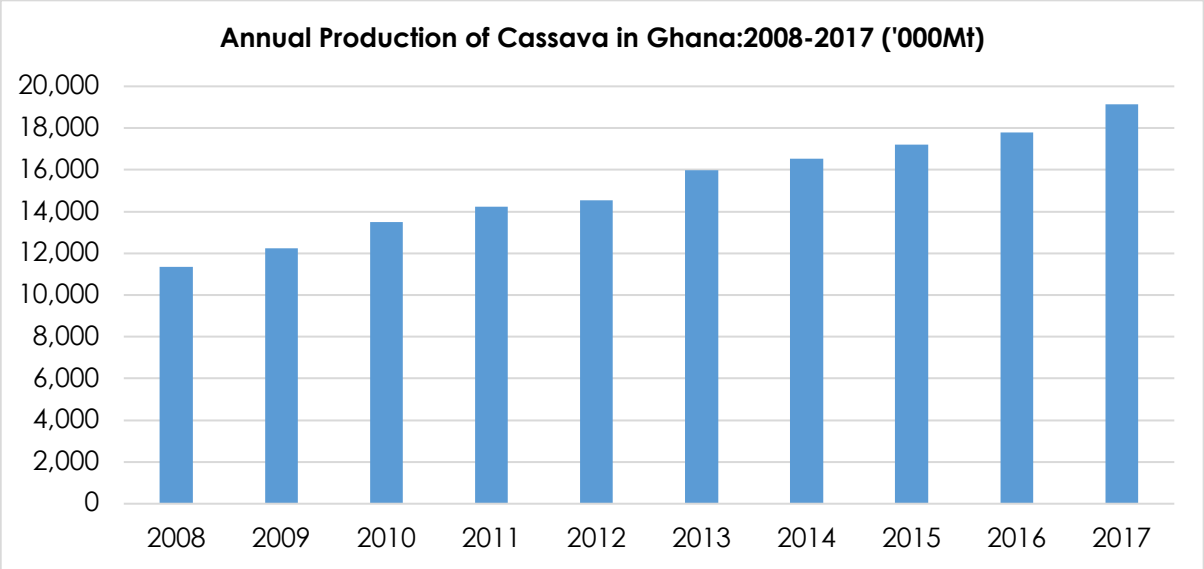
In 2016, the agriculture sector contributed 20.1% of Ghana's GDP (Institute of Statistical Social and Economic Research, 2017). It employed about two thirds of the population, but the sector was challenged with issues of low productivity, post-harvest losses, and low value addition along commodity-value chains (Ministry of Food and Agriculture, 2013). Undoubtedly, women play very significant roles in Ghana's Agriculture Sector but receive little attention in the provision of agricultural services and inputs support (Quaye et al., 2014; Ministry of Food and Agriculture, 2014).

As an agricultural commodity, cassava is one of Ghana's major staples. Cassava production and processing provide sources of livelihoods to farming households, particularly women who dominate the processing and marketing subsectors (Costa Pinto et al., 2014). Ghana produced 17,212,760 metric tons of cassava in 2015, 17,798,220 metric tons in 2016, and 19,137,940 metric tons in 2017. According to Food and Agriculture Organization (2013), Ghana was the sixth largest producer of cassava in the world in terms of value. Production (planting), bulking after harvesting, marketing of fresh roots, and subsequent processing is largely work done by women.

Vanhuyse (2012) observed that approximately 50% of the cassava harvest was consumed directly or sold as fresh roots to be consumed, boiled or pounded, at the household level (*fufu*); 25% was processed into

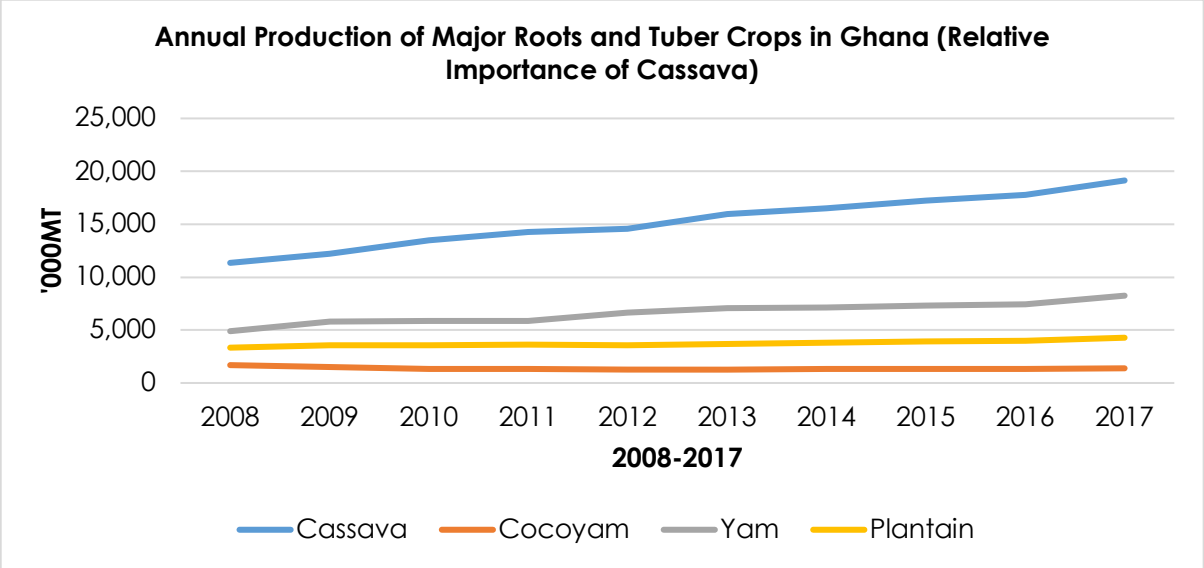
gari (roasted fermented cassava); 18% was used to produce a*gbelima* (fermented cassava mash); 6% was used to produce *konkonte* (dried cassava chips); and 1% went to industrial use.

Figure 1: Annual Production of Cassava in Ghana, 2008-2017



Source: Ministry of Food and Agriculture (2018).

Figure 2: Production Levels of Some Major Crops in Ghana, 2008-2017



Source: Ministry of Food and Agriculture (2018).

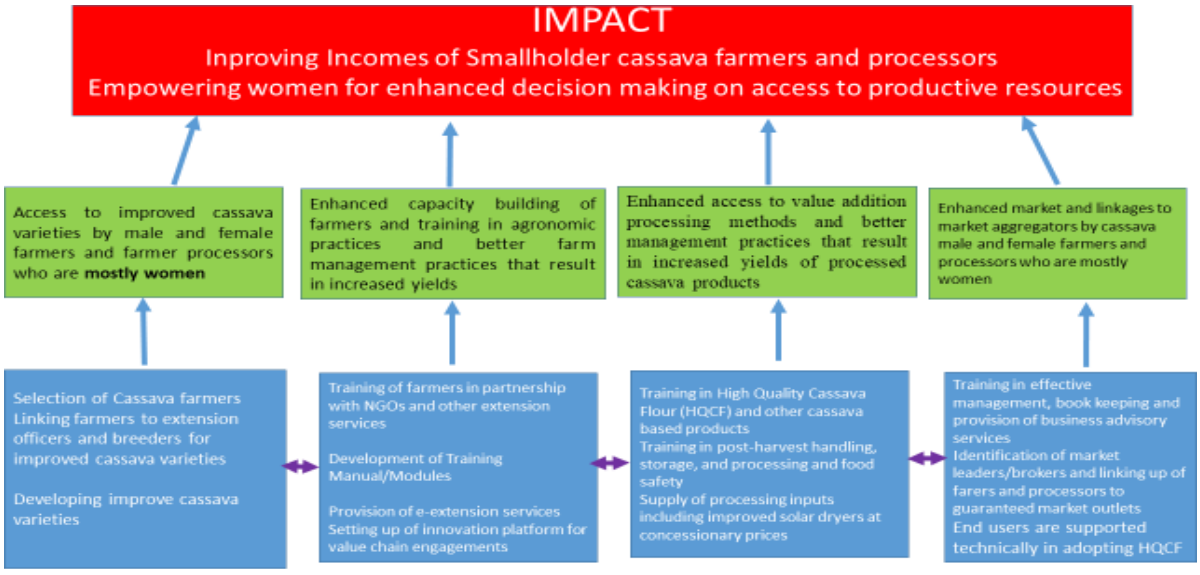
A number of development interventions have been employed in Ghana's agricultural sector over the past two decades. Among them is the Cassava: Adding Value for Africa Project (hereafter, C:AVA). C:AVA was implemented to reduce poverty and improve access to markets by cassava value chain actors. C:AVA targeted

farmers and processors of cassava and consciously empowered women in selected communities in the Brong-Ahafo and Volta Regions of Ghana. Implementation of C:AVA in the Brong-Ahafo Region started in 2009-2014 (Phase 1) and 2015-2018 (Phase 2) in 112 communities and seventy active groups. C:AVA was funded by the Bill & Melinda Gates Foundation.

C:AVA project outcomes included access to improved cassava varieties as well as training and capacity-building in improving agronomic practices and farm management. The result was an increase in yields and in the income of farmers and processors, particularly women. For processors, C:AVA transferred value addition processing methods and enhanced market access and linkages to market aggregators. These were complementary to training in capacity-building and record keeping, business advisory services, and access to credit services. C:AVA intentionally included gender in its project implementation to ensure that women were empowered and benefited equally from the project's activities.

By the theory of change (Figure 3), the C:AVA project was expected to improve the livelihood of project beneficiaries through increased yields and incomes by gender, enhance market access and women's empowerment in participating in decision-making processes at both household and community levels, and create changes in the sociocultural factors that limited women's participation.

Figure 3: Theory of Change for the C:AVA Project



Research evidence has shown that women's economic empowerment can be achieved through interventions that use appropriate savings approaches, access to credit and business management training, land-registration and land-titling programs that include women farmers, quality affordable childcare for women

wage workers, and loan schemes, among others. An empirical assessment of the union "facilitation effect" among Ghanaian labor market workers by Owoo et al. (2017) showed that effective access to mandatory non-wage benefits was key to achieving decent working conditions. Work by Heath and Mobarak (2011) on the creation and expansion of factory jobs for women in the garment sector in Bangladesh provided another illustration of how women's employment can have effects that go beyond the women themselves and touch other household members and their communities.

Meanwhile, work by Said-Allsopp and Tallontire (2014) on women's empowerment in the Kenyan horticultural industry demonstrated changes in the process of empowerment as a result of women's becoming employed. The pathways the authors described were (1) different ways of being; (2) different ways of doing; and (3) sharing experiences. Empowerment was seen as a sequential process in which finding one form of power leads to other forms of power. The paper concluded that the extent to which empowerment was able to happen depended upon the employment quality workers enjoyed and this, in turn, was dependent on the governance structures in place within the workplace.

Women have also been empowered through knowledge- and capacity-building that have enabled them to gain confidence and develop networks to become business leaders. Examples could be drawn from ACCESS! African Businesswomen in International Trade, whose goal is to promote the economic empowerment of women and which aims to improve business-support services for women to build capacity for exports and allow them to succeed in international and regional markets. Eco-tourism in Ethiopia, plant-based products with pharmaceutical qualities in the Republic of Congo and Benin, eco-textiles in Uganda, and one-stop solutions for outfitting hospitals with medical equipment in South Africa are other model programs (ACCESS!, n.d.) Morioka and Nicholas (2014) considered economic empowerment to be broader than a question of money. As the authors explained, women also value the relationships they form, the freedom they achieve to think and act, and the greater respect and power they experience at home and within the community as a result of paid work.

Nardi (2015) proposed that any strategy to empower women in rural value chains needed to consider local governments and providers of rural extension services as important stakeholders. His experience from CARE's work in Ghana and India suggested that partnerships with civil society could play a key role in overcoming challenges to women's empowerment. According to the author, the structural aspects of women's empowerment take long-term efforts to change, and strategies that target cultural norms and informal institutions are needed.

Some beliefs and perceptions about women's participation in value chains were analyzed by Spence (2011), who found that women's roles were secondary and that women mainly occupied unskilled positions and low-paid work; men, conversely, were decision makers. Spence illustrated that social attitudes towards women

limited their participation in activities and that regulations, customs, and institutional practices were barriers to women's access to resources.

The literature has considered women's empowerment to be a multidimensional concept that can be investigated in its political, social, financial, and educational aspects (Kaur & Singh, 2017; Vigneri & Lombardini, 2016). Women have been empowered through their participation in Self Help Group and access to credit (Badruddin, 2017; Poonam, Madhu & Prasad, 2017), through their involvement in Global Value Chains and markets (Nardi, 2015; Said-Allsopp & Tallontire, 2014; Morioka & Nicholas, 2014; Spence, 2011; Chain, 2010). Alkire et al. (2013) developed a women's empowerment index with reference to the Women's Empowerment in Agriculture Index developed by the International Food Policy Research Institute within the context of impact evaluations of interventions. Their study emphasized that empowerment was a multi-dimensional concept and so they looked at the possibility of combining a variety of indicators into a composite index.

In their study, Alkire et al. (2013) considered relational indicators of power dynamics between the genders at the household and community levels, participation in decision-making, contribution to household income, participation in community governance, control over household assets, and personal time, among others. Zoogah (2010) tackled women's empowerment by investigating gender disparities in access to economic resources, including credit, land, economic power sharing, and caretaking roles and responsibilities. Agarwala and Lynch (2006) considered women's autonomy as empowerment in a multidimensional construct involving such factors as violence, family decision-making, community involvement, and household economic decisions.

In our research, decision-making with regard to production assets by gender and access to market were considered empowerment factors, and we aimed to assess the effectiveness of C:AVA as a tool to address gender gaps, empower women, and improve livelihoods.

The rest of the paper is organized in five subsections. The next section, 2.0, presents a review of literature. This is followed by the objectives of the study. Our research questions, associated hypotheses, and a summary of analytical approaches are then presented. The next subsection presents the methodology together with the detailed analytical approach we used to address our specific objectives. The results subsection presents and discusses the findings of the study. The last subsection draws conclusions and makes policy recommendations.

1.2 Research questions andobjectives

In line with the above objectives, our overall research question was "Does women's participation in C:AVA lead to improvement in their empowerment?." Within this, five more specific research questions were explored. The

associated hypotheses and summary of the analytical approach are presented in Table 1.

Table 1: Specific Research Questions, Hypotheses, and Analytical Model

Research Question	Hypotheses	Analytical approach used to answer the research question
RQ1. What is the effect of the C:AVA project participation on farm income by gender?	HO: There is no significant effect of C:AVA project participation on farm income by gender	Propensity Score Matching (PSM); Average Treatment Effects (ATE)
	HA: There is significant effect of C:AVA project participation on farm income by gender	
RQ2. Is there an association between C:AVA project participation and household poverty levels?	HO: There is no significant association between C:AVA project participation and household poverty levels.	Correlation coefficient and chi^2 statistics
	HA: There is a significant association between C:AVA project participation and household poverty levels.	
RQ3. What is the effect of C:AVA project participation on market access by gender?	HO: There is no significant relationship between C:AVA project participation and market access by gender.	Probit regression model
	HA: There is a significant relationship between C:AVA project participation and market access by gender.	
RQ4. Does women's participation in C:AVA lead to improvement in their empowerment?	HO: Women's participation in C:AVA does not lead to improvement in women's empowerment	Proportional distribution test, chi^2 test
	HA: Women's participation in C:AVA leads to improvement in women's empowerment	
RQ5. How did the community and families respond to women's participation in C:AVA? Barriers to women's empowerment		Content analysis of Focused Group Discussion outcomes Proportional distributions

2 Literature review

The economic gap between the poorest 10% and the richest 10% of the Ghanaian population suggests that those living in poverty have benefitted less from efforts to develop the economy. According to Cooke, Hague,

and McKay, “the wealthiest decile now consumes 6.8 times the amount than the poorest 10%. The average consumption of the wealthiest group increased by 27% between 2006 and 2013, whereas for the poorest it only increased by 19%—meaning that growth for the richest group was over 1.4 times greater than for the poorest in this period. The wealthiest 10% consume around one third of all national consumption, whereas the poorest 10% consume just 1.72% (2016, p. 2).

Although Ghana attained lower middle-income status in 2010 and recorded significant expansion in the economy, this did not reflect in adequate job creation or decent work as reflected in the Government of Ghana (2014) which emphasized all-inclusive growth and equity in sharing of the benefits from economic growth. The principle here requires that all labor categories enjoy growth benefits in a more equitable manner despite the challenges of labor unemployment and underutilization. On a similar note, Goal 5 of the SDG “promote[s] gender equality and empowerment of women. Providing women and girls with equal access to education, health care, decent work, and representation in political and economic decision-making processes will fuel sustainable economies and benefit societies and humanity at large.”

According to the International Labour Organization (2008), the “employed” are all persons of working age who, during a given reference period were in paid employment or self-employment as defined below:

Paid employment:

- *“at work”: persons who, during a given reference period, performed some work for wage or salary, in cash or in kind;*
- *“with a job but not at work”: persons who, having already worked in their present job, were temporarily not at work during a given reference period but had a formal attachment to their job,*

Self-employment:

- *“at work”: persons who, during a given reference period, performed some work for profit or family gain, in cash or in kind;*
- *“with an enterprise but not at work”: persons with an enterprise, which may be a business enterprise, a farm or a service undertaking, who were temporarily not at work during the reference period for some specific reasons.*

Underemployment indicates underutilization of the productive capacity of the employed population, including that which arises from a deficient national or local economic system. The International Labour

Organization (2008) described the following as types of underemployment:

- *Time-related underemployment: This exists when the hours of work of an employed person are insufficient in relation to an alternative employment situation in which the person is willing and available to engage.*
- *Skill-related inadequate employment: The willingness to change the current work situation in order to use current occupational skills more fully and availability to do so.*
- Income-related inadequate employment: The desire to change the current work situation in order to increase income that is limited by a low level of organization of work or productivity; insufficient tools, equipment, training, or infrastructure.

Unemployment, on the other hand, refers to the share of the labor force that is without work but is available for and seeking employment. Unemployment has often been cited as a measure of the low employment content of Ghana's strong growth performance over the past three decades. Women's unemployment in Ghana was estimated at 6.1 in 2016, according to the World Bank. According to Baah-Boateng (2013), employment growth in Ghana continues to trail economic growth as a result of high growth of low employment generating sectors against sluggish growth of high labor absorption sectors. The Ghana Living Standards Survey 6 stated that the unemployment rate in the country was marginally higher for women (2.0%) than for men (1.6%) and was higher in urban (3.5%) in contrast to rural areas (0.8%). The unemployment rate for young people was estimated at 3.3%; young women were particularly disadvantaged and had much higher inactivity rates than men.

Research evidence by Zoogah (2010) showed gender disparities in access to economic resources, including credit, land, and economic power-sharing. The author emphasized that gender disparities affected women's potential for achieving the kind of economic autonomy they needed to provide a better quality of life for themselves and their dependents. For example, limited access to agricultural inputs, especially for food crops, severely curtailed women's potential productivity.

Zoogah further added that women faced a number of disadvantages in the labor market because of the need to reconcile the twin roles of homemaker and money-maker, which affects work status, the length and structure of their workday, and salary levels. Jütting, Luci, and Morrisson (2010) further explained that the employment sector offered less scope and potential for women as well as lower pay for the same work.

In Ghana, gender inequality has become a major concern in the agricultural sector, which employs about two-thirds of the population. Although women form half the agricultural labor force in Ghana and in Africa (50%)

(Food and Agriculture Organization, 2011), their access to extension services is limited compared to their male counterparts as a consequence of sociocultural practices. The case for enhancing women's productivity was strengthened by the work of researchers, including Quaye et al. (2014), who have observed a wide gender gap in crop productivity between men and women. The gender productivity gap has been attributed to such factors as limited access to production assets and to services (land, technology, and extension services, e.g.) (Ministry of Food and Agriculture, 2014). The Quaye group also reported in 2014 that men were culturally empowered and better positioned than women to assert stronger rights over productive resources, including improved production and processing technologies.

Addition research by Quaye, Fuseini, and Boadu (2016) showed gender gaps in production assets and extension services in the three northern regions of Ghana that were the result of sociocultural barriers. Cultural discrimination against women in access to land was observed in the smaller plots of land apportioned to women. Men inherited land, but women held land in trust for their sons while they were young. There were gendered associations with some crop types. For example, farming men cultivated maize and adopted related technologies while women cultivated soybeans and adopted soybean-related technologies as a result of resource constraints. Cultural limitations against women as farmers could be overcome, however, if extension-package delivery were gender-responsive.

Despite significant interventions in cassava value chains, a number of challenges remain. According to Naziri et al. (2014) the challenges in the cassava value chain include the following:

- Small scale and traditional systems of production that cannot sustain fast growing demand,
- Inefficiencies in production that results in high production cost and low yields, and
- High percentage losses and waste in the cassava value chain.

These issues were further exacerbated by the lack of appropriate policy governing the use of High-Quality Cassava Flour (HQCF), and improper disposal of liquids (risking the discharge of high-cyanide waste materials into bodies of water) and of solid waste (e.g., peels and pulp), all of which posed threats to the environment. High post-harvest losses in the cassava value chain have implications for overall food availability and for smallholder farmer incomes—especially the incomes of women who dominate the marketing and processing of cassava in Ghana (Quartey & Martin, 2008). The C:AVA project tackles the challenge of high post-harvest losses through the development of equitable, high-quality cassava flour (HQCF) value chains that improve the incomes and livelihoods of smallholder farmers and especially of women.

A number of additional opportunities exist in the cassava value chain, including (i) the use of

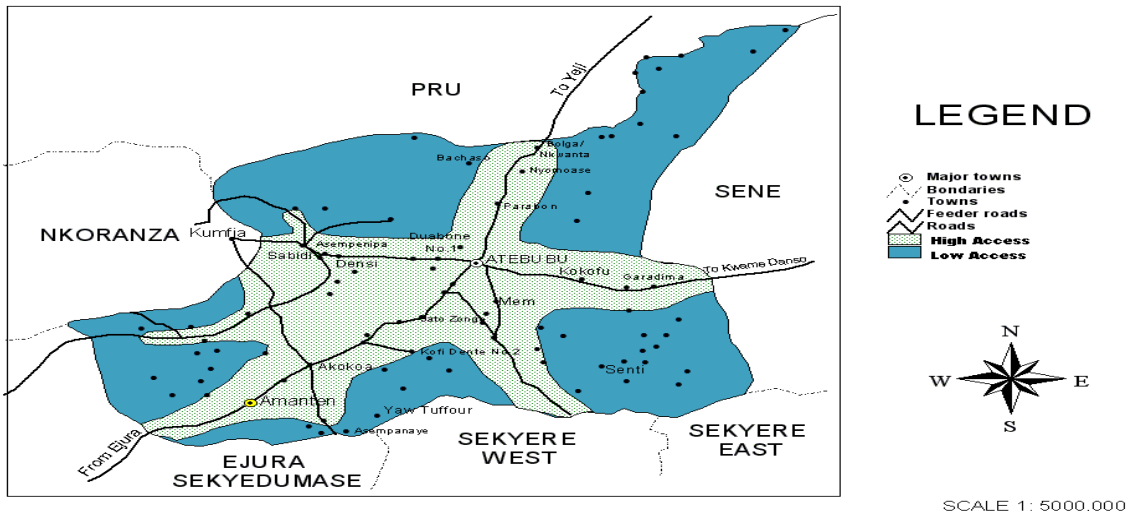
improved/more convenient versions of traditional processed products; (ii) the use of low-quality cassava flour as an import substitute for plywood and paperboard adhesives; (iii) potential markets for cassava products in the production of sweeteners; (iv) mosquito coils; and (v) brewing industry as well as the use of improved technologies such as mechanized dryers (flash, rotary, and bin), mechanized peeling, improvement in sun-drying, and recycling from dewatering. There is also market potential for the use of waste and peels for mushroom production and animal feed.

3 Methodology and data

3.1 Study area

This study was carried out in the Atebubu-Amantin District of the Brong-Ahafo Region in Ghana where the C:AVA project was implemented. The Brong-Ahafo Region is the second largest producer of cassava in Ghana and produced 3,797,416 metric tons of cassava root in 2015 (Ministry of Food and Agriculture, 2018). The majority of households in the area are involved in cassava farming, processing of agricultural produce, and trade. The Atebubu-Amantin District has eight area councils that serve as the smallest planning units. The Konkrompe Area Council in the Atebubu-Amantin District was selected for the CBMS census because most of the communities in which the C:AVA project was implemented were located within that council's area.

Figure 4: A Map of Atebubu-Amantin District Showing Area Councils and Major Communities



Source: Atebubu-Amantin District Assembly, 2017.

3.2 Census design and instruments

We adapted the Community Based Monitoring System (CBMS) developed by Reyes (2006) to gather household and community data in the study locations. [1] Three CBMS questionnaires were developed for data gathering. The Ghana CBMS household questionnaire was aligned to a data-requirement matrix under the supervision of the CBMS Network Team and designed to capture information on demographic and socioeconomic information at the household and individual level, including (i) housing and household characteristics; (ii) demographics; (iii) education and literacy; (iv) economic activities and sources of income; (v) health and nutrition; (vi) water and sanitation; (vii) waste management; (viii) energy; (ix)calamity, hunger, disaster preparedness, and death; and (x) interventions and programs.

The community-profile questionnaire was administered to opinion leaders/district assembly/area council leaders in the communities. The community-profile questionnaire solicited data on physical and demographic characteristics of the study communities, including land area, number of households, population, economic activities, infrastructure, and service institutions such as health and educational facilities, financial institutions, police stations, post offices, and agricultural facilities such as mills, markets, and input supply. It also captured data on water supply, sources of energy, waste-disposal systems, disaster and risk management, significant events, and decision-making arrangements.

An addendum questionnaire was designed to collect supplementary data and information relating to participation in C:AVA and to empowerment and barriers to participation in C:AVA by gender, extension services, and support received, including incomes, market access, intra-household decision-making, and access to production resources.

The electronic versions of the questionnaires were installed onto a tablet using the CBMS Scan software. Provisions were made to gather data on the GPS position of each household, as well as on basic services and social amenities in the study locations. The data were sent, consolidated, and downloaded from the CBMS Web Portal.

3.3 Training, pretest and data collection

A five-day, hands-on training was organized for twenty enumerators and supervisors for CBMS data collection

[1] The adaptions were based on Ghana Living Standard Survey Instruments and other available survey instruments for purposes of comparison. Specific questions regard the C:AVA project and participation were also included.

in Ghana. The enumerators included assemblymen, teachers, and national services personnel recruited from the study locations. The training was conducted at the World Vision Training Centre Conference Room, Atebubu, in the Brong-Ahafo Region of Ghana from February 5-8, 2018.

On February 9, 2018, the instruments were pre-tested. The pre-tested questionnaires were updated and uploaded onto the CBMS Scan tablet for the data collection exercise with technical backstopping from the CBMS Network Team.

Figure 5: Enumerators and supervisors training, February 5-8, 2018. Photo by CBMS Ghana team.

Data collection in the communities took the form of a census. In each study location, a number of households were identified whose members would respond to questions regarding the household and the individuals within it.

Figure 6: Enumerators interviewing respondents in New Konkrompe and Fakwasi

Figure 8: Enumerators Conducting Interviews in Praprabon and Fakwasi.

Respondents to the household profile questionnaire were the household head or any person knowledgeable enough to provide information about the household and members. Data collection took place from February to March 2018. In all, data from 2,716 households in twenty communities in the study locations were collected. Table 2 shows the distribution of households per community.

Table 2: Distribution of Households per Study Community

No.	Planning Unit	Community	Population	Number of Households
1	Atebubu Urban Council	Kokofu	1,034	248
2	Konkrompe Area Council	New Konkrompe	2,173	589

No.	Planning Unit	Community	Population	Number of Households
3	Konkrompe Area Council	Afrefreso	676	145
4	Konkrompe Area Council	Sawakye	371	77
5	Konkrompe Area Council	Old Konkrompe	321	99
6	Konkrompe Area Council	Mem	385	103
7	Konkrompe Area Council	Watro	458	139
8	Nyomoase Area Council	Praprabon	761	174
9	Kumfia-Fakwasi Town Council	Fakwasi	1,241	348
10	Kumfia-Fakwasi Town Council	Bompa	303	70
11	Kumfia-Fakwasi Town Council	Kumfia	1,714	479
12	Akokoa Area Council	Famfour	289	55
13	Konkrompe Area Council	Seanti	182	28
14	Konkrompe Area Council	Seneso	211	52
15	Konkrompe Area Council	Kumkumso	26	11
16	Konkrompe Area Council	Boniafo	292	56
17	Konkrompe Area Council	Abrewanko	39	11
18	Konkrompe Area Council	Dagatiline	17	5
19	Konkrompe Area Council	Ali Kuraa	117	16
20	Konkrompe Area Council	Kwabena Gyan	47	11
All			10,657	2,716

Source: CBMS Census (2018) of selected communities, Konkrompe Area Council.

3.4 Data processing

Data were downloaded from the CBMS portal and converted to Stata files. The data were cleaned to remove duplicate IDs, coded, and labelled for analysis. Descriptive and inferential analyses were done using STATA Statistical Software Version 15. With technical support from the CBMS Network Team in the Philippines, the data were processed to generate the CBMS core indicators and SDG indicators of the selected communities. Poverty maps were generated using QGIS, and GPS readings of household locations made it possible to generate household-level CBMS indicator maps. The CBMS data collected forms the basis of analysis of this study.

3.5 Data validation

After data processing and generation of the CBMS core and SDG indicators, validation workshops were organized both at the district level (where representatives included district and local authorities from the pilot communities) and at the national level to engage policy makers. During these workshops, preliminary findings were presented to the stakeholders to validate and solicit input. This provided the participants the opportunity

to discuss underlying reasons for the CBMS results and ways of putting the data to use in community planning.

3.6 Analytical techniques

Based on literature and experience, appropriate analytical methods were employed to address our research questions. Our analytical methods are described here.

Research Question 1*: What is the effect of C:AVA project participation on farm income by gender?*

Propensity Score Matching (PSM) method was employed to assess the effect of participation in C:AVA on farm income. This quasi-experimental method was adopted because there was no time-series data collected before the 2018 CBMS (Austin, 2008). Following Segal et al. (2007), Propensity Score Marching was estimated in four stages.

In Stage 1: Propensity scores were estimated using a probit regression model of participation in C:AVA. The model took the form:

$$Y = \beta_0 + \beta_1 Age + \beta_2 Hholdsize + \beta_3 LandOwnership + \beta_4 Education + \beta_5 Expereince + \beta_6 Gender + \beta_7 Extension + \varepsilon \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where Y = 1 if the respondent was a beneficiary of C: AVA and 0 otherwise.

Table 3 presents the description of the explanatory variables used in the model.

Table 3: Probit Model Explanatory (Independent) Variables

Variables	Definition	C:AVA beneficiaries	Non-C:AVA beneficiaries	Difference	t-statistics[2]
Farm Income	Income obtained from farming activities in Ghana cedis (GHS) per year	5739.46	5077.96	661.49***	2.2566
Age	Age of household head in years	51.59	44.43	7.16***	6.8707
Household size	Number of household members	5.58	5.2	.4***	3.9518
Educational level	1 if the household head has some form of formal	.6495	.5786	.07	4.4755

[2] A t-statistic is a type of inferential statistic used to determine whether a significant difference exists between the means of two groups (beneficiaries and non-beneficiaries), which are related in certain features.

	education and 0 if no formal education				
Land ownership	1 if household owns a land and 0 otherwise	.87	.75	.13***	9.1982
Gender	1 if a man and 0 if a woman	.51	.50		
Experience	1 if household head has 3 or more years of experience in farming and 0 otherwise	.75	0.55	.19***	12.1832
Extension	1 if household has access to extension services and 0 otherwise	.34	.08	.26***	27.9046

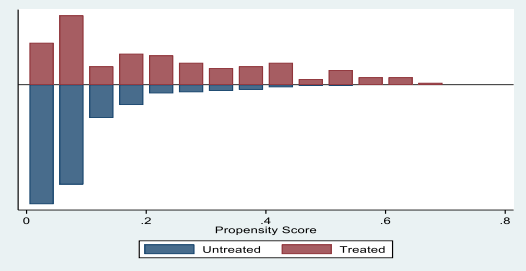
Note: Difference significant at 10% (*), 5% (**), 1% (***). Source: 2018 CBMS Census of selected communities, Konkrompe Area Council.

The estimated probit regression results were used to predict propensity scores (see Appendix 1).

In Stage 2: The results of Stage 1 were used to estimate the propensity scores.

Stage 3*:* An evaluation of the quality of the balance of the predicted propensity scores between C:AVA beneficiary and non-beneficiary groups was conduct. This was done with the aid of graphical representation as indicated in Figure 9. Following the distribution of the propensity scores, near neighborhood matching method was used to create comparable groups. One-to-many matching was used in order not to lose a sizeable number of the sample for estimation.

Figure 9: Distribution of Propensity Scores



In the final stage (*Stage 4*), we estimated differences in the outcomes of interest (changes in income levels). The effect of participation in C:AVA on income was estimated as the Average Treatment Effect (ATE). This was measured as the difference in mean (average) farm income between units assigned to the treatment and units assigned to the control. The results are presented and discussed in Table 4.

Research Question 2*: Is there an association between C:AVA project participation and household poverty levels?*

In this study, we proxied poverty by a number of factors, including access to potable water, toilet facilities, and electricity, along with the average daily income of individual household members. This was based on an "indicator variables on poverty matrix" developed by the CBMS team to compute a Multidimensional Poverty Index. These variables were correlated with the dummy variable of participation in C:AVA. Z-statistics were generated to assess the level of significance of associations among the variables.

Research Question 3*: What is the effect of C:AVA project participation on market access by gender?*

We defined market access as the ability of a farmer to sell all his or her farm produce. Because this variable was categorical in nature (market access), a probit regression model was estimated to assess the effect of C:AVA project participation on market access by gender. The model is presented in Equation 2.

Market_Access=$\beta_0 + \beta_1 Age + \beta_2 Age2 + \beta_3 Education + \beta_4 Household_{size} + \beta_5 Experience + \beta_6 Gender + \beta_7 Treat + \beta_7 Female * C{:}\, AVA + \beta_{78} Christian + \beta_9 Muslim + \varepsilon$)……(2)

where:

Market_Access is equal to 1 if farmer is able to sell all produce regularly and zero otherwise;
Treat (policy variable) is equal to 1 if the farmer was a C:AVA beneficiary and zero otherwise;
The interaction terms *Female*C:AVA* is equal to 1 if the farmer was a woman and C:AVA beneficiary and zero otherwise;
Christian is equal to 1 if the religion of the household head is Christian and zero otherwise; and

Muslim is equal to 1 if the religion of the household head is Muslim and zero otherwise.[3]

The estimate coefficients (probabilities) are presented in Appendix 2**.** The estimated marginal effects are presented and discussed in the results section.

Research Question 4*: Does women's participation in C:AVA lead to improvement in their empowerment?*

As indicated earlier, we assessed women's empowerment through women's participation in decision-making at the household level. Proportional distributions and differences in means were computed to assess participation in decision-making regarding the use of productive resources before and after participation in C:AVA. Table 5 presents estimated results.

Research Question 5*: How did the community and families respond to women's participation in C:AVA? What were the barriers to women's empowerment?*

The research question was addressed with information gathered through focus group discussions. Separate focus group discussions were held for women and men in five randomly selected communities of the twenty in our study area. Content analysis supported percentage distribution results generated from the data.

3.7 Gaps, limitations and opportunities

Our study demonstrates the potential of CBMS as a tool to aid planning at the district-assembly level in Ghana. Because no baseline data on C:AVA exited, we employed a quasi-randomized approach to assess the program's impact. Consequently, the data gathered were based on respondents' recall of information before and after participating in C:AVA. That notwithstanding, we believed important inferences could be made on the outcomes of the study with proper caveats.

4 Application and results

[3] All other variables are same as those defined Table 3.

4.1 Effect of Participation in C:AVA on Farm Incomes

Table 4 presents the results of our measures of the effects of C:AVA on farm income. The overall results showed that the C:AVA project raised participants' farm income by GHC 981.71, on average (statistically significant at 10%). This sum is 50.4% higher than the average income of non-C:AVA respondents.

Table 4: Average Treatment Effect of C:AVA Interventions on Participants

			Average Treatment Effect[4]	
	Variable	**Sample**	**Coefficient**	**t-value**
Pooled sample	Farm Income	Matched	981.71*	1.67
		Unmatched	943.64***	2.91
Women	Farm Income	Matched	2,167.75**	2.18
		Unmatched	2,318.69***	4.48
Men	Farm Income	Matched	276.40	0.27
		Unmatched	790.47	1.11

Note: Coefficient significant at 10% (*), 5% (**), 1% (***)

A further analysis by gender shows that incomes of members of women-headed households increased by 2.2% over the overall average of GHC 2,167.75 (statistically significant at 5%). This could be a result of the fact that women participants dominated in the marketing of cassava, including purchasing and processing from men who farmed. The results further showed that, although men-headed households recorded increased income of about GHC 276.40 compared to non-participants in C:AVA, the result was not statistically significant. The project-development impact on income was impressive, but outcomes could have been much higher. Because of C:AVA's market-driven nature, the programmed targeted farmers who cultivated large areas of cassava (at least two acres). The program's impact would have been greater if this criterion were not enforced. Because of the predominance of smallholder farmers in Ghana, an approach that aggregated produce from farmers irrespective of farm size would have allowed greater participation and, thus, impact. Further expansion of the program may also require identifying and including measures that enable improvement of outcomes for both men- and women-headed households. This is especially important in most African countries where men-headed households dominate communities.

[4] The Average Treatment Effect measures the difference in mean (average) outcomes between units assigned to the treatment and units assigned to the control.

4.2 Association between C:AVA Project Participation and Household Poverty Levels

C:AVA project outcomes were anticipated to alleviate poverty among beneficiaries. Table 5 shows the results of Pearson's measure of the level of association of participation in C:AVA and level of poverty proxied by daily expenditure of individuals (below and above the poverty line,[5]) access to potable water, decent toilet, and electricity. The results showed that about 60% of C:AVA participants were above the poverty line with a daily expenditure of more than GHC 10 per day. The associated chi^2 statistic was 6.6 (statistically significant at 5%). Thus, an association between C:AVA participation and average daily expenditure of household members was demonstrated. The study also observed that a higher proportion of C:AVA participants had access to potable water (77.2%), decent toiled facilities (86.4%), and electricity (55.3%). The associated chi^2 statistics were 12.3, 38.8, and 4.2, respectively. While the observed association was statistically significant at the 1% level in the case of access to water and decent toilet facilities, the association with access to electricity was significant at the 5% level (Table 5). Considering poverty to be multidimensional, this shows that C:AVA project participants were better off compared to project non-participants.

Table 5: Association between C:AVA Participation and Poverty Indicators

Variable	C:AVA Participation		All	Pearson Chi(2)[6]	Probability
	No	Yes			
Poverty level					
Above poverty line	1,682	140	1,822	6.57**	0.010
	(67.8)	(59.6)	(67.1)		
Below poverty line	799	95	894		
	(32.2)	(40.4)	(32.9)		
Water					
No access	587	32	619	12.30***	0.000
	(23.7)	(13.6)	(22.8)		
Access	1,894	203	2,097		
	(76.3)	(86.4)	(77.2)		
Toilet					
No access	401	76	477	38.80***	0.000
	(16.2)	(32.3)	(17.6)		
Access	2,080	159	2,239		
	(83.8)	(67.7)	(82.4)		
Electricity					
No access	939	105	1,044	4.24**	0.040
	(37.9)	(44.7)	(38.4)		
Access	1,542	130	1,672		
	(62.2)	(55.3)	(61.6)		

Note: Coefficient significant at 10% (*), 5% (**), 1% (***); column percentage in parenthesis.

[5] Proportion of households living below the USD $1.90-a-day poverty line.

[6] The chi^2 test is intended to show how likely it is that an observed distribution is due to chance.

4.3 Effect of C:AVA Project Participation on Market Access, by Gender

Access to market remains one of the challenges farmers face in the Atebubu-Amantin District and in Ghana as a whole. This was partly a result of the poor and non-motorable roads that rendered some of the major food-producing villages unreachable, especially during the rainy season. Access to emerging food-processing markets could be another constraint as a result of lack of information on traders and prices as well as capacity to meet food processing and safety standards. Consequently, any intervention aimed at increasing productivity, including C:AVA, should incorporate measures to ensure access to market so that farmers and processors can sell their produce/products. Access to market will also serve as a stimulus in enhancing adoption of improved production and processing practices by farmers and processors, respectively. Interactions with C:AVA project managers revealed that efforts were made to enhance market access as part of project support to beneficiaries.

This subsection presents and discusses the marginal effect results obtained as post estimation from a probit regression model on the determinant of market access among farmers (Table 6). Market access (the dependent variable) was measured as a binary variable based on farmers' ability to sell their produce. It was measured as 1 if the farmer indicated being able to sell all their surplus produce and zero otherwise.

Table 6: Marginal Effect Results of Probit Regression Model on Market Access

Variables	Coefficient	z	P>z[7]
Age	.000867	1.19	0.236
Age2	-.0000148	-1.42	0.156
Education	.0418658***	4.46	0.000
Household size	.0124021***	8.27	0.000
Experience	.0203395**	2.03	0.042
Gender (Women)	-.0201131	-2.14	0.032
Treat	.2539466***	9.98	0.000
Women-C:AVA	-.0004868	-0.02	0.986
Christian	.0852462***	9.26	0.000
Muslim	.0728931***	3.24	0.001
Extension	-.1297561***	-11.31	0.000

[7] Z-Score is a standard deviation and explains how many standard deviations from the mean the result is. If the z-score is positive, it indicates that the score is above the mean, a negative z-score indicates the score is below the population mean, and a 0 z-score indicates the score is same as the population mean. p-value, conversely, is a probability that allows the null hypothesis to be rejected (or not) and alternative hypotheses to be accepted (or not).

Income	.0511032***	12.56	0.000
Pseudo R2		0.0703	
Prob > chi²		0.0000	
Log likelihood		-4986.3964	

Note: Coefficient significant at 10% (*), 5% (**), 1% (***).

The results showed that formal level of education increased the probability of market access by about 4.2% (statistically significant at 1%). Also, an increase in household size improved access to market by 1.2% (statistically significant at 1%). Farmers with at least three years of experience in farming were 2% more likely to have access to market compared to farmers with less than three years of farming experience (significant at 5%). The coefficient of the policy variable, *treat*, showed that C:AVA participants were 25.4% more likely to have access to market for their produce as compared to non-participants (statistically significant at 1%). In all, women were 2% less likely to have market access than men (significant at 5%). A further gender analysis showed that women C:AVA participants were 72% more likely to have market access than women who did not benefit from the project. Likewise, men who participated in C:AVA were 25.5% more likely to have market access for their produce than men who did not (significant at 1%).

Religion of a farmer was found to influence market access. Farmers who were Christians and Muslims in the study locations were 8.5% and 7.2%, respectively, and were more likely to have market access compared to farmers who belonged to other religions (both statistically significant at 1%). The results further showed that farmers with access to extension services in the study location were about 13% less likely to have market access (statistically significant at 1%). While this does not conform to a priori expectations, it indicates the limited extension-services delivery in the study location. The data showed that only 10% of the study sample had access to extension services. The need to capacitate District Agricultural Development Units with staffing and logistics for effective extension delivery cannot be overemphasized. The local C:AVA project coordinator revealed that, in establishing market linkages, the formation of cooperatives by women influenced their bargaining power and also emphasized the need for farmers and processors to form associations for greater influence in such areas as credit access, markets, and crop insurance.

Overall, the study predicted 23.1% of the determinant of market access to farmers/processors in the study location. Other factors must be explored in future studies to offer policy recommendations that enhance farmers' access to markets.

4.4 Effects of C:AVA Project Participation on Women's Empowerment

Women's empowerment was assessed using participation in decisions regarding household productive resources, including the use and non-use of productive resources such as land, seed, extensions, services, tractor services, irrigation services, improved processing technologies, market and marketing information, and credit decisions. An assessment of participation in decision-making before and after C:AVA showed an improvement in collective decision-making regarding productive resources (Table 7). The increase in collective decision-making ranged from 7.9% to 23.4% (all increases were statistically significant).

Table 7 demonstrates that, before the C:AVA project, *men alone* dominated decision-making on productive resources such as land (59.8%), extension services (48.9%), and tractor services (60.9%). Men's decision-making on productive resources was over 50% for fertilizer(65.5%), irrigation services (51.0%), improved processing technologies (64.7%), markets and marketing information (61.8%), and credit services (51.1%); , comparatively, the proportion of women making decision regarding productive resources was less than 20% in all cases.

Table 7: Decision-Making Regarding Access to Productive Resources

Resource	Before Participation in C:AVA (%)			After CAVA (%)			% Diff. Both	Z-statistic
	Men Only	Women Only	Both	Men Only	Women Only	Both		
Land	59.8	3.4	36.8	38.7	1.2	60.1	23.4***	8.0113
Seed	40.9	11.6	47.5	28.7	3.1	68.2	20.8***	6.5520
Extension	48.6	7.0	44.4	31.6	1.7	66.8	22.4***	7.1803
Fertilizer	27.3	7.2	65.5	19.9	2.3	77.8	12.3***	3.5073
Tractor Services	60.9	3.5	35.6	40.0	3.9	56.1	20.5***	7.2117
Irrigation Services	43.7	5.4	51.0	29.6	5.5	64.9	13.9***	4.3939
Improved Processing Technology	27.1	8.2	64.7	21.8	5.0	73.2	8.5**	2.4684
Market and Marketing Information	18.6	19.7	61.8	14.3	16.1	69.6	7.9**	2.3326
Credit	46.0	3.0	51.1	25.4	6.7	67.9	16.8***	5.2319

Note: Coefficient significant at 10% (*), 5% (**), 1% (***); Z- statistic computed using proportional test.

Apart from markets, market information, and improved processing technology, collective decision-making regarding household production resources increased more than 10% after participation in C:AVA. In a focus group discussion with C:AVA project participants, it became evident that training from the project on

farming as a business had contributed immensely to this development. Furthermore, the results showed that inclusive decision-making regarding land by household increased by 23.4% and 22.4% regarding extension services (both were statistically significant at 1%). Other details can be found in table 7.

4.5 Sociocultural Factors that Influenced Women's Participation in C:AVA

C:AVA participants were asked to evaluate sociocultural factors that influenced women's participation in C:AVA as well as their participation in other development projects in the study communities. Table 8 shows the findings.

The results showed limited sociocultural barriers to women's participation in C:AVA and development programs in the study communities in general. However, less than 8% of the respondents admitted to the existence of some sociocultural barriers to women's participation in development programs. Factors such as the need to seek permission from spouse (7.7%), gender roles in households (5.2%) and time spent by women on household chores and care given (5.1%) were prominent among them.

Table 8: Sociocultural Factors that Influenced Women's Participation in C:AVA

Sociocultural Factors	Yes (%)
Limitations by gender roles in the households	5.24
Culturally women were supposed to get permission from the husbands before participating	7.69
Women do not own their own cassava farms	2.53
Women spend all their time on household chores and care giving	5.12
Women were not allowed to join groups	1.99
Women were not allowed to make their own decisions	3.42
Others	0.15

Source: CBMS data (2018)

Furthermore, respondents indicated other factors that attracted women to C:AVA, include their realization of the good market opportunities offered by the project and the money earned by initial project participants from their farms.

As the literature has made clear, women need both resources and a sense of agency to achieve livelihood outcomes (Sharaunga, Mudhara & Bogale, 2019; Jost et al., 2016; Miriti et al., 2019) and interventions should target women's strategic and practical needs. Power imbalances and cultural stereotypes that deter

women's empowerment and socioeconomic development need to be tackled through awareness initiatives.

5 Conclusions and policy implications

The need for evidence based and informed planning was critical in ensuring effective allocation and distribution of scarce resources to areas where they were mostly needed for outmost impacts. The CBMS was proven very useful tool for obtaining census information to support this course as evidenced in this study. We found that overall C:AVA project raised the incomes of participants by GHC 981.71 on the average. This was statistically significant at 10% level. The incomes of women-headed households increased by 2.2% over the average to GHC 2,167.75 (statistically significant at 5%).

Factors such as household size, farming experience, educational level, religion, and income influenced market access in the study location. The coefficient of the policy variable, *treat*, showed that C:AVA project participants were 23.1% more likely to have access to markets for their produce than were non-participants (statistically significant at 1%). Furthermore, the results showed that there were limited sociocultural barriers to women's participation in C:AVA and development programs in the study communities in general.

Mainstreaming gender and ensuring women's participation in C:AVA led to improvement in their empowerment status as reflected in enhanced market access and their involvement in household decision-making. Beneficiaries had more marketing opportunities than non-beneficiaries and the difference in market access (measured in terms of ability to sell off produce) was statistically significant.

Reflecting on the theory of change, the C:AVA project met its expectation of improving livelihoods by increasing incomes by gender and providing access to water, decent toilet facilities, and enhanced markets, although there was still room for improvement.

Based on the findings the study concludes that the C:AVA project empowered women by increasing their level of income and participation in household decision-making regarding use of productive resources.

The study recommends the adaption of CBMS methodology by the Ministry of Local Government Services through District Assemblies in Ghana to help provide data to aid planning and assess outcomes of development interventions for improved livelihoods. Agricultural development projects in Ghana should intentionally include gender in their implementation. Further expansion of C:AVA project may require identifying and including measures that will enhance improvement of outcomes for both men- and women-headed households.

Research question	Key findings	Policy implications	Recommendations
What is the effect of	We found that, overall,	Mainstreaming gender	The Ministry of Local

Research question	Key findings	Policy implications	Recommendations
C:AVA participation on farm incomes by gender?	C:AVA raised participants' incomes of by GHC 981.71 on the average. A further analysis by gender showed that incomes of members of women-headed households increased by 2.2%.	and ensuring women's participation in C:AVA led to improvement in their empowerment status as reflected in an enhanced market access and their involvement in household decision-making.	Governance Services should mainstream gender in all developmental programs/projects in Ghana.
Is there an association between C:AVA participation and household poverty levels?	The results show significant differences in the association between C:AVA participation and higher average daily expenditure of household members compared to project non-beneficiaries.	C:AVA improved the level of poverty of C:AVA beneficiary households and enhanced their access to potable water, descent toiled facilities and electricity	The Ministry of Local Government Services through its District Assemblies in Ghana should adopt the CBMS methodology to help gather data to aid planning and targeting of development interventions to achieve outmost impact
What is the effect of C:AVA project participation on market access by gender?	C:AVA project participants were 25.4% more likely to have access to market for their produce as compared to non-participants.	The C:AVA project enhanced market access for project beneficiaries	The Ministry of Local Government Services should mainstream marketing and commercialization activities in all agricultural and entrepreneurial developmental projects by linking farmers to markets within and outside their respective districts as a sustainability measure.
Did women's participation in C:AVA lead to improvement in their empowerment?	An assessment of the participation in decision-making before and after C:AVA participation shows an improvement in collective decision-making regarding productive resources. The percentage increase ranged from 7.9 to 23.4%.	Women's participation in C:AVA led to improvement in their empowerment status as reflected in their involvement in household decision-making.	At the municipal and district levels, women should be encouraged to participate in developmental projects by eliminating any sociocultural barriers. There is a need for advocacy and sensitization on gender issues to eliminate

Research question	Key findings	Policy implications	Recommendations
			barriers to women's empowerment and increase their access to and participation in decision-making on productive resources.
How did the community and families respond to women's participation in C:AVA? Barriers to women's empowerment	The results showed limited sociocultural barriers to women's participation in C:AVA and development programs in the study communities in general.	Although the study found limited sociocultural barriers to women in project participation, the fact that less than 8% of the respondents admitted to the existence of some sociocultural barriers to women's participation in development programs means that some level of sociocultural barriers to women's empowerment exist and cannot be ignored	At the municipal and district levels, women should be encouraged to participate in developmental projects by eliminating any sociocultural barriers. There is a need for advocacy and sensitization on gender issues to eliminate barriers to women's empowerment and increase their access to and participation in decision-making on productive resources.

References

ACCESS for African Businesswomen in International Trade (n.d.). *International Trade Center*. Available at http://www.intracen.org/itc/projects/pact-ii/access.

Agarwala, R. and Lynch, S. M. (2006). Refining the Measurement of Women's Autonomy: An International Application of a Multi-Dimensional Construct. *Social Forces, 84*(4), 2069-2090.

Alkire, S., Meinzen-Dick, R., Peterman, A., Seymour, G., and Vaz, A. (2013). The Women's Empowerment in Agriculture Index. *World Development*, *52,* 71-91.

Austin P. (2008). The Performance of Different Propensity-Scores Methods for Estimating Relative Risk. *Journal of Clinical Epidemiology*, *61*(6): 537-545.

Baah-Boateng, W. (2013). Determinants of Unemployment in Ghana. *African Development Review*, 21(4), 385-399.

Badruddin, S.T. (2017.) Self Help Groups: An Emerging Power in Women's Empowerment. *Asian Journal of Multidisciplinary Studies, 5*(10), 80-82.

Chain, M., K. (2010). Improving Opportunities for Women in Smallholder-Based Supply Chains: Business Case and Practical Guidance for International Food Companies. Seattle, WA: Bill & Melinda Gates Foundation.

Cooke, E., Hague, S., and McKay, A. (2016). The Ghana Poverty and Inequality Report: Using the Sixth Ghana Living Standards Survey 2016. New York, NY: UNICEF. Available at https://cocoainitiative.org/wp-content/uploads/2016/01/Ghana_Poverty_and_Inequality_Analysis_FINAL_Match_20161.pdf.

Costa Pinto, D., Herter, M. M., Rossi, P., and Borges, A. (2014). Going Green for Self or for Others? Gender and Identity Salience Effects on Sustainable Consumption. *International Journal of Consumer Studies*, *38*(5), 540-549.

Food and Agriculture Organization (2011) The State of Food and Agriculture: Women in Agriculture, Closing the Gender Gap for Development. Rome, Italy: FAO.

Food and Agriculture Organization (2013). Statistics. Rome, Italy: FAOSTAT (The Statistics Division of the FAO). Available at http://www.fao.org/statistics/en/.

Government of Ghana (2014). Ghana Shared Growth and Development Agenda, 2014-2017. Accra, Ghana: Government of Ghana.

Heath, R., and Mobarak, M. (2011). Does Demand or Supply Constrain Investments in Education? Evidence from Garment Sector Jobs and the Female Stipend Program in Bangladesh. Seattle, WA: University of Washington. Available at https://faculty.washington.edu/rmheath/garments%20paper%20Heath%20Mobarak%20Nov%202%202011.pdf.

Institute of Statistical Social and Economic Research (2017). The State of the Ghanaian Economy. ISSER Report. Legon, Ghana: University of Ghana.

International Labour Organization (ILO) (2008). Report V. Skills for Improved Productivity, Employment Growth and Development, International Labour Conference, 97th Session 2008. Geneva, Switzerland: ILO.

Jost, C., Kyazze, F., Naab, J., Neelormi, S., Kinyangi, J., Zougmore, R., Aggarwal, P., Bhatta, G., Chaudhury, M. Tapio-Bistrom, M.-L., Nelson, S., and Kristjanson, P. (2016). Understanding Gender Dimensions of Agriculture and Climate Change in Small Holder Farming Communities. *Climate and Development 8*(2), 133-144.

Jütting J., Luci, A., and Morrisson, C. (2010). Why Do So Many Women End Up in Bad Jobs? A Cross-Country Assessment. OECD Development Centre Working Papers 287. Paris, France: Organisation for Economic Co-operation and Development Publishing.

Kaur, A. and Singh, N. (2017). Changing Behaviour of Society towards Women's Empowerment. *International Journal of Research in Commerce & Management, 8*(2), 20-23.

Ministry of Food and Agriculture (2014). Gender Analysis of Agricultural Sector in Ghana (2014). Report of the MOFA under the Under West African Agricultural Productivity Improvement Project. Accra, Ghana.

Ministry of Food and Agriculture (2018). Agricultural Sector Progress Report. Accra, Ghana: Statistics Research and Information Directorate.

Miriti, L., Masiga, C., Wamue, N., and Maina, I (2019). Gender Gaps in Decision-making Power in Households: Case of Improved Bee Keeping Among the Maasai Community in Trans Mara, Narok County, Kenya. *International Journal of Gender Studies 4*(1), 19-36.

Morioka K, Nicholas G. (2014). Women Empowerment and Value Chains: Experiences of Women in Cambodia, Palestine and Uganda. Camperdown, Australia: Action Aid.

Nardi, G. (2015). Women's Economic Empowerment in Rural Value Chains: The Role of the Private Sector. *CARE Insights*. London, England: CARE International. Available at https://insights.careinternational.org.uk/development-blog/women-s-economic-empowerment-in-rural-value-chains-the-role-of-the-private-sector.

Naziri, D., Quaye, W., Siwoku, B., Wanlapatit, S., Phu, T. V., and Bennett, B. (2014). The Diversity of Postharvest Losses in Cassava Value Chains in Selected Developing Countries. *Journal of Agriculture and Rural Development in the Tropics and Subtropics*, *115*(2), 111-123.

Owoo, Nkechi S., Dávalos, J., Lambon-Quayefio, M. P., Manu, S. B. (2017). An Empirical Assessment of the Union "Facilitation Effect" in Ghanaian Labor Market Workers. PEP Working Paper 2017-08. Nairobi, Kenya: Partnership for Economic Policy.

Poonam, K., Madhu, A., and Prasad, Y.M. (2017). An Empirical Research on Role of Banks in Women's Empowerment. *Journal of Indian Management & Strategy, 22*(2), 40-44.

Quartey, Q. and Martin, A. (2008). Gender and Diversity Report Prepared under C:AVA project. Unpublished manuscript.

Quaye, W., Fuseini M., and Boadu, P. (2016). Policy Brief **o**n Gender Responsive Agricultural Extension Delivery for Improved Agricultural Productivity in Northern Ghana. Unpublished manuscript.

Quaye, W., Okai, M., Dowuona, S.N., and Dziedzoave, N. (2014). Gender Dimensions of Decision Making and Production Assets and Challenges Facing Women in Making Decisions Regarding Production and Processing Activities. *Development in Practice,* 26(1), 77-90.

Reyes, Celia M. (2006). Alternative Means Testing Options Using CBMS, PIDS Discussion Paper Series No. 2006-22. Makati City, the Philippines: Philippine Institute for Development Studies (PIDS).

Said-Allsopp, M. and Tallontire, A.M. (2014). Pathways to Employment? Dynamics of Women's Participation in Global Value Chains. *Journal of Cleaner Production 107*, 114-121.

Segal, J. B., Griswold, M., Achy-Brou, A. C., Herbert, R., Bass, E. B., Wu, A. W., and Frangakis, C. E. (2007). Using Propensity Score Subclassification to Estimate Effects of Longitudinal Treatments: An Example Using New Diabetes Medication. *Medical Care*, *45*, 149-157.

Sharaunga, S., Mudhara, M., and Bogale, A. (2019). Conceptualization and Measurement of Women's Empowerment Revisited. *Journal of Human Development and Capabilities, 20*(1), 1-25.

Spence, N. (2011). Gender Issues in Trade: Agricultural Value Chains, What Have We Learnt to Date. A Paper Prepared for the Continental Conference on Mainstreaming Gender into Trade Policy, 12-14 November 2011, Accra, Ghana.

Vanhuyse, F. (2012). Draft Report: Monitoring Visit to C:AVA Ghana 4, 17 November, 2012. Accra, Ghana. Unpublished manuscript.

Vigneri, M. and Lombardini, S. (2016). Women's Empowerment in Mali: Impact Evaluation of the Educational Project Girls Can—Promoting Secondary Education in West Africa. Oxford, England: Oxford Committee for Famine Relief (OXFAM).

Zoogah, D.B. (2010). Why Should I Be Left Behind? Employees' Perceived Relative Deprivation and Participation in Development Activities. *Journal of Applied Psychology*, *96*(1), 159-173.

Annex

Annex 1a: Estimated Probit Regression Results for Predicting Propensity Scores

```
Probit regression                                 Number of obs     =      9,583
                                                  LR chi2(13)       =     953.26
                                                  Prob > chi2       =     0.0000
Log likelihood = -2591.5762                       Pseudo R2         =     0.1553
```

treat	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age_yr	.0103536	.0037193	2.78	0.005	.0030639	.0176433
age_yr2	-.0000578	.000047	-1.23	0.219	-.0001499	.0000343
Education	.2249393	.041486	5.42	0.000	.1436282	.3062505
Male	.0415301	.0387833	1.07	0.284	-.0344838	.1175439
phsize	.0040847	.0069183	0.59	0.555	-.0094749	.0176442
experience	.4524178	.0555573	8.14	0.000	.3435274	.5613081
land_own	.1241097	.0634743	1.96	0.051	-.0002977	.248517
Extension	1.009069	.0492347	20.50	0.000	.9125705	1.105567
Married	-.0568351	.0539618	-1.05	0.292	-.1625983	.0489281
logIncome	-.1303319	.0168747	-7.72	0.000	-.1634056	-.0972581
christian	.0156343	.0385471	0.41	0.685	-.0599166	.0911852
muslim	-.1250691	.0854645	-1.46	0.143	-.2925765	.0424383
market	.5759372	.0424067	13.58	0.000	.4928215	.6590528
_cons	-1.252596	.1711957	-7.32	0.000	-1.588133	-.9170587

Annex 1b: Estimated Effect of C:AVA on Farm and Total Household Income (totin) Aggregated from Data

```
. psmatch2 treat, outcome(Income_farming_N totin) pscore(ps)
```

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
Income_farming_N	Unmatched	6572.51227	5628.87069	943.641582	324.242305	2.91
	ATT	6572.51227	5590.80043	981.711846	587.755167	1.67
totin	Unmatched	12989.6169	14877.273	-1887.65612	638.575639	-2.96
	ATT	12989.6169	13479.671	-490.054108	1275.33855	-0.38

Note: S.E. does not take into account that the propensity score is estimated.

psmatch2: Treatment assignment	psmatch2: Common support On suppor	Total
Untreated	8,646	8,646
Treated	937	937
Total	9,583	9,583

```
. psmatch2 treat if reln==1 & sex==2, outcome(Income_farming_N totin) pscore(ps)
```

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
Income_farming_N	Unmatched	4514	2195.31376	2318.68624	517.000813	4.48
	ATT	4514	2346.25	2167.75	996.29863	2.18
totin	Unmatched	6797.85	7839.90977	-1042.05977	1449.52537	-0.72
	ATT	6797.85	6716.05	81.8	1630.77442	0.05

Note: S.E. does not take into account that the propensity score is estimated.

psmatch2: Treatment assignment	psmatch2: Common support On suppor	Total
Untreated	647	647
Treated	40	40
Total	687	687

```
. psmatch2 treat if reln==1 & sex==1, outcome(Income_farming_N totin) pscore(ps)
```

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
Income_farming_N	Unmatched	6160.4012	5369.93308	790.468114	714.56507	1.11
	ATT	6160.4012	5884	276.401198	1012.8536	0.27
totin	Unmatched	12292.9701	14557.38	-2264.4099	1411.08479	-1.60
	ATT	12292.9701	13629.2796	-1336.30958	2083.18182	-0.64

Note: S.E. does not take into account that the propensity score is estimated.

psmatch2: Treatment assignment	psmatch2: Common support On suppor	Total
Untreated	1,599	1,599
Treated	167	167
Total	1,766	1,766

Annex 3: Estimated Probit Results of Market-Access Model

```
. probit market age_yr age2 edu phsize Female experience treat Female_cava christian muslim Extension logincome

Iteration 0:   log likelihood = -5363.7199
Iteration 1:   log likelihood = -4989.2394
Iteration 2:   log likelihood = -4986.3968
Iteration 3:   log likelihood = -4986.3964

Probit regression                                 Number of obs     =      9,583
                                                  LR chi2(12)       =     754.65
                                                  Prob > chi2       =     0.0000
Log likelihood = -4986.3964                       Pseudo R2         =     0.0703
```

market	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age_yr	.0028481	.002403	1.19	0.236	-.0018617	.0075579
age2	-.0000486	.0000343	-1.42	0.156	-.0001158	.0000186
edu	.1365457	.0304388	4.49	0.000	.0768866	.1962047
phsize	.0407414	.0049263	8.27	0.000	.031086	.0503968
Female	-.0660861	.0309196	-2.14	0.033	-.1266873	-.0054848
experience	.0672791	.0333769	2.02	0.044	.0018616	.1326966
treat	.7156514	.0651835	10.98	0.000	.5878941	.8434086
Female_cava	-.0016	.0899168	-0.02	0.986	-.1778338	.1746337
christian	.2800376	.0303504	9.23	0.000	.2205519	.3395233
muslim	.2289328	.0678029	3.38	0.001	.0960415	.3618241
Extension	-.5009162	.0540964	-9.26	0.000	-.6069431	-.3948893
logincome	.1678763	.0134544	12.48	0.000	.1415061	.1942464
_cons	-3.059911	.1417015	-21.59	0.000	-3.337641	-2.782181

```
.
end of do-file

. mfx

Marginal effects after probit
      y  = Pr(market) (predict)
         =  .23103329
```

variable	dy/dx	Std. Err.	z	P>|z|	[	95% C.I.	]	X
age_yr	.000867	.00073	1.19	0.236	-.000567	.002301		24.9798
age2	-.0000148	.00001	-1.42	0.156	-.000035	5.7e-06		1014.04
edu*	.0418658	.00939	4.46	0.000	.023453	.060279		.424189
phsize	.0124021	.0015	8.27	0.000	.009464	.01534		5.30888
Female*	-.0201131	.00939	-2.14	0.032	-.038508	-.001718		.497443
experi~e*	.0203395	.01002	2.03	0.042	.000699	.03998		.636961
treat*	.2539466	.02545	9.98	0.000	.204061	.303832		.097777
Female~a*	-.0004868	.02734	-0.02	0.986	-.054077	.053103		.046958
christ~n	.0852462	.00921	9.26	0.000	.067203	.103289		1.41459
muslim*	.0728931	.02248	3.24	0.001	.028843	.116943		.213086
Extens~n*	-.1297561	.01148	-11.31	0.000	-.152249	-.107264		.116143
loginc~e	.0511032	.00407	12.56	0.000	.043126	.05908		9.30313

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. probit market age_yr age2 edu phsize experience treat christian muslim Extension logincome if Female==1

Iteration 0:   log likelihood = -2634.9471
Iteration 1:   log likelihood = -2449.8615
Iteration 2:   log likelihood = -2448.2933
Iteration 3:   log likelihood = -2448.2931
Iteration 4:   log likelihood = -2448.2931

Probit regression                                 Number of obs     =      4,767
                                                  LR chi2(10)       =     373.31
                                                  Prob > chi2       =     0.0000
Log likelihood = -2448.2931                       Pseudo R2         =     0.0708
```

market	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age_yr	.0004809	.0033429	0.14	0.886	-.006071	.0070329
age2	-.0000146	.0000472	-0.31	0.758	-.0001072	.000078
edu	.1138976	.0435426	2.62	0.009	.0285556	.1992396
phsize	.0435157	.0069406	6.27	0.000	.0299124	.0571189
experience	.0874597	.0476047	1.84	0.066	-.0058438	.1807631
treat	.7181795	.0704442	10.20	0.000	.5801114	.8562477
christian	.3473701	.0529917	6.56	0.000	.2435083	.451232
muslim	.383042	.1154556	3.32	0.001	.1567531	.6093309
Extension	-.5392797	.0770404	-7.00	0.000	-.6902762	-.3882832
logincome	.1586855	.0188044	8.44	0.000	.1218295	.1955415
_cons	-3.16178	.2084057	-15.17	0.000	-3.570248	-2.753312

```
.
end of do-file

. mfx

Marginal effects after probit
      y  = Pr(market) (predict)
         =  .22435835
```

variable	dy/dx	Std. Err.	z	P>|z|	[	95% C.I.	]	X
age_yr	.000144	.001	0.14	0.886	-.001818	.002106		25.1812
age2	-4.36e-06	.00001	-0.31	0.758	-.000032	.000023		1022.34
edu*	.0342005	.01311	2.61	0.009	.008513	.059888		.464443
phsize	.0130298	.00208	6.27	0.000	.008958	.017101		5.34529
experi~e*	.0259527	.014	1.85	0.064	-.001484	.05339		.633103
treat*	.2527402	.02706	9.34	0.000	.19971	.30577		.094399
christ~n	.104012	.01579	6.59	0.000	.073062	.134962		1.47934
muslim*	.1237199	.03966	3.12	0.002	.045981	.201459		.204531
Extens~n*	-.1351944	.01548	-8.73	0.000	-.165536	-.104853		.119153
loginc~e	.0475147	.00559	8.49	0.000	.03655	.05848		9.26599

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. probit market age_yr age2 edu phsize experience treat christian muslim Extension logincome if Male==1

Iteration 0:   log likelihood = -2727.8023
Iteration 1:   log likelihood = -2536.5999
Iteration 2:   log likelihood = -2535.2718
Iteration 3:   log likelihood = -2535.2716

Probit regression                                 Number of obs     =      4,816
                                                  LR chi2(10)       =     385.06
                                                  Prob > chi2       =     0.0000
Log likelihood = -2535.2716                       Pseudo R2         =     0.0706

------------------------------------------------------------------------------
      market |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      age_yr |   .0053025   .0034785     1.52   0.127    -.0015152    .0121203
        age2 |  -.0000852     .00005    -1.71   0.088    -.0001831    .0000127
         edu |   .1635624   .0429067     3.81   0.000     .0794668     .247658
      phsize |   .0386225   .0070077     5.51   0.000     .0248876    .0523574
  experience |   .0494047   .0468618     1.05   0.292    -.0424427    .1412521
       treat |   .7122006   .0678177    10.50   0.000     .5792803     .845121
    christian |   .2488613   .0375759     6.62   0.000     .1752139    .3225087
      muslim |    .148788    .085194     1.75   0.081    -.0181892    .3157651
   Extension |  -.4647385   .0759887    -6.12   0.000    -.6136736   -.3158034
   logincome |   .1774093   .0193057     9.19   0.000     .1395707    .2152479
       _cons |  -3.103888   .1969862   -15.76   0.000    -3.489974   -2.717802
------------------------------------------------------------------------------

. mfx

Marginal effects after probit
      y  = Pr(market) (predict)
         =  .23744419
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.      z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
  age_yr |    .0016388      .00107    1.52   0.127  -.000468  .003745   24.7803
    age2 |   -.0000263      .00002   -1.71   0.088  -.000057  3.9e-06   1005.82
     edu* |    .0511995      .01359    3.77   0.000   .024569   .07783   .384344
  phsize |    .0119366      .00217    5.51   0.000   .007693   .01618   5.27284
experi~e* |    .0151921      .01434    1.06   0.289  -.012909  .043293   .640781
   treat* |    .2545918      .02615    9.74   0.000    .20334  .305844   .101121
christ~n |    .0769124      .01158    6.64   0.000   .054224  .099601    1.3505
  muslim* |    .0473012      .02781    1.70   0.089  -.007196  .101798   .221553
Extens~n* |   -.1240639      .01695   -7.32   0.000   -.15728 -.090848   .113164
loginc~e |    .0548297      .00593    9.24   0.000   .043205  .066454   9.33989
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

Annex 3 Household Characteristics

Relation to Household Head	percentage
Head	25.65
Spouse	14.55
Son/Daughter	45.93
Son/Daughter in-law	0.68
Grandson/Granddaughter	3.55
Father/Mother	7.0
Other relatives, specify	1.67

Housemaid/boy	0.06
Step-son/Step-daughter	0.2
Others, specify	0.72

Sex of Household Member	**percentage**
Men	50.26
Women	49.74

Marital Status	**percentage**
Single	44.43
Married	46.68
Widowed	4.5
Divorced/Separated	3.39
Loose Union	0.99

Religion	**percentage**
Christianity	71.41
Muslim	21.30
Traditionalist	3.73
Other(specify)	3.56

Nature of Employment	**percentage**
A paid employee	5.87
Self-employed in non-agriculture (with employees)	1.68
Self-employed in non-agriculture (without employees)	11.08
Contributing family worker non-agriculture	4.12
Self-employed in agric. (with employees)	5.4
Self-employed in agric. (without employees	40.5
Contributing family worker non-agriculture	28.58
Domestic employee (household help)	0.15
Apprentice	2.08