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Conservation Agriculture: Gendered Impacts on Households' Livelihoods

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In response to climate change, new technologies resilient to climatic variability have been promoted among smallholder farmers. Conservation Agriculture (CA) has been promoted since the 1990s in sub-Saharan Africa. However, as with any new technology, various factors affect adoption and ultimately the impact of the technology.Gender is one such factor. Both female and male smallholder farmers are faced with numerous constraints to accessing productive resources Female farmers face more problems in adopting new technology than do male farmers, resulting in few of them adoptining them. This in turn reduces the impact that these technologies have on their livelihood. Using Zambian nationally representative data, the study examines the gendered impacts of CA on smallholder households' livelihood outcomes - household income, crop income, crop diversification, and dietary diversity score. Results show that CA adoption improves a household's level of dietary diversity and crop diversification. However, the impact of CA on these livelihood outcomes reduces if the household is femaleheaded or the farmer (male or female) is in a female headed household. Therefore, promotion of CA should take into account the gender differences at household level and within the household, as well as female farmers' access to productive resources.

Key words:
Conservation agriculture, Gender, Impact, Livelihood outcomes, Zambia

Introduction

Sub-Saharan Africa's (SSA) agricultural production is threatened by climate variability and change which is evident in the increase in variable temperatures, changes in precipitation patterns and increased occurrences of extreme events such as droughts and floods (IPCC, 2014; Nelson, 2009). In order to sustain food production and productivity in light of these challenges, new innovative technologies which are resilient to climatic variability have been promoted over the years, especially among smallholder farmers who form the bulk of farmers and are the most vulnerable. One such technology is Conservation Agriculture (CA). CA consists of a package of farming practices based on three main principles, namely: minimum mechanical soil disturbance; permanent

organic soil cover; and crop rotation (FAO, 2001; Haggblade and Tembo, 2003). It isintended to reduce the negative impacts of climate variability and change by optimizing crop yields and profits while maintaining a balance between agricultural, economic and environmental benefits (FAO, 2011). It has been promoted in SSA since the 1990s (FAO, 2001; Haggblade and Tembo, 2003). However, as a practice that has been promoted for over a decade, and despite the benefits, adoption rates remain relatively low.

Among smallholder farmers, female farmers play a significant role in agricultural production, with more female farmers engaging in agriculture (78%) compared to male farmers at 69% (Sitko et al. 2011). However, even though female farmers engage in agriculture production more than male farmers, the rates of technology adoption are lower among female farmers than male farmers (Quisumbing 1996; Ragasa et al. 2013). Both female and male smallholder farmers are faced with numerous constraints when it comes to having access to productive resources. However, female farmers find it even more challenging to access these resources due to traditional and cultural barriers (Doss, 2001). In particular female farmers have limited access/ownership to land, credit, and other productive assets such as livestock. This hinders adoption of new technologies by female farmers, as their limited resource endowments have an impact on their adoption capability which in turn reduces the impact that these technologies have on their livelihood.

The adoption of CA as an improved technology has remained relatively low due to a number of issues. Studies have been carried out in Zambia to try and establish the factors that might contribute to the adoption of the various CA practices. These studies examine a number of factors affecting CA adoption, for instance resource availability, e.g. land, labour, income, access to machinery, credit, as well as household/farmer characteristics such as education level and gender of the household head/farmer (Arslan et al., 2013; Chomba, 2004; Grabowski et al., 2016; Haggblade and Tembo, 2003; Kabwe, Donovan and Samazaka, 2005; Ngoma, Mulenga and Jayne, 2014; Ngombe et al., 2014; Nyanga, Johnsen and Kalinda, 2012). Other studies have also looked at the impacts of CA on yield and household income (Abdulai, 2016; Manda et al., 2016; Goeb, 2013; Ngoma, 2016;Haggblade and Tembo, 2003; Kabamba and Muimba-Kankolongo, 2009). However, little attention has been paid towards understanding the gender dynamics in CA uptake, for instance how CA adoption among female farmers within male-headed households, and as household heads themselves, impacts on their livelihoods. These dynamics are important as CA interventions are not gender-neutral and as such have different impacts on the adopter based on the gender and the household dynamics (Farnworth et al, 2016). This study will examine the impact of CA and gender on different livelihood outcomes

considering the different gender types within the household. In particular the study will examine the gendered CA impacts on total household income and gross value of crop production. The study goes further to look at the gendered impact of CA on household crop diversification, and dietary diversity which most existing studies have not explored. The findings from this study will help to have more gender sensitive programming and promotion of CA.

The rest of the study is organised as follows: the data and methods used in the study are described in Section 2, and the results of the study are presented in Section 3. Section 4 presents the conclusion and recommendations.

Data and Methods

Data

The study uses nationally representative data drawn from two waves of the Rural Agricultural Livelihoods Surveys (RALS). These surveys were conducted by IAPRI in collaboration with the Zambia Central Statistical Office (CSO) and the Ministry of Agriculture and Livestock (now Ministry of Agriculture) and cover the 2010/11 (RALS 2012) and 2013/14 (RALS 2015) agricultural season. The RALS data sets provide comprehensive information on smallholder farm households cultivating less than 20 hectares of land for farming and /or livestock production purposes. The first survey wave (RALS 2012) was administered to 8,840 agricultural households in 442 SEAs. A follow-up survey of the same households was conducted in May/June 2015, and a total of 7,254 were re-interviewed. The RALS 2012 sampling frame was based on information and cartographic data from the 2010 Zambia Census of Population and Households.

The RALS data provide reliable estimates at both provincial and national levels. We use a balanced panel of 6,989 crop-producing households in both 2010/11 and 2013/14 farming seasons from the 7,254 balanced panel households, excluding 265 livestock-only raising households. Furthermore, CA is most suited for areas that are prone to drought and erratic rainfall. These are Agro-Ecological Zone (AEZ) I, IIA and IIB, excluding AEZ III. Therefore, our analysis is based on these three zones, excluding AEZ III. In terms of CA adoption, we used household data from the 2013/14 agricultural season with some lagged household factors (initial household conditions) from RALS 2012 used as explanatory variables. Hence, we assume that all the lagged household level variables used in our models are at least weakly exogenous.[1]

In addition, we also used other data sets to include variables that were not collected in the RALS data. In particular qualitative data from Focus Group Discussions (FGDs) to get more insight about CA adoption. The FDGs were held in selected districts in AEZ I, IIA and IIB in which CA has primarily been promoted though recent promotional activities which also covered AEZ III (the

high rainfall zone in the northern parts of the country). The districts that were covered during the period February/March 2016 were Sesheke, Sinazongwe, Choma, Monze, Kaoma, Mumbwa, Nyimba, Petauke, and Katete.

Conceptual Framework

CA is intended to improve farm soil fertility, improve water retention to mitigate against low and/or variable rainfall, reduce soil erosion and in turn increase yields and incomes, as well as improve household food and nutrition levels (Mayer, 2015; FAO, 2001). This has been the basis under which it has been promoted for the past two decades among smallholder farmers in Zambia. However, to achieve these outcomes, several factors are at play, for instance the farmers choose the best collection of commodities (practices) based on the limited resources available to them and the environment they operate in. To gain a better understanding of the factors at play to achieve these outcomes we turn to the Sustainable Livelihoods Framework (SLF) (Figure 1). The SLF is centred on the multiple livelihood options and strategies that household have to make to attain different livelihood outcomes. The outcomes are dependent on the households' resource base which might be tangible or intangible (livelihood assets), the context in which the household operates (vulnerability context), the policy and institutional environment, and the technologies available (Ashley and Carney, 1999 and DFID, 1999). The household's ability to access resources is one of the most important aspects to attaining improved livelihood outcomes. This access is, however, dependent on the vulnerability context of the household. Among the main issues influencing a household's vulnerability is gender of the household head and/or the household's decision marker. Female household heads and/or decision makers tend to have limited access to resources such as land, credit and information and technology, compared to their male counterparts (Quisumbing et al., 2014; Farnworth et al., 2016). This difference in resources based on the gender of the household head and/or decision makers influences the household's livelihood outcomes.

Drawing from this framework, this study examines the gendered impacts of CA on selected livelihood outcomes. In particular we look at the gendered impact of CA on total household income and gross value of crop production. In addition, the study looks at the gendered impact of CA on crop diversification. Crop diversification is expected to increase a household's resilience to shocks and maintain or increase its food security. Crop diversification is measured through the computation of the Simpson Index for Diversification (SID). SID is a widely used measure of the level of diversification in the context of crop production and is calculated as follows:

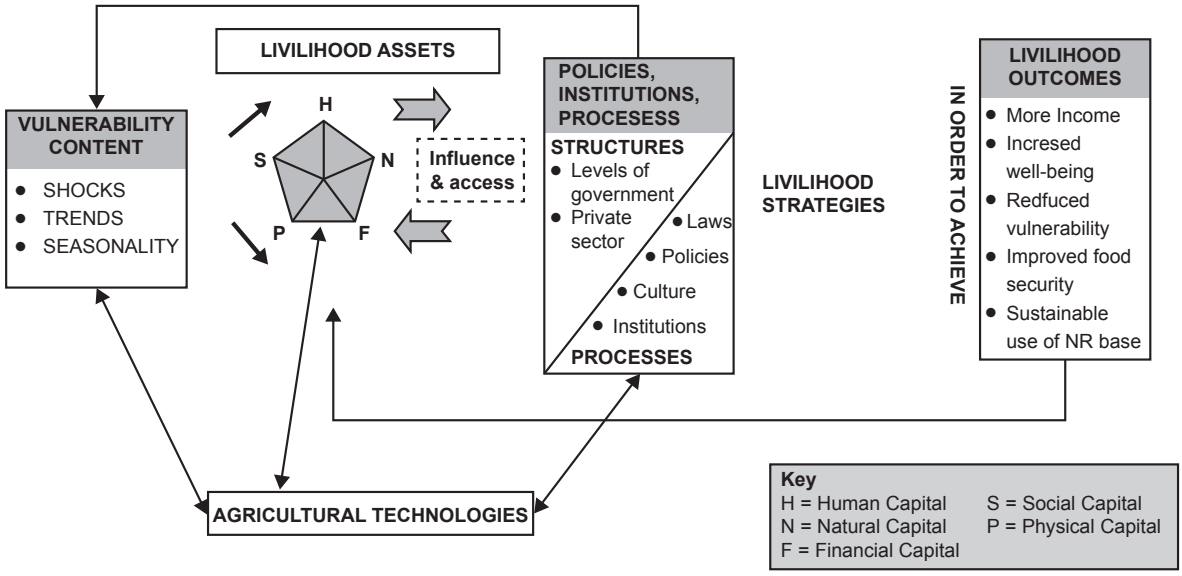

Figure 1: Sustainable Livelihoods Framework
Source: Adapted from DFID, 1999

$$SID = \sum_{i=1}^{n} P_i^2 \qquad (1)$$

Where Pi is the proportionate area of the ith crop in the total cropped area. The SID ranges from 0 to 1 such that 0 is a complete lack of diversification and 1 indicates complete diversification.

Finally, we analyse the gendered impact of CA on the household's dietary diversity (HDDS), which we use to proxy for the household's nutrition status. The HDDS relates to nutrient adequacy (coverage of basic needs regarding macro and micro nutrients) and to diet variety/balance, which are two of the main components of diet quality. In general, the HDDS reflects a snapshot of the economic ability of a household to access a variety of foods. The score is calculated by summing the number of food groups consumed in the household or by the individual respondent over the 24-hour recall period. Table A1 shows the twelve food groups that are used to compute the score.[2] Based on this set of food groups, the HDDS ranges from 0 to 12—with the level of diversity increasing with the HDDS.

A priori, we expect CA to have a positive effect on total household income, gross value of crop, crop diversification and HDDS, more so for male farmers, compared to their female counterparts, due to better resource endowments.

Econometric Model

A common measure of impact is given by the mean difference in the outcome variable between the participants after receiving the treatment and what their outcome variable would have been had they not received the treatment, also referred to as the average treatment effect on the treated or ATT (Wooldridge, 2001; Smith and Sweetman, 2001). That is,

$$ATT = E(Y_i^1 - Y_i^0 \mid w_i = 1) \quad (2)$$

where Y_i^1 is the outcome variable if household i participates in the programme/ treatment Y^0_i is the outcome variable if household *i* did not participate in the treatment, *x* is a vector of household characteristics, and $w_i \in \{0,1\}$ is an indicator variable equal to 1 (one) if the household is in the treatment group and 0 (zero) otherwise.

One of the biggest challenges in impact evaluation is that only Y_i^1 or Y^0_i, and not both, is observed for any given household, as the case may be. This is so because it is not possible for the same unit of study to be both a participant and a non-participant. Thus, with *w=1*only Y_i^1 is observed and Y^0_i is missing data. In randomised experiments, Y^0_i can be estimated from control households[2]. This makes it possible to attribute any systematic differences in the outcome variable between treated and control units to the programme in question. In a non-randomised study like ours, the counterfactual has to be estimated from the controls through carefully chosen statistical tools. This is necessary because the systematic differences common between participants and non-participants in the absence of the intervention are likely to lead to selection bias, given by

$$b = E(Y_i^0 \mid w_i = 1) - E(Y_i^0 \mid w_i = 0) \quad (3)$$

This bias could be corrected if $E(Y^0_i \mid w_i = 1)$ were known. We then estimate the conditional average treatment effect on the treated as follows

$$ATT = E(Y_{1i} - Y_{0i} \mid x, w_i = 1) \quad (4)$$

where *x* is a vector of covariates.

Empirical Model and Estimation Strategy

Following from equation 4, we measure the gendered impact of CA on outcome Y_i, by estimating a model that contains binary variables for CA, and gender as explanatory variables. The following base model is formulated:

$$Y_i = y_i + CA_i + gender_i + x_i + e_i \quad i=1,....,N \quad (5)$$

where Y_i denotes an outcome, such as household income, gross value of crop production, or dietary diversity score for household i ; CA_i = 1 if a household used CA and 0 otherwise; $gender_i$= 1 if female and 0 if male; x_i captures the household-level fixed effects (assumed constant over time); and e_i is an error term.

To get the differential impact of gender and adoption of CA on crop and household income, we interacted CA adoption and gender of either the household head or the decision maker, yielding equation 6:

$$Y_i=y_i + CA_i + gender_i + CA_i * gender_i + x_i + e_i \; i=1,....,N \qquad (6)$$

We estimate equations 5 and 6 using a conditional treatment effect as it is more realistic because there are other factors affecting the outcome variables apart from CA and gender and we need to control for them by including a vector of other explanatory variables. The estimated treatment effect is interpretable as a *ceteris paribus* effect.

Variables Used in the Models

The livelihood outcome variables examined in this study include the following: (a) household income; (b) gross value of crop production; (c) level of crop diversification (SID); and (d) household dietary diversity score (HDDS). With CA adoption as the treatment variable of interest. CA, as defined earlier consists of a package of farming practices based on three main principles namely: 1) minimum mechanical soil disturbance (minimum tillage); 2) permanent organic soil cover, and 3) crop rotation. CA adoption can be disaggregated into *full* CA (i.e. practising minimum tillage, maize-legume rotation and residue retention); *partial* CA (minimum tillage with either maize-legume rotation or residue retention and *general* CA (minimum tillage with either crop rotation and/or residue retention). For our analysis we use the definition of general CA. For the gender explanatory variables of interest, we examine the effect of the household head's gender on the livelihood outcome variables, as well as the gender of the decision maker's field.

Other explanatory variables were included based on literature and these were disaggregated into six categories as follows: human capital assets, household/farm assets, institutional factors, social factors, market access, and climatic factors. Although the treatment effects estimator used in this study controls for unobserved time-invariant characteristics, there may be area-specific time-variant effects that might be corrected with both CA and the outcome. To control for such area-specific time-variant effects, agro-ecological/ were added to the estimation models. We measure the impact of CA on the

outcome variables in zones AEZ I, IIa and IIb excluding AEZ III. This is because CA is suitable in these zones and most of the promotional activities are also centred in these zones compared to AEZ III. Table 1 presents the descriptive statistics for all the variables used in this study.

Table 1: Variable Description

Variables	Mean	Standard Deviation	Min	Max
CA Adoption	0.06	0.228	0	1
Human capital assets				
Gender of the HH head (1=female)	0.19	0.40	0	1
Female Decision Marker (=1)	0.28	0.451	0	1
Age of the HH head	47.65	14.71	18	105
Education level of the HH head in years	5.99	3.63	0	19.00
Adult equivalents	4.57	2.19	1	23.42
HH with chronically ill adults	0.05	0.21	0	1
Household head/spouse has kinship ties (=1)	0.61	0.488	0	1
Hired Labour (=1)	0.41	0.492	0	1
Household/Farm assets				
Landholding Size (Ha)	2.49	2.47	0.01	45.2
Log of Productive assets (ZMW)*	11.69	3.77	0	23.30
Ownership of cell phone (=1)	0.56	0.49	0	1
Ownership of Radio/TV (=1)*	0.64	0.48	0	1
Institutional factors				
Access to credit (=1)	0.17	0.37	0	1
Membership in a farmer organisation (=1)	0.55	0.50	0	1
Off-farm participation (=1)*	0.75	0.434	0	1
Social factors				
Witchcraft, not hard work can make you successful	2.86	1.35	1	5
Prayer, not hard work can make you successful	3.30	1.40	1	5
Market access				
Distance to the nearest Boma (Km)	39.11	32.76	0.00	250
Climatic Factors				
AEZ I (=1)	0.08	0.28	0	1
AEZ IIb (=1)	0.06	0.25	0	1
AEZ IIa (=1)	0.43	0.49	0	1

Source: Authors' computations *Lagged Variables

Results

We begin this section by presenting some descriptive statistics regarding gender differences in CA adoption and livelihood outcomes. We then econometrically examine whether there are differences in gendered impacts of CA on household's livelihood outcomes by gender of the household head and gender of the decision maker.

Descriptive Statistics

Gender Differences in CA Adoption

Table 2 below shows the differences in CA practices, CA adoption in general, and CA disaggregated into full CA and partial CA by the gender of the household head and the decision maker. The results show that statistically, male headed households tend to practice ripping (5.6%) more compared to female headed households (2.7%), showing that male heads have more access to mechanisation compared to the female headed households. While there are no statistical differences among male and female headed households in terms of adoption of the other practices. However, we look at whether this still remains the same when the gender dynamics within the households are examined, i.e. by the gender of the decision maker in a female headed household. In particular, female farmers in female headed household (FFHH), female farmers in male headed household (FMHH), male farmers in female headed households (MFHH) and male farmers in male headed households (MMHH). We find that MMHH households have higher minimum tillage adoption rates compared to the other farmer household dynamics, followed by FFHH. On the other hand, FFHH tend to practice crop rotation more than the other farmers in different household dynamics, while male farmers tend to adopt partial CA more than FFHH. This shows that the gender dynamics within the household and not just the gender of the household head tend to matter for adoption of certain practices.

Table 2: Percent of Households Using CA Practices by Gender of the Household Head and Decision Maker

				Female farmers in		Male farmers in	
	All Households	Male Headed Household	Female Headed Household	Female Headed Household	Male Headed Household	Female Headed Household	Male Headed Household
Number of Households	838,472	576,700	204,341	460,987	162,088	19,476	1,330,176
Minimum Tillage (%)	14.3	14.5a	13.7a	6.7a	4.5b	3.0b	8.2c
Planting Basins/ Potholes (%)	5.3	4.7a	6.3a	3.3a	2.2a	0.7c	2.1ac
Zero Tillage (%)	4.9	4.6a	5.6a	1.5a	1.2a	0.6a	4.2b
Ripping (%)	4.8	5.6a	2.7b	2.0a	1.2a	1.6a	1.9a
Crop Rotation (%)	49.6	48.7a	44.8a	29.0a	45.6b	28.0a	26.1a
Crop Residue Retention (%)	58.5	58.4a	58.7a	46.5a	40.2b	36.3ab	42.3cb
CA general	11.7	12a	11.1a	5.5ab	6.6a	7.9a	6.8ac
Full CA adopters	4.8	5.0a	4.3a	1.7a	1.4a	4.7a	1.4a
Partial CA adopters	6.9	7.0a	6.8a	3.8ac	5.1a	3.2a	5.4ab

Source: CSO/MAL/IAPRI 2015. Note: Values with the same superscript are not significantly different at 5%.

Gender Differences in Livelihood Outcomes

Table 3 shows the gender differences in the livelihood outcomes of interest by household head, as well as by the gender of the decision maker in a female headed household. As outlined before, differences in access to resources vary based not just on gender of the household head level, but also on the dynamics within the household. We find that female headed households have significantly lower livelihoods outcomes across all the outcomes of interest except for crop diversification compared to the male headed household. These results are consistent with evidence showing that women/female headed households across sub-Saharan Africa tend to have limited access to productive agricultural resources compared to their male counterparts (Farnworth et al., 2016; Doss and Morris 2000; Koru and Holden 2008), which translates to lower productivity and reduced livelihood outcomes.

Table 3: Gender Differences in Livelihood Outcomes

	All Households	Male Headed Household	Female Headed Household	Female farmers in		Male farmers in	
				Female Headed Household	Male Headed Household	Female Headed Household	Male Headed Household
Household Income (ZMW)	16865.15	19420.14a	9687.93b	10518.34a	21570.72b	10744.66a	20280.32c
Gross value of crops harvested (ZMW)	5621.27	6429.23a	3351.63a	4066.97a	7700.83b	4933.68a	7578.28b
Simpson Index of Crop Diversification	0.38	0.38a	0.37a	0.44a	0.45a	0.46a	0.45a
Household Dietary Diversity Score (1-12)	5.73	5.86a	5.34b	5.45a	6.12c	5.65ac	5.96c

Source: CSO/MAL/IAPRI 2015. Note: Values with the same superscript are not significantly different at 5%.

On the other hand, farmers in male headed households generally have better household and crop income, than farmers in female headed household's, implying that the presence of a male head in the household tends to increase the farmers' livelihood outcomes. In particular, compared to the other groups, FMHH had statistically significant higher household and crop income, followed by MMHH.

Gender Differences in Conservation Agriculture and Livelihood Outcomes

CA adoption is said to have numerous benefits, one of which is that it encourages production of various crops, through crop rotation. This is said to increase a household's crop production and productivity which in turn leads to improved gross value of crop production and ultimately total household income. The cereal-legume rotation also increases crop diversification and diversity in a household's food groups. Based on these benefits, we examine the four livelihood outcomes of

interest by gender of the household head among CA and non-CA users (Table 4). The bivariate results show that CA users generally have higher livelihood outcomes than non-CA users.

Table 4: Gender Differences in Conservation Agriculture and Livelihood Outcomes

	---Non-CA users---		---CA users---	
	Male Household Head	**Female Household Head**	**Male household Head**	**Female Household Head**
Household Income (ZMW)	19288.37a	9857.66b	21656.62a	6720.51bc
Gross value of crops harvested (ZMW)	6312.43a	3346.5bd	8374.2c	3483.29d
	---Non-CA users---		**---CA users---**	
	Male Household Head	**Female Household Head**	**Male Household Head**	**Female Household Head**
Household Dietary Diversity Score (1-12)	5.82a	5.37b	6.68c	4.78db
Simpson Index of Crop Diversification	0.38a	0.37a	0.46b	0.47bc

Source: CSO/MAL/IAPRI 2015. Note: Values with the same superscript are not significantly different at 5%.

In particular, both male and female headed households adopting CA have significantly higher household and crop income and are more diversified in term crop than non-CA users. Male headed households in both CA and non-CA users obtain higher crop and household income, than their female counterparts, the same applies for HDDS. This as mentioned before might be because male headed households are said to be more resource endowed.

Econometric Results

The bivariate results in the above section indicate that there might be differences in the livelihood outcomes based on the gender of the household head and more so on the inter-household gender dynamics. Therefore, in this section, controlling for all other variables, we examine whether there are any gendered impacts of CA on the selected livelihood outcomes.

Are there gender differences in CA's impact on households' livelihood outcomes?

Table 5 shows the results for the impact of CA and the gender of the household

head on household income, crop income, crop diversification, and HDDS. The results show that CA adoption has impact on household income but increases crop income. This might indicate that the gains from CA under current conditions are not large enough, thus income at crop production level does not differ between CA and non-CA households. We also find that gender alone has an impact on both household and crop income. In both outcomes, female headed households tend to obtain lower levels of household and crop income - affirming findings by other studies (Doss and Morris 2000; Koru and Holden 2008). However, when we consider the gendered impact of CA, we find that there are no differences between male and female household heads and CA and non-CA adopters. For crop diversification and HDDS, we find that CA adoption has a positive impact on both. However, this impact is reduced if a household is headed by a female. Table 6 shows the differential impact of CA on crop diversification and HDDS, and it can be seen that households with male heads who adopt CA have higher crop diversification levels and HDDS compared to female headed household.

However, as alluded to earlier, the household gender dynamics might affect the livelihood outcomes, and the descriptive results indicate that it could be the case. Therefore, we examine the effect of the gender of the decision maker and the gender dynamics at field level.

Does the CA impact differ by intra-household gender dynamics?

Table 7 shows the gendered impact of CA on the livelihood outcome by gender of the decision maker on a particular field as well as the gender of the decision maker in different household dynamics. Similar to the results that we obtained when we looked at the gender of the household head, we find that there is no statistical difference between gendered impact of CA adopter and non-CA adopter when it comes to household income and crop income, even when disaggregated by the gender of the decision maker and the household dynamics that the decision makers finds themselves in.

The impact of CA on crop diversification and HDDS tends to matter by gender of the decision maker as well as the household dynamics that the decision makers find themselves in. We find that the impact of CA on both crop diversification and HDDS is reduced if the field decision makers are female compared to if they are male. When we took a closer look at the intra-household gender dynamics, for crop diversification we found that MMHH who adopted CA had the highest impact of 0.28, while MFHH had the lowest impact. FMHH on the other hand had a higher impact of 0.073 compared to FFHH (Table 8). Under HDDS, FMHH had the highest impact, while FFHH had the lowest. These findings imply that the presence of a male head boosts the female's livelihood outcome, which could be stemming from the fact that male farmers have better access to resources compared to female farmers. Therefore, going a step

further, we examine the gendered impact of CA on the livelihood outcomes, with regard to the household's access to productive assets.

Table 5: Impact of CA and Gender of Household head on Household Income, Crop income, Crop Diversification and HDDS

Variables		Household Income		Household Income		Crop Income		Crop Income		Crop Diversification		Crop Diversification		HDDS		HDDS
CA Adoption (=1)		-0.481		-0.198		0.719*		0.403		0.395***		0.256***		2.134***		1.632**
			(0.386)		(0.341)		(0.428)		(0.378)		(0.082)		(0.078)		(0.732)		(0.689)
Gender of the HH head (1= female)		-0.182***		-0.193***		-0.227***		-0.201***		-0.001		0.016		0.063		0.217**	
			(0.040)		(0.047)		(0.044)		(0.052)		(0.010)		(0.011)		(0.082)		(0.097)
Gender of HH head*CA Adoption				0.122				-0.327				-0.223***				-1.969***	
					(0.356)				(0.394)				(0.082)				(0.720)
Constant		5.364***		5.332***		5.362***		5.399***		0.468***		0.485***		1.741***		1.808***	
			(0.170)		(0.167)		(0.188)		(0.184)		(0.042)		(0.039)		(0.352)		(0.342)
Observations		3,872		3,872		3,872		3,872		3,872		3,872		3,872		3,872	

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Note: See Appendix A2, for the full set of results

Table 6: Calculated Impact of CA and Gender of Household head on Crop Diversification and HDDS

	CA	**Gender**	**Gender CA**	**Female Headed Impact**	**Male Headed Impact**
Crop Diversification	0.275	0.021	-0.252	0.044	0.275
HDDS	1.162	0.249	-1.219	0.192	1.162

Table 7: Impact of CA and Gender of Decision Marker on Household Income, Crop Income, Crop Diversification and HDDS

Variables	**Household Income**	**Household Income**	**Crop Income**	**Crop Income**	**Crop Divers-ification**	**Crop Divers-ification**	**HDDS**	**HDDS**
CA adoption (=1)	-0.281	-0.270	0.198	0.204	0.275***	0.284***	1.162***	1.122***
	(0.172)	(0.172)	(0.184)	(0.183)	(0.038)	(0.038)	(0.369)	(0.368)
Female Decision Marker (=1)	-0.091***		-0.119***		0.021***		0.249***	
	(0.025)		(0.026)		(0.006)		(0.053)	
Female Decision Maker* CA Adoption	0.221		-0.200		-0.252***		-1.219***	

Variables	**Household Income**	**Household Income**	**Crop Income**	**Crop Income**	**Crop Divers-ification**	**Crop Divers-ification**	**HDDS**	**HDDS**
	(0.178)		(0.190)		(0.039)		(0.381)	
FFHH		-0.195***		-0.211***		0.020***		0.191***
		(0.028)		(0.029)		(0.006)		(0.059)
FMHH		0.118***		0.064*		0.025***		0.346***
		(0.035)		(0.037)		(0.008)		(0.076)
MFHH		0.141		0.129		0.019		0.014
		(0.120)		(0.127)		(0.028)		(0.257)
FFHH* CA Adoption		0.227		-0.181		-0.272***		-1.498***
		(0.182)		(0.194)		(0.040)		(0.390)
FMHH*CA Adoption		0.163		-0.270		-0.236***		-0.478
		(0.196)		(0.209)		(0.044)		(0.421)

Variables	**Household Income**	**Household Income**	**Crop Income**	**Crop Income**	**Crop Diversification**	**Crop Diversification**	**HDDS**	**HDDS**
MFHH*CA Adoption		-0.340		-0.530		-0.272***		-0.091
		(0.314)		(0.335)		(0.072)		(0.676)
Constant	5.401***	5.473***	5.580***	5.643***	0.605***	0.603***	1.624***	1.675***
	(0.096)	(0.096)	(0.102)	(0.102)	(0.022)	(0.022)	(0.205)	(0.206)

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Note: See Appendix A3, for the full set of results

Table 8: Calculated Impact of CA and Gender of Decision Marker on Crop Diversification and HDDS

	CA	FFHH	FMHH	MFHH	FFHH	FMHH	MFHH	IMPACT	
Crop Diversification	0.284	0.02			-0.272			0.032	FFHH
	0.284		0.025			-0.236		0.073	FMHH
	0.284						-0.272	0.012	MFHH
								0.284	MMHH
HDDS	1.122	0.191			-1.498			-0.185	FFHH
	1.122		0.346					1.468	FMHH
	1.122							1.122	MFHH
	1.122							1.122	MMHH

Do resource endowments matter?

Table 9 shows the impact of CA, productive assets, and gender of decision marker on the selected livelihood outcomes. The productive assets are examined based on terciles. The results show that for household income, crop diversification, and HDDs, the impact of Female decision makers adopting CA, in the higher assets group, the impact is higher compared to the lower productive assets group.

Table 9: Impact of CA, Productive assets and Gender of Decision Marker on Household Income, Crop Income, Crop Diversification, and HDDS

Variables	Household Income	Crop Income	Crop Diversification	HDDS
CA Adoption	-0.396**	0.124	0.270***	1.471***
	(0.161)	(0.178)	(0.037)	(0.361)
Female Decision maker	-0.063***	-0.107***	0.013***	0.262***
	(0.021)	(0.023)	(0.005)	(0.048)
Productive assets (=1)	-0.437***	-0.316***	0.009*	-0.453***
	(0.021)	(0.023)	(0.005)	(0.047)
Productive assets (=3)	0.498***	0.323***	-0.045***	0.351***
	(0.021)	(0.023)	(0.005)	(0.048)
FDM*CA*PA1	0.125	-0.243	-0.244***	-1.917***
	(0.178)	(0.197)	(0.041)	(0.400)
FDM*CA*PA3	0.437**	-0.080	-0.224***	-0.914**
	(0.177)	(0.195)	(0.041)	(0.398)
Constant	7.102***	6.746***	0.517***	3.094***
	(0.103)	(0.113)	(0.025)	(0.233)

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Note: See Appendix A4, for the full set of results

Conclusion and Recommendations

Sub-Saharan Africa's (SSA) agricultural production is threatened by climate variability and change as seen by the increase in variable temperatures, changes in precipitation patterns and increased occurrences of extreme events such as droughts and floods. Hence for sustained food production and productivity, new innovative technologies which are resilient to climatic variability have been promoted along the years, especially among smallholder farmers who form the bulk of farmers and are the most vulnerable. Conservation Agriculture (CA) which consists of a package of farming practices based on three main principles, namely: minimum mechanical soil disturbance; permanent organic soil cover; and crop rotation is one such technology. It has been promoted in SSA and Zambia in particular since the 1990s with relatively low adoption rates despite the benefits. This has been due mainly to a number of issues including the constraints to access to productive resources by farmers more so for female farmers than male farmers. In particular female farmers have limited access/ ownership to land, credit, and other reproductive assets such as implements.

This then hinders adoption of new technologies by female farmers, as their limited resource endowments have an impact on their adoption capability which in turn reduces the impact that these technologies have on their livelihood. Even with this being the case, little attention has been paid towards understanding the gender dynamics in CA uptake, for instance how CA adoption among female farmers, within male headed households and as household heads themselves impacts on their livelihoods. These dynamics are important as CA interventions are not gender-neutral and as such have different impacts on the adopter based on the gender and the household dynamics.

Using nationally-representative data and insights from FGDs, the study therefore examined the impact of CA and gender on different livelihood outcomes (crop income, household income, crop diversification, and household dietary diversity). The results showed that at household level there are no differences between male and female household heads in terms of the impact of CA on crop income and household income. This holds even when the CA impact is examined by the gender of the decision maker and the household dynamics. For crop diversification and household dietary diversity, the results showed that MMHH and FMHH adopting CA had the highest impact respectively. While farmers under female headed households tended to have lower CA impacts on both crop diversification and HDDS. We also found that female decision makers in households with more productive assets tended to have better CA impacts than females decision makers in households with less productive assets, implying the importance of resource endowments. Based on these results, we recommend that CA promotions and programming should take into account the gender of the farmers as well as the dynamics within different households. As the impact of CA on certain livelihood outcomes reduces among female farmers, stemming from the differences in resource accessibility among male and female farmers.

Endnotes

1 The set of food groups is derived from the U.N. FAO (Food and Agricultural Organization). Food Composition Table for Africa. Rome, Italy, 1970. As viewed at www.fao.org/docrep/003/X6877E/X6877E00.htm.

2 Although randomisation does not necessarily get rid of selection bias, it balances the bias between the treatment and comparison groups (Barker 2000).

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Appendix

Table A1: Table of Food Groups Used to Compute the Household Dietary Diversity Score

A. Cereals	E. Meat, poultry, offal	I. Milk and milk products
B. Root and tubers	F. Eggs	J. Oil/fats
C. Vegetables	G. Fish and seafood	K. Sugar/honey
D. Fruits	H. Pulses/legumes/nuts	L. Miscellaneous
HDDS = A+B+C+D+E+F+G+H+I+K+J+K+L (ranges between 0 and 12)		

Table A2: Impact of CA and Gender of Household head on Household Income, Crop income, Crop Diversification, and HDDS

Variables	CA adoption (=1)		Gender of the HH head (1=female)		CA adoption * Female HH head		Age of HH head (years)		Level of education HH head (years)
Household Income	-0.481	(0.386)	-0.182***	(0.040)			-0.004***	(0.001)	0.063***
Household Income	-0.198	(0.341)	-0.193***	(0.047)	0.122	(0.356)	-0.004***	(0.001)	0.062***
Crop Income	0.719*	(0.428)	-0.227***	(0.044)			-0.003**	(0.001)	0.010**
Crop Income	0.403	(0.378)	-0.201***	(0.052)	-0.327	(0.394)	-0.002**	(0.001)	0.011**
Crop Divers-ification	0.395***	(0.082)	-0.001	(0.010)			-0.000	(0.000)	-0.005***
Crop Divers-ification	0.256***	(0.078)	0.016	(0.011)	-0.223***	(0.082)	0.000	(0.000)	-0.004***
HDDS	2.134***	(0.732)	0.063	(0.082)			-0.006***	(0.002)	0.089***
HDDS	1.632**	(0.689)	0.217**	(0.097)	-1.969***	(0.720)	-0.005**	(0.002)	0.090***

Land-holding Size (Ha)		Hired Labour (=1)		Household head/ spouse has kinship ties (=1)		Adult equiva-lents		HH with chronically ill adults (=1)		**Variables**
0.053***	(0.031)	0.427***	(0.032)	-0.120***	(0.007)	0.070***	(0.065)	-0.123*	(0.005)	**Household Income**
0.053***	(0.031)	0.423***	(0.031)	-0.124***	(0.007)	0.070***	(0.065)	-0.119*	(0.005)	**Household Income**
0.121***	(0.035)	0.435***	(0.035)	-0.006	(0.008)	0.054***	(0.072)	-0.184**	(0.005)	**Crop Income**
0.120***	(0.034)	0.439***	(0.034)	0.000	(0.008)	0.054***	(0.072)	-0.189***	(0.005)	**Crop Income**
0.006***	(0.008)	-0.001	(0.008)	0.038***	(0.002)	0.001	(0.016)	-0.020	(0.001)	**Crop Divers-ification**
0.006***	(0.007)	0.001	(0.007)	0.041***	(0.002)	0.001	(0.015)	-0.022	(0.001)	**Crop Divers-ification**
0.045***	(0.065)	0.415***	(0.066)	-0.109*	(0.015)	0.047***	(0.136)	0.148	(0.010)	**HDDS**
0.043***	(0.064)	0.419***	(0.064)	-0.085	(0.014)	0.047***	(0.133)	0.133	(0.009)	**HDDS**

Membership in a farmer organisation (=1)		Access to credit (=1)		Ownership of Radio/ TV (=1)*		Ownership of cell phone (=1)*		Log of Productive assets (ZMK)*		**Variables**
0.102***	(0.039)	0.162***	(0.036)	0.151***	(0.036)	0.295***	(0.011)	0.141***	(0.006)	**Household Income**
0.093***	(0.036)	0.149***	(0.036)	0.147***	(0.035)	0.288***	(0.010)	0.144***	(0.006)	**Household Income**
0.258***	(0.043)	0.404***	(0.040)	0.115***	(0.040)	0.062	(0.012)	0.086***	(0.007)	**Crop Income**
0.270***	(0.040)	0.421***	(0.039)	0.120***	(0.039)	0.072*	(0.011)	0.084***	(0.007)	**Crop Income**
0.012	(0.009)	0.150***	(0.009)	0.026***	(0.009)	-0.025***	(0.003)	-0.011***	(0.002)	**Crop Divers-ification**
0.018**	(0.009)	0.158***	(0.008)	0.029***	(0.008)	-0.020**	(0.002)	-0.012***	(0.002)	**Crop Divers-ification**
0.113	(0.079)	0.020	(0.075)	0.126*	(0.075)	0.243***	(0.022)	0.154***	(0.013)	**HDDS**
0.144**	(0.074)	0.065	(0.073)	0.140*	(0.072)	0.271***	(0.021)	0.148***	(0.013)	**HDDS**

	Distance to the nearest Boma (Km)		Prayer not hard work can make you successful		Witchcraft not hard work can make you successful		Off-farm participation (=1)*		**Variables**
(0.001)	0.002***	(0.011)	-0.022**	(0.011)	0.008	(0.034)	0.572***	(0.035)	**Household Income**
(0.001)	0.002***	(0.010)	-0.021**	(0.011)	0.009	(0.034)	0.572***	(0.033)	**Household Income**
(0.001)	0.005***	(0.012)	-0.025**	(0.012)	0.008	(0.038)	-0.185***	(0.039)	**Crop Income**
(0.001)	0.004***	(0.012)	-0.027**	(0.012)	0.006	(0.038)	-0.186***	(0.037)	**Crop Income**
(0.000)	-0.000	(0.003)	-0.002	(0.003)	0.002	(0.009)	-0.023***	(0.009)	**Crop Divers-ification**
(0.000)	-0.000	(0.002)	-0.003	(0.003)	0.001	(0.008)	-0.024***	(0.008)	**Crop Divers-ification**
(0.001)	-0.001	(0.022)	-0.008	(0.023)	0.034	(0.072)	0.318***	(0.072)	**HDDS**
(0.001)	-0.001	(0.021)	-0.013	(0.023)	0.030	(0.070)	0.306***	(0.069)	**HDDS**

Variables	**Household Income**	**Household Income**	**Crop Income**	**Crop Income**	**Crop Divers-ification**	**Crop Divers-ification**	**HDDS**	**HDDS**
AEZ IIa (=1)	0.092**	0.087*	0.534***	0.539***	0.016	0.018*	0.695***	0.701***
	(0.045)	(0.045)	(0.050)	(0.049)	(0.011)	(0.010)	(0.094)	(0.091)
AEZ IIb (=1)	0.245***	0.249***	0.521***	0.515***	0.088***	0.085***	-0.831***	-0.846***
	(0.064)	(0.063)	(0.070)	(0.069)	(0.016)	(0.015)	(0.132)	(0.129)
Constant	5.364***	5.332***	5.362***	5.399***	0.468***	0.485***	1.741***	1.808***
	(0.170)	(0.167)	(0.188)	(0.184)	(0.042)	(0.039)	(0.352)	(0.342)
Observations	3,872	3,872	3,872	3,872	3,872	3,872	3,872	3,872

Table A3: Impact of CA and Gender of Decision Maker on Household Income, Crop Income, Crop Diversification, and HDDS

Variables	Household Income	Household Income	Crop Income	Crop Income	Crop Divers-ification	Crop Divers-ification	HDDS	HDDS
CA adoption (=1)	-0.281	-0.270	0.198	0.204	0.275***	0.284***	1.162***	1.122***
	(0.172)	(0.172)	(0.184)	(0.183)	(0.038)	(0.038)	(0.369)	(0.368)
Female Decision Maker (=1)	-0.091***		-0.119***		0.021***		0.249***	
	(0.025)		(0.026)		(0.006)		(0.053)	
Female Decision Maker* CA adoption	0.221		-0.200		-0.252***		-1.219***	
	(0.178)		(0.190)		(0.039)		(0.381)	
FFHH		-0.195***		-0.211***		0.020***		0.191***
		(0.028)		(0.029)		(0.006)		(0.059)
FMHH		0.118***		0.064*		0.025***		0.346***

	Age (years)		MFHH* CA Adoption		FMHH* CA Adoption		FFHH* CA Adoption		MFHH		**Variables**
(0.001)	-0.005***										**Household Income**
(0.001)	-0.005***	(0.314)	-0.340	(0.196)	0.163	(0.182)	0.227	(0.120)	0.141	(0.035)	**Household Income**
(0.001)	-0.003***										**Crop Income**
(0.001)	-0.003***	(0.335)	-0.530	(0.209)	-0.270	(0.194)	-0.181	(0.127)	0.129	(0.037)	**Crop Income**
(0.000)	0.000*										**Crop Divers-ification**
(0.000)	0.000**	(0.072)	-0.272***	(0.044)	-0.236***	(0.040)	-0.272***	(0.028)	0.019	(0.008)	**Crop Divers-ification**
(0.001)	-0.003**										**HDDS**
(0.001)	-0.003**	(0.676)	-0.091	(0.421)	-0.478	(0.390)	-1.498***	(0.257)	0.014	(0.076)	**HDDS**

Hired Labour (=1)		Household head/ spouse has kinship ties (=1)		Adult equivalents		HH with chronically ill adults		Education level (years)	**Variables**
0.408***	(0.017)	-0.122***	(0.004)	0.069***	(0.037)	-0.068*	(0.003)	0.058***	**Household Income**
0.410***	(0.017)	-0.126***	(0.004)	0.065***	(0.037)	-0.089**	(0.003)	0.056***	**Household Income**
0.404***	(0.018)	-0.028	(0.004)	0.054***	(0.039)	-0.092**	(0.003)	0.016***	**Crop Income**
0.406***	(0.018)	-0.031*	(0.004)	0.050***	(0.039)	-0.111***	(0.003)	0.015***	**Crop Income**
0.001	(0.004)	0.027***	(0.001)	-0.000	(0.008)	-0.004	(0.001)	-0.003***	**Crop Divers-ification**
0.000	(0.004)	0.027***	(0.001)	-0.001	(0.008)	-0.005	(0.001)	-0.003***	**Crop Divers-ification**
0.434***	(0.037)	-0.114***	(0.008)	0.040***	(0.079)	0.056	(0.006)	0.091***	**HDDS**
0.434***	(0.037)	-0.113***	(0.008)	0.037***	(0.079)	0.040	(0.006)	0.089***	**HDDS**

	Ownership of Radio/ TV (=1)*		Ownership of cell phone (=1)*		Log of Productive assets (ZMK)*		Landholding Size (Ha)		**Variables**
(0.020)	0.157***	(0.019)	0.267***	(0.006)	0.149***	(0.003)	0.055***	(0.017)	**Household Income**
(0.020)	0.143***	(0.019)	0.266***	(0.006)	0.146***	(0.003)	0.054***	(0.017)	**Household Income**
(0.021)	0.146***	(0.021)	0.086***	(0.006)	0.089***	(0.004)	0.107***	(0.018)	**Crop Income**
(0.021)	0.133***	(0.021)	0.086***	(0.006)	0.087***	(0.004)	0.107***	(0.018)	**Crop Income**
(0.005)	0.024***	(0.004)	-0.025***	(0.001)	-0.014***	(0.001)	0.003***	(0.004)	**Crop Divers-ification**
(0.005)	0.024***	(0.004)	-0.025***	(0.001)	-0.014***	(0.001)	0.003***	(0.004)	**Crop Divers-ification**
(0.043)	0.147***	(0.042)	0.243***	(0.013)	0.152***	(0.007)	0.050***	(0.037)	**HDDS**
(0.043)	0.135***	(0.042)	0.244***	(0.013)	0.150***	(0.007)	0.050***	(0.037)	**HDDS**

Variables	**Household Income**	**Household Income**	**Crop Income**	**Crop Income**	**Crop Divers-ification**	**Crop Divers-ification**	**HDDS**	**HDDS**
Access to credit (=1)	0.130***	0.129***	0.354***	0.353***	0.130***	0.130***	0.138***	0.139***
	(0.019)	(0.019)	(0.020)	(0.020)	(0.004)	(0.004)	(0.041)	(0.041)
Membership in a farmer organisation (=1)	0.090***	0.091***	0.233***	0.234***	0.004	0.004	0.148***	0.150***
	(0.019)	(0.019)	(0.020)	(0.020)	(0.004)	(0.004)	(0.040)	(0.040)
Off-farm participation (=1)*	0.520***	0.522***	-0.139***	-0.137***	-0.013***	-0.013***	0.275***	0.274***
	(0.019)	(0.019)	(0.020)	(0.020)	(0.004)	(0.004)	(0.040)	(0.040)
Witchcraft not hard work can make you successful	0.009	0.009	0.005	0.005	0.002	0.002*	0.052***	0.052***
	(0.006)	(0.006)	(0.007)	(0.007)	(0.001)	(0.001)	(0.013)	(0.013)

Constant		AEZ IIb (=1)		AEZ IIa (=1)		Distance to the nearest Boma (Km)		Prayer not hard work can make you successful	**Variables**
5.401***	(0.036)	0.326***	(0.025)	0.065**	(0.000)	0.002***	(0.006)	-0.012**	**Household Income**
5.473***	(0.036)	0.330***	(0.025)	0.073***	(0.000)	0.002***	(0.006)	-0.013**	**Household Income**
5.580***	(0.038)	0.589***	(0.027)	0.484***	(0.000)	0.004***	(0.006)	-0.025***	**Crop Income**
5.643***	(0.038)	0.594***	(0.027)	0.491***	(0.000)	0.004***	(0.006)	-0.026***	**Crop Income**
0.605***	(0.008)	0.075***	(0.006)	0.004	(0.000)	-0.000***	(0.001)	-0.002*	**Crop Divers-ification**
0.603***	(0.008)	0.075***	(0.006)	0.004	(0.000)	-0.000***	(0.001)	-0.002*	**Crop Divers-ification**
1.624***	(0.077)	-0.798***	(0.055)	0.719***	(0.001)	-0.002**	(0.012)	0.005	**HDDS**
1.675***	(0.077)	-0.803***	(0.054)	0.723***	(0.001)	-0.002***	(0.012)	0.003	**HDDS**

Variables	Household Income	Household Income	Crop Income	Crop Income	Crop Divers-ification	Crop Divers-ification	HDDS	HDDS
	(0.096)	(0.096)	(0.102)	(0.102)	(0.022)	(0.022)	(0.205)	(0.206)
Observations	11,216	11,216	11,216	11,216	11,216	11,216	11,216	11,216

Table A4: Impact of CA, Productive assets, and Gender of Decision Maker on Household Income, Crop Income, Crop Diversification, and HDDS

LABELS	Household Income	Crop Income	Crop Diversification	HDDS
CA Adoption	-0.406**	0.145	0.277***	1.409***
	(0.162)	(0.180)	(0.037)	(0.364)
Female Decision maker	-0.060***	-0.111***	0.014***	0.281***
	(0.021)	(0.023)	(0.005)	(0.047)
Productive assets (=1)	-0.440***	-0.316***	0.009*	-0.458***
	(0.021)	(0.023)	(0.005)	(0.047)
Productive assets (=3)	0.498***	0.324***	-0.045***	0.346***
	(0.021)	(0.023)	(0.005)	(0.048)
FDM*CA*PA1	0.146	-0.257	-0.251***	-1.842***
	(0.179)	(0.198)	(0.042)	(0.403)
FDM*CA*PA3	0.426**	-0.104	-0.229***	-0.888**
	(0.178)	(0.196)	(0.041)	(0.400)
Age (years)	-0.007***	-0.005***	0.000**	-0.005***
	(0.001)	(0.001)	(0.000)	(0.001)
Education level (years)	0.051***	0.012***	-0.002***	0.085***
	(0.002)	(0.003)	(0.001)	(0.005)
HH with chronically ill adults	-0.048	-0.076**	-0.004	0.087
	(0.035)	(0.038)	(0.008)	(0.078)
Adult equivalents	0.053***	0.042***	0.000	0.027***
	(0.004)	(0.004)	(0.001)	(0.008)
Household head/spouse has kinship ties (=1)	-0.088***	-0.009	0.025***	-0.082**
	(0.016)	(0.018)	(0.004)	(0.037)
Hired Labour (=1)	0.344***	0.360***	0.004	0.363***
	(0.017)	(0.018)	(0.004)	(0.037)
Landholding Size (Ha)	0.041***	0.098***	0.004***	0.041***
	(0.003)	(0.004)	(0.001)	(0.007)
Log of Productive assets (ZMK)*	0.053***	0.026***	-0.009***	0.069***
	(0.006)	(0.007)	(0.002)	(0.014)

LABELS	Household Income	Crop Income	Crop Diversification	HDDS
Ownership of cell phone (=1)*	0.198***	0.037*	-0.023***	0.166***
	(0.019)	(0.020)	(0.004)	(0.042)
Ownership of Radio/TV (=1)*	0.161***	0.144***	0.022***	0.137***
	(0.019)	(0.021)	(0.005)	(0.043)
Access to credit (=1)	0.148***	0.361***	0.127***	0.132***
	(0.018)	(0.020)	(0.004)	(0.041)
Membership in a farmer organisation (=1)	0.064***	0.211***	0.004	0.106***
	(0.018)	(0.020)	(0.004)	(0.040)
Off-farm participation (=1)*	0.531***	-0.130***	-0.013***	0.287***
	(0.018)	(0.019)	(0.004)	(0.040)
Witchcraft not hard work can make you successful	0.012**	0.007	0.002	0.058***
	(0.006)	(0.006)	(0.001)	(0.013)
Prayer not hard work can make you successful	-0.009	-0.022***	-0.002*	0.008
	(0.005)	(0.006)	(0.001)	(0.012)
Distance to the nearest Boma (Km)	0.002***	0.004***	-0.000***	-0.002**
	(0.000)	(0.000)	(0.000)	(0.001)
AEZ IIa (=1)	0.089***	0.506***	0.004	0.741***
	(0.024)	(0.026)	(0.006)	(0.054)
AEZ IIb (=1)	0.424***	0.664***	0.071***	-0.702***
	(0.034)	(0.037)	(0.008)	(0.077)
Constant	7.159***	6.780***	0.515***	3.148***
	(0.103)	(0.113)	(0.025)	(0.233)
Observations	11,216	11,216	11,216	11,216