

WEAI+ FINAL RESULTS: GENDER EQUITY IN SOYBEAN PRODUCTION IN RURAL GHANA

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CONTENTS

ACKNOWLEDGEMENTS.....	1
LIST OF ACRONYMS & ABBREVIATIONS.....	1
EXECUTIVE SUMMARY.....	2
INTRODUCTION.....	3
THE FEED THE FUTURE SOYBEAN INNOVATION LAB & WOMEN'S EMPOWERMENT IN AGRICULTURE INDEX.....	3
METHODS.....	5
ANALYSIS.....	7
PRELIMINARY RESULTS.....	9
SAMPLE CHARACTERISTICS.....	9
DWELLING CHARACTERISTICS.....	9
WEAI PRELIMINARY RESULTS	10
SOYBEAN MODULES' PRELIMINARY RESULTS.....	10
FINAL RESULTS.....	11
EMPOWERMENT AND KEY DEMOGRAPHICS.....	11
EMPOWERMENT DIFFERENCES ACROSS THE FOUR DISTRICTS	14
EMPOWERMENT DIFFERENCES WITHIN THE SAME HOUSEHOLDS.....	16
SUMMARY OF RESULTS.....	17
REFERENCES.....	19
RESOURCES & WEBSITES.....	20
APPENDIX I.....	21

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LIST OF ACRONYMS & ABBREVIATIONS

CBO	Community Based Organization
CRS-Ghana	Catholic Relief Services-Ghana
FBO	Farmer Based Organization
FTF	Feed the Future
5DE	Five Domains of Empowerment in Agriculture
HH	Household
IFPRI	International Food Policy Research Institute
MoFA	Ministry of Food and Agriculture, Republic of Ghana
MSU	Mississippi State University
OPHI	Oxford Poverty and Human Development Initiative
SARI	Savanna Agricultural Research Institute
SES	Socioeconomic Status
SGER	Socioeconomic/Gender Equity Research
SIL	Soybean Innovation Lab / FTF Innovation Lab for Soybean Value Chain Research
SSRC	Social Science Research Center, Mississippi State University
UIUC	University of Illinois at Urbana-Champaign
USAID	United States Agency for International Development
WEAI	Women's Empowerment in Agriculture Index
WEAI+	Women's Empowerment in Agriculture Index+Soy Modules / WEAI+Ghana YR1 Survey



EMPOWERING
WOMEN FARMERS
WITH THE SAME
ACCESS TO LAND,
NEW TECHNOLOGIES
AND CAPITAL AS
MEN CAN INCREASE
CROP YIELDS
BY AS MUCH
AS 30 PERCENT

—USAID, 2016

EXECUTIVE SUMMARY

The goal of the WEAI+ Ghana YR1 Survey is to better understand how gender equity and other socioeconomic factors within the agricultural sector impact men and women smallholder farmers in order to help transition rural women, families, and communities towards better food security, health, and economic development through sustainable soy production. To achieve this goal, the Soybean Innovation Lab's Socioeconomic/Gender Equity Research (SGER) team adapted the [Women's Empowerment in Agriculture Index \(WEAI\)](#) into the WEAI+ (WEAI + Soybean Modules).

In 2014, the SGER team administered the WEAI+ Ghana YR1 Survey to 675 men and women smallholder farmers in nine villages in Tolon, Saboba, Chereponi, and Karaga Districts in Ghana's Northern Region. Village selection, community mobilization, enumerator recruitment and IRB-required compliancy in the [CITI Human Subject Research](#) course, enumerator training workshops, and the survey enumeration were conducted in partnership with Catholic Relief Services-Ghana. All instruments and procedures were approved by the Mississippi State University Institutional Review Board.

The WEAI+ was enumerated in 2014 in the four districts over a three-week period, data entry and preliminary analysis were conducted in 2014-2015, and preliminary results were published in 2015 in the report, *Gender Equity & Soybean Uptake in Northern Ghana: WEAI+ Preliminary Results—Special Report on Implementing the WEAI+ Baseline* (Ragsdale & Read-Wahidi, 2015).

WEAI+ FINAL RESULTS RESEARCH QUESTIONS

1 To what extent are empowerment differences influenced by socioeconomic status, education, household type, marital status, and religion?

2 To what extent does empowerment differ at the district level across the study's four sites of Tolon, Saboba, Chereponi, and Karaga Districts?

3 To what extent does empowerment differ between men and women farmers within the same households?

The 2015 open-access technical report includes a detailed description of the process of culturally adapting the WEAI for Ghana and adding the soybean modules to produce the WEAI+ survey instrument, community mobilization, enumerator training, data collection methods, description of the WEAI+ preliminary analyses and findings, and discussion of WEAI+ preliminary results. It is available for download at https://www.researchgate.net/publication/290997138_Gender_Equity_Soybean_Uptake_in_Northern_Ghana_a_WEAI_Preliminary_Results.

This 2016 open-access technical report includes a description of the WEAI+ final analyses, results, and discussion. Our final analyses concentrate on exploring the following three research questions: 1) To what extent are empowerment differences influenced by socioeconomic (SES) status, education, household type, marital status, and religion?; 2) To what extent does empowerment differ at the district level across the four study sites of Tolon, Saboba, Chereponi, and Karaga Districts?; 3) To what extent does empowerment differ among men and women farmers within the same households? We found that – even after controlling for SES and education — men remained significantly more empowered across a number of key indicators, and this remained the case even among men and women farmers within the same households. We also found that significant empowerment differences exist across particular indicators as a result of religion, household type, and district. The WEAI+ methods, selected preliminary results germane to understanding the context of the final results, the final results, and summary are detailed below.

INTRODUCTION

THE FEED THE FUTURE SOYBEAN INNOVATION LAB & WOMEN’S EMPOWERMENT IN AGRICULTURE INDEX (WEAI)

Led by Dr. Peter Goldsmith (University of Illinois at Urbana-Champaign), the USAID-funded *Feed the Future Innovation Lab for Soybean Value Chain Research: Soybean Innovation Lab* is one of 24 Feed the Future Innovation Labs “central to advancing novel solutions that support our goals to reduce global hunger, poverty and undernutrition” (Feed the Future, 2013). The Soybean Innovation Lab’s objective is to provide the scientific support needed to help smallholder farmers utilize the rising demand for soy as a means to assist developing countries in addressing food insecurity and protein malnutrition.

The Soybean Innovation Lab includes a consortium of leading scientists at five U.S. universities as well as in-country partners in sub-Saharan Africa with the common goal of transitioning rural farmers and communities toward improved food security and economic development through sustainable soy production. The goal of The Soybean Innovation Lab's Socioeconomic/Gender Equity Research (SGER) team, which led by Dr. Kathleen Ragsdale (Mississippi State University), is to better understand how gender equity and other socioeconomic factors within the agricultural sector impact men and women smallholder farmers in order to help transition rural women, families, and communities towards better food security, health, and economic development.

Towards this goal, the SGER team adapted the [Women's Empowerment in Agriculture Index \(WEAI\)](#) into the WEAI+ (WEAI + Soybean Modules). The original WEAI is an assessment of gender empowerment, control over agricultural inputs and decision-making, access to credit and other household and agricultural factors specifically tailored to men and women smallholder farmers which was developed through a partnership with the U.S. Government's Feed the Future initiative, USAID (United States Agency for International Development), IFPRI (International Food Policy Research Institute), and OPHI (Oxford Poverty and Human Development Initiative). The WEAI technical details are available at <http://www.ifpri.org/publication/womens-empowerment-agriculture-index> (USAID, IFPRI & OPHI, 2016).

The WEAI has five domains of empowerment and ten indicators. Domain 1

WEAI: Five Domains of Empowerment (5DE)

Domain	Indicators
Production	Input in productive decision-making
	Autonomy in production
Resources	Ownership of assets
	Purchase, sale, or transfer of assets
	Access to and decisions on credit
Income	Control over use of income
Leadership	Group member
	Speaking up in public
Time	Workload
	Leisure

Adkins et al. (2013). The Women's Empowerment in Agriculture Index. OPHI Working Paper No. 55. Available at: <http://www.ifpri.org/publication/womens-empowerment-agriculture-index>

is *Production* and its two indicators include 1) input in productive decision-making and 2) control over agricultural production. Domain 2 is *Resources* and its three indicators include 1) ownership of assets, 2) purchase, sale or transfer of assets, and 3) access to and decisions on credit. Domain 3 is *Income* and it includes the single indicator of control over use of income. Domain 4 is *Leadership* and its two indicators include 1) group membership and 2) speaking up in public. Domain 5 is *Time* and its two indicators include 1) workload and 2) leisure. These indicators are discussed in detail below in the *Analysis* section.

For the WEAI+, we retained all of the original WEAI modules — to which we made minor adaptations to improve cultural relevance for implementation in Ghana — and added four soybean-related modules. The WEAI+ was enumerated in 2014 in Ghana’s Northern Region, data entry and preliminary analysis were conducted in 2014-2015, and preliminary results were published in 2015 in the report, *Gender Equity & Soybean Uptake in Northern Ghana: WEAI+ Preliminary Results—Special Report on Implementing the WEAI+ Baseline* (Ragsdale & Read-Wahidi, 2015).

The 2015 open-access technical report includes a detailed description of the process of culturally adapting the WEAI for Ghana and adding the soybean modules to produce the WEAI+ survey instrument, of the strategic efforts to ensure community mobilization, enumerator training workshops, data collection methods, description of the WEAI+ preliminary analyses, presentation of the WEAI+ preliminary findings, and discussion of WEAI+ preliminary results. The 2015 preliminary report is available to download at https://www.researchgate.net/publication/290997138_Gender_Equity_Soybean_Uptake_in_Northern_Ghana_WEAI_Preliminary_Results.

The purpose of the WEAI+ is to collect culturally relevant data on socioeconomic and gender-specific outcomes among men and women smallholder farmers in rural agricultural communities, with a special emphasis on soybean production and other agricultural-related issues. This approach is vital as it is widely recognized that men and women farmers have different needs, priorities, access to resources, and decision-making power (Grown 2011; Heintz 2006) and in sub-Saharan Africa, women smallholder farmers are vulnerable to inequalities in access to resources, education/training, and power over agricultural decision-making. Indeed, USAID estimates that “by empowering women farmers with the same access to land, new technologies and capital as men, we can increase crop yields by as much as 30 percent helping to feed a growing population” (USAID, 2016).

METHODS

The WEAI+ includes 21 modules to collect information across individual- and household-level domains, including individual and household demographics, dwelling characteristics, household food insecurity, household decision making in production and income generation, key crop cultivation, access to capital and credit, access to extension specialists, individual leadership and influence in the community, group

membership, agricultural decision making, and time allocation. It also included modules to collect information on soybean and other seed access, soybean cultivation practices, soybean cultivation months, and soybean income-generation months. Modules included yes/no response items, open-ended questions, fill-in-the-blank questions, and Likert scale response items.

The WEAI+ was administered to men and women smallholder farmers in nine villages in four districts of Ghana's Northern Region. The three districts of Saboba, Chereponi and Tolon were selected to serve as SIL's "soybean intervention" districts and Karaga District served as the "control" district,



Map of Ghana's ten regions, including the Northern Region.
Source: https://www.cia.gov/library/publications/resources/cia-maps-publications/mao-downloads/ghana_admin.jpg/image.jpg

due to its low soybean production (based on the data we had available in 2014) (Ghana Statistical Service, 2010). See Appendix I for a 2014 map of the distribution of households cultivating soybean in Ghana's Northern Region, which is based on 2010 population and house census data from the Ghana Statistical Service. Participants were considered eligible for the study if they self-reported that they were 1) age 18 or older, 2) a decision-maker in their household, and 3) a resident of the village. Data was collected over a three-week period in May 2014.

Prior to data collection, we recruited teams of men and women enumerators who spoke English and the local dialect(s) of the villages in which the survey was to be implemented. Each enumerator attended a one-day WEAI+ Enumerator Training Workshops held in their local district that was led by SIL's SGER team in collaboration with Catholic Relief Services-Ghana. In addition, each enumerator completed the web-based Collaborative Institutional Training Initiative (CITI) Human Subject Research training and was approved to serve as an enumerator by the Mississippi State University Institutional Review Board.

ANALYSIS

The WEAI+ Preliminary Report focused on analysis of 1) the overall WEAI, 2) the WEAI five domains of empowerment (i.e., *Production*, *Resources*, *Income*, *Leadership*, *Time*), 3) the WEAI ten indicators that are subdomains' of the five domain of empowerment. These indicators narrow in on more specific agriculture-relevant factors within each of the WEAI's five domains (USAID, IFPRI, & OPHI, 2012). For example, *Production* includes the two indicators of 1) input in productive decision-making and 2) autonomy in agricultural production. *Resources* includes the three indicators of 1) ownership of assets, 2) purchase, sale or transfer of assets (i.e., decision-making and control over the purchase, sale, or transfer of assets), and 3) access to and decisions on credit. *Income* includes the single indicator of control over use of income (which includes decision-making and control over personal income that men and women generate themselves).

Leadership includes the two indicators of 1) group membership (i.e., Membership in community organizations like farmer-based organizations (FBOs) and 2) speaking up in public, which is a measure of a person's influence in their community. *Time* includes the two indicators of 1) workload (i.e., decision-making and control over one's own workload) and 2) leisure (i.e., decision-making and control over one's own leisure time). Following the procedures set forth by Alkire and colleagues (2013), responses to each of the 10 indicators are weighted to create a score for each of the five domains.

As guided by the developers of the WEAI (Alkire et al., 2013), the WEAI+ data were recoded to create the ten indicators (i.e., 1.1 *Input in Productive Decision-Making*, 1.2 *Autonomy in Production*, 2.1 *Asset Ownership*, 2.2 *Purchase, Sale, or Transfer of Assets*, 2.3 *Access to and Decisions on Credit*, 3.1 *Control Over Income Use*, 4.1 *Group Membership*, 4.2 *Speaking Up in Public*, 5.1 *Workload*, and 5.2 *Leisure*). The ten WEAI indicators were then weighted to create the five WEAI

WEAI 10 INDICATORS

- 1.1 Input in productive decision-making
- 1.2 Autonomy in production
- 2.1 Asset ownership
- 2.2 Purchase, sale, or transfer of assets
- 2.3 Access to and decisions on credit
- 3.1 Control over use of income
- 4.1 Group membership
- 4.2 Speaking up in public
- 5.1 Workload
- 5.2 Leisure

domains of empowerment (i.e., 1 *Production*, 2 *Resources*, 3 *Income*, 4 *Leadership*, and 5 *Time*) and finally, the five dimensions to the overall WEAI score.

The WEAI+ preliminary analyses focused on addressing two questions: 1) How do women smallholder farmers compare with men smallholder farmers in terms of empowerment across the WEAI's five domains of agriculture?; 2) How do women smallholder farmers compare with men smallholder farmers in terms of soybean cultivation, access to soybean seed, and income generation from soy? We identified a number of differences across gender in both the WEAI preliminary results and those of the WEAI+ Soybean Modules.

For the final analysis presented in this report, we looked more closely at the WEAI+ results to consider additional findings across the ten WEAI indicators, the five WEAI domains of empowerment, and any other significant predictors of empowerment among men and women smallholder farmers in Ghana's Northern Region. Specifically, we explored the following three research questions in the final analysis:

- 1 To what extent are empowerment differences influenced by socioeconomic status (SES), education, household type, marital status, and religion?**
- 2 To what extent does empowerment differ across the study's four data collection sites of Tolon District, Saboba District, Chereponi District, and Karaga District?**
- 3 To what extent does empowerment differ among men farmers and women farmers within the same households?**

We conducted descriptive analyses including frequencies, cross tabulations, and correlations to examine the variables of interest. Analyses were conducted using SPSS 22.0 and significance level was set at $p < .05$. The next sections below, we first present selected preliminary results that are important to understanding the final results. We then present the final results followed by the discussion section.

PRELIMINARY RESULTS

SAMPLE CHARACTERISTICS

Table 1 presents the individual demographics among the sample of 675 men and women smallholder farmers recruited from 11 villages in four districts in Ghana's Northern Region. The sample was almost evenly split between men and

Table 1. Individual and Household Demographics (N = 675)			
	Male % (n)	Female % (n)	Total % (n)
Gender	50.7 (342)	49.3 (333)	100 (675)
Married	87.4 (299)	92.8 (309)	90.1 (607)
Married couple, dual-adult household	94.7 (329)	92.8 (309)	93.7 (629)
Muslim	66 (226)	70.2 (234)	68.1 (459)
< Primary education	83.5 (285)	87.6 (292)	85.5 (577)

women, such that 50.7 percent (n = 342) of the participants were male and 49.3 percent (n = 333) of the participants were female. A majority of participants were married (90.1%) and also resided in a dual-adult household consisting of a married couple (93.7%). The household's primary religion for a majority of participants was Islam (68.1%), followed by Christianity (23.9%). The majority of participants reported less than primary education (85.5 %). Approximately thirty percent of participants resided in either Chereponi District (32%, n = 216), Saboba District (32%, n = 216) or Tolon District (26.4% (n = 178), as compared to Karaga District (9.6%, n = 65).

DWELLING CHARACTERISTICS

The majority of dwellings were made of mud plaster walls (78.4%) with cement/concrete flooring (53.2%) or earth flooring (45.1%) and with thatch roofing (59.7%) or corrugated sheet metal roofing (38.2%). A majority of dwellings were reported to be in either good repair (42.84%) or moderate repair (37.76%) as compared to poor repair (13.88%). A majority of dwelling did not have a water source (tap) inside the house (94.9%). The main water sources for household general use primarily included boreholes (43.6%), surface water (e.g., river, pond, stream, dam, spring) (40.4%), and wells (10.9%). Likewise, primary sources of drinking water included boreholes (44.83%), surface water (37.23%), and wells (10.63%). A majority of households did not have access to electricity (62.4%) and the primary lighting sources included non-electrical lanterns, candles, or paraffin (61.90%) as compared to electricity (34.10%).

WEAI PRELIMINARY RESULTS

In the preliminary report, we explored how women smallholder farmers compare with men smallholder farmers in terms of empowerment across the ten WEAI indicators, across the five WEAI domains, and across the overall WEAI. We found that women farmers were significantly less empowered than men farmers across three of the ten WEAI indicators. For *Input in Decision Making*, 90.58 percent of men farmers and 66.16 percent of women farmers were found to have adequate empowerment, while 33.83 percent of women farmers were found to have inadequate empowerment ($\chi^2 = 59.37$, $p < .001$). For *Purchase, Sale, and Transfer of Assets*, over one-quarter of women farmers (26%) were found to have inadequate empowerment ($\chi^2 = 76.78$, $p < .001$). Similarly, for *Speaking Up in Public*, approximately one-quarter of women farmers (23.77%) were found to have inadequate empowerment ($\chi^2 = 35.61$, $p < .001$).

Analysis across the five WEAI domains of empowerment (i.e., *Production*, *Resources*, *Income*, *Leadership*, and *Time*) indicated that significant gender differences in empowerment — all favoring males — were found in three of these five domains, including *Production* ($t = 4.03$, $p < .001$), *Resources* ($t = 2.41$, $p = .02$), and *Leadership* ($t = 2.96$, $p = .003$). Finally, significant gender difference in empowerment favoring males was found in the overall WEAI score ($t = 3.20$, $p = .002$).

SOYBEAN MODULES' PRELIMINARY RESULTS

Findings from our preliminary analysis of the Soybean Modules further highlighted gender differences among women and men farmers in Ghana's Northern Region, and spotlighted how these differences specifically relate to soybean production. For example, we found that while the majority of both men and women farmers had grown soybean in the past, men farmers were significantly more likely to have grown soybean as compared to women farmers ($p = .000$). Likewise, while the majority of both men and women farmers knew where to buy soybean seed, men farmers were significantly more likely to report that they had this knowledge ($p = .018$).

Regarding use of agricultural inputs on soybean crops, women were more likely than men farmers to have used both fertilizer ($p = .005$) and inoculant ($p = .029$) on their soybeans. The Soybean Module results also shed additional light on the WEAI finding that women farmers were significantly less comfortable talking with local agricultural extension agents than were their male counterparts ($\chi^2 = 35.61$, $p < .001$). Of the sample who had received free improved soybean seed, men farmers were most likely to have received

soybean seed from their local agricultural extension agents and women farmers were more likely to have received soybean seed from their local markets. Likewise, of the sample who had used inoculum on their soybeans before planting, men farmers were most likely to have received inoculum from their agricultural extension agents and women farmers were most likely to have received inoculum from their from their local markets.

FINAL RESULTS

EMPOWERMENT AND KEY DEMOGRAPHICS

Following-up on the preliminary analyses exploring gendered empowerment gaps across the ten WEAI indicators, the five WEAI domains, and the overall WEAI, we hypothesized that additional empowerment gaps would emerge across key demographic factors including 1) socioeconomic status (SES), 2) educational level, 3) household type, 4) marital status, and 5) religious affiliation. Due to the limited variability in the last four of these factors among our sample of men and women farmers in Ghana's Northern Region, educational level, household type, marital status, and religious affiliation were recoded.

For example, educational level was recoded so that respondents who reported "less than primary education (or no school)" were compared against those in all other educational categories (e.g., "primary education," "middle school leaving certificate," etc.). Household type was recoded so that respondents who reported they belonged to a "female-only headed household" or a "male-only headed household" were each *separately* compared against respondents who reported they belonged to a "married couple household" (i.e., a dual-adult household of a married couple). Marital status was recoded so that "married" respondents were compared against those in all other categories (i.e., "never married," "separated," "divorced," and "widowed"). Religious affiliation was recoded so that respondents who reported that they were "Muslim" were compared against those in all other religion categories (i.e., "Christian," traditionalist," and "other").

Although SES is often calculated as some combination of income, education level, and occupation, there was very little variation among occupation in our purposeful sample of smallholder farmers and, therefore, we could not calculate SES using occupation. In addition, because the WEAI collects data on income and then uses that data to calculate the WEAI score itself, we could not use income as a proxy for SES. In village settings, researchers have relied on inventories of material possessions to gauge subtle

variations in SES (Graham, 2004) or measure relative household wealth/ownership of assets (Fotso et al, 2012). Since the WEAI+ collects detailed descriptions of dwelling characteristics,

we use variations among dwelling characteristics as a measure of SES. Exploratory factor analysis with promax rotation was performed to determine whether items in the Dwelling Characteristics Module unidimensionally reflect participants' SES.

The exploratory factor analysis results indicated a two-factor simple structure: three items for Factor One, *Sources of House Utilities* (i.e., the main source of water for general use, the main source of drinking water, and the main lighting source) and four items for Factor Two, *State of Dwelling* (i.e., the roof's material, the floor's material, the exterior wall's material,

and the dwelling's general condition). Given that these two factors had a minimal correlation ($r = -.04$, $p = .39$), we made a decision to use the factor score of Factor Two (*State of Dwelling*) to operationalize SES.

Table 2. Results of Logistic Regression Predicting Indicator *Speaking Up in Public*

		<i>b</i>	S.E.	Wald	Odds Ratio	95% CI for OR	
Step 1 ^a						Lower	Upper
	Constant	-0.14	0.74	0.37	0.87		
	Education	-0.27	0.42	0.41	0.77	0.34	1.73
	SES	0.04	0.02	5.84*	1.04	1.01	1.07
Step 2 ^b							
	Constant	0.27	0.83	0.10	1.31		
	Education	-0.03	0.46	0.00	0.97	0.39	2.40
	SES	0.06	0.02	9.53**	1.06	1.02	1.10
	Female	-1.46	0.33	20.07***	0.23	0.12	0.44
	Female-only Headed HH	0.51	0.70	0.52	1.66	0.42	6.60
	Male-only Headed HH	19.20	15089.99	0.00	216956932.75	0.00	.
	Not Married	-0.28	0.48	0.35	0.75	0.29	1.94
	Other Religion	-1.37	0.34	16.27***	0.25	0.13	0.49

^a $R^2 = .015$ ^b $R^2 = .109$
^{*} $p < .05$ ^{**} $p < .01$ ^{***} $p < .001$

Table 3. Results of Logistic Regression Predicting Indicator *Input in Productive Decision-Making*

		<i>b</i>	S.E.	Wald	Odds Ratio	95% CI for OR	
Step 1 ^a						Lower	Upper
	Constant	0.59	0.67	0.75	1.80		
	Education	-0.14	0.38	0.14	0.87	0.41	1.83
	SES	0.02	0.01	1.80	1.02	0.99	1.05
Step 2 ^b							
	Constant	1.31	0.74	3.13	3.70		
	Education	-0.19	0.42	0.20	0.83	0.36	1.89
	SES	0.03	0.02	2.79	1.03	1.00	1.06
	Female	-1.54	0.30	25.76*	0.22	0.12	0.39
	Female-only Headed HH	0.13	0.62	0.05	1.14	0.34	3.83
	Male-only Headed HH	19.00	15122.89	0.00	178657832.55	0.00	.
	Not Married	0.37	0.52	0.50	1.45	0.52	4.00
	Other Religion	-0.55	0.32	3.05	0.58	0.31	1.07

^a $R^2 = .004$; ^b $R^2 = .092$
^{*} $p < .001$

For each of the indicator scores, hierarchical binary logistic regression was performed with SES and educational level as the Block 1 predictors (covariates), and household type, gender, marital status, and religion as the Block 2 predictors.

After controlling for SES and educational level, however, we did find that females, non-Muslims, and unmarried respondents were significantly less likely to be “adequate” in one or more of the indicators.

Whereas SES and educational level are commonly used as control variables, they were not found to be predictive of most of the ten WEAI indicators, with the exception of *Speaking Up in Public* (Table 2). For this

indicator — without the effect of every standard deviation of increase in SES — individuals would be 1.04 times more likely to have adequate empowerment in *Speaking Up in Public*. We also found that Muslims farmers were 4.00 times more likely than non-Muslims farmers to have adequate empowerment in *Speaking Up in Public* and men farmers were 4.35 times more likely than women farmers to have adequate empowerment in *Speaking Up in Public*.

Table 4. Results of Logistic Regression Predicting Indicator *Purchase, Sale, or Transfer of Assets*

		<i>b</i>	S.E.	Wald	Odds Ratio	95% CI for OR	
Step 1 ^a						Lower	Upper
	Constant	2.54	0.74	11.84*	12.65		
	Education	0.82	0.51	2.61	2.26	0.84	6.10
	SES	-0.02	0.02	1.41	0.98	0.95	1.01
Step 2 ^b							
	Constant	4.62	0.94	23.93**	101.35		
	Education	0.48	0.56	0.75	1.62	0.54	4.81
	SES	-0.02	0.02	1.33	0.98	0.95	1.01
	Female	-2.90	0.53	29.66**	0.06	0.02	0.16
	Female-only Head	-0.45	0.66	0.47	0.64	0.18	2.31
	Male-only Headed HH	16.84	15128.99	0.00	20494533.19	0.00	.
	Not Married	0.37	0.66	0.31	1.45	0.39	5.30
	Other Religion	0.48	0.41	1.37	1.61	0.73	3.58

^a $R^2 = .009$ ^b $R^2 = .156$
^{*} $p < .01$ ^{**} $p < .001$

Table 5. Results of Logistic Regression Predicting Indicator *Autonomy in Production*

		<i>b</i>	SE	Wald	Odds Ratio	95% CI for OR	
Step 1 ^a						Lower	Upper
	Constant	1.62	0.63	6.75*	5.07		
	Education	-0.54	0.33	2.72	0.58	0.31	1.11
	SES	-0.02	0.01	1.82	0.98	0.96	1.01
Step 2 ^b							
	Constant	1.60	0.65	6.08*	4.97		
	Education	-0.38	0.37	1.06	0.69	0.34	1.41
	SES	-0.02	0.01	1.27	0.99	0.96	1.01
	Female	-0.11	0.24	0.21	0.90	0.56	1.43
	Female-only Headed HH	0.38	0.64	0.35	1.46	0.42	5.08
	Male-only Headed HH	21.33	17918.78	0.00	1834743971.35	0.00	.
	Not Married	0.36	0.40	0.82	1.44	0.66	3.16
	Other Religion	-0.73	0.32	5.26*	0.48	0.26	0.90

^a $R^2 = .019$ ^b $R^2 = .053$
^{*} $p < .05$

Again, after controlling for SES and education, we found significant differences in the indicator of *Input in Productive Decision Making* (Table 3). For this indicator, we found that men farmers were 4.65 times more likely than women farmers to have adequate empowerment in *Input in Productive Decision Making*.

In addition, we found significant empowerment differences in the indicator of *Purchase, Sale, or Transfer of Assets* (Table 4). Here, we found that men farmers were 16.67 times more likely than women farmers to have

adequate empowerment in *Purchase, Sale, or Transfer of Assets*. We also found significant empowerment differences in the indicator of *Autonomy in Production* (Table 5), such that Muslims farmers were 2.07 times more likely than non-Muslims farmers to have adequate empowerment in *Autonomy in Production*.

Finally, we found significant empowerment differences in the indicator of *Group Membership* (Table 6), such that non-Muslims were 1.61 times more likely to have adequate empowerment in *Group Membership* as compared to than Muslims. Also, male-only headed households were 16.67 times less likely to have adequate empowerment in *Group Membership* as compared to households headed by a married couple.

		<i>b</i>	S.E.	Wald	Odds Ratio	95% CI for OR	
Step 1 ^a						Lower	Upper
	Constant	0.97	0.86	1.27	2.63		
	Education	-0.43	0.45	0.92	0.65	0.27	1.58
	SES	0.02	0.02	0.71	1.02	0.98	1.05
Step 2 ^b							
	Constant	1.04	0.93	1.27	2.83		
	Education	0.19	0.54	0.12	1.03	0.42	3.45
	SES	0.02	0.02	1.66	1.03	0.99	1.06
	Female	-0.50	0.35	2.07	0.61	0.31	1.20
	Female-only Headed HH	-0.86	0.62	1.94	0.42	0.13	1.42
	Male-only Headed HH	-2.83	1.26	5.04*	0.06	0.01	0.70
	Not Married	-0.18	0.57	0.10	0.83	0.27	2.56
	Other Religion	0.48	0.41	1.37*	1.61	0.73	3.58
^a R ² = .004 ^b R ² = .061 *p < .05							

EMPOWERMENT DIFFERENCES ACROSS THE FOUR DISTRICTS OF TOLON, SABOBA, CHEREPONI & KARAGA

The WEAI data also allowed us to compare empowerment variation across the four different districts of Ghana's Northern Region in which we implemented the WEAI+ survey, including Tolon, Saboba, Chereponi, and Karaga Districts. To examine district-level differences in the WEAI scores, a series of Chi-Square (χ^2) tests for independence were conducted, and the results are summarized in Table 7. Using |Standardized Residual (SR)| > 1.96 as the cutoff, we found that district-level differences emerged in six of

the ten WEAI indicators, including 1) *Input in Productive Decision-Making*, 2) *Autonomy in Production*, 3) *Purchase, Sale, or Transfer of Assets*, 4) *Group Membership*, 5) *Speaking Up in Public*, and 6) *Workload*.

Compared to the other three districts, Tolon District had significantly more individuals who have inadequate empowerment in *Purchase, Sale, or Transfer of Assets* (SR = 2.2), *Group Membership* (SR = 3.3), and *Speaking Up in Public* (SR = 4.5). However, we found that Tolon District also had significantly fewer individuals who have inadequate empowerment in *Workload* (SR = -2.7) and significantly more individuals who have adequate empowerment in *Workload* (SR = 5.7).

As compared to the other three districts, Saboba District had significantly more individuals who have inadequate empowerment in *Input in Productive Decision-Making* (SR = 2.3) and significantly fewer individuals who have inadequate empowerment in *Purchase, Sale, or Transfer of Assets* (SR = -2.4).

Table 7. Results of Chi-Square Tests Examining Differences in Indicator Scores at the District-Level

	Chi-Square ^a (χ^2)	Valid Sample (n)	Phi (ϕ)
1.1 Input in Productive Decision-Making	28.66***	671	.20
1.2 Autonomy in Production	21.93***	542	.20
2.1 Ownership of Assets	6.95	569	.11
2.2 Purchase, Sale, or Transfer of Assets	12.73**	660	.14
2.3 Access to and Decisions on Credit^b	11.10*	173	.25
3.1 Control Over Use of Income	1.79	529	.06
4.1 Group Membership	31.04***	480	.25
4.2 Speaking Up in Public	54.25***	654	.29
5.1 Workload	54.60***	650	.29
5.2 Leisure	5.08	589	.09

^adf = 3 for all Chi-Square tests

^bCell Expected Frequencies < 5

*p < .05. **p < .01. ***p < .001

As compared to the other three districts, Chereponi District had significantly fewer individuals who have inadequate empowerment in *Input in Productive Decision-Making* (SR = -2.5), *Group Membership* (SR = -2.2), and *Speaking Up in Public* (SR = -3.7). However, compared to other districts, Chereponi District had significantly fewer individuals who have adequate empowerment in *Workload* (SR = -3.0).

Karaga District mirrored the same patterns we found in Chereponi District for three indicators, such that as compared to the other three districts, Karaga District had significantly fewer individuals who have inadequate empowerment in *Input in Productive Decision-Making* (SR = -2.7), *Group Membership* (SR = -2.9), and *Speaking Up in Public* (SR = -3.2). Likewise, Karaga District also had significantly fewer individuals who have adequate empowerment in *Workload* (SR = -2.5). In addition to those characteristics shared by Chereponi District, we found that Karaga District also had significantly fewer individuals who have inadequate

empowerment in *Autonomy in Production* (SR = -3.0) and significantly more individuals who have adequate empowerment in *Autonomy in Production* (SR = -3.0).

EMPOWERMENT DIFFERENCES WITHIN THE SAME HOUSEHOLDS

To better control for the between-household factors (e.g., SES) that may affect the gender gap in empowerment, we conducted a series of matched-samples *t* tests among pairs of males and female respondents who reported living the same household. The majority of male and female same-household pairs are assumed to be husbands and wives, since 93 percent of the overall sample reported living in a dual-adult household consisting of a married couple. Due to missing data across particular items, the number of same-household pairs varies across our analysis of each domain as well as for the overall WEAI score.

We found that the empowerment gap among pairs of same-household men ($M = .88$, $SD = .07$) and women ($M = .83$, $SD = .10$) across the overall WEAI score was not significant, but the effect size is notable ($t = 1.39$, $p = .19$, $r = .37$) especially considering the small sample size ($n = 26$). Our findings suggest that husbands tend to have adequate empowerment across all five WEAI domains as compared to their wives, but these differences only reached significance in the domains of *Production* and of *Leadership*. In the domain of *Production*, among a total of 212 pairs of married couples, male household members had significantly higher empowerment scores ($M = .16$, $SD = .05$) than did women household members ($M = .13$, $SD = .07$), with a medium to large effect ($t = 5.32$, $p < .001$, $r = .34$). Similarly, in the domain of *Leadership*, among a total of 162 pairs, men household members had significantly higher empowerment scores ($M = .18$, $SD = .04$) than did women household members ($M = .17$, $SD = .06$), with a small-to-medium effect ($t = 3.19$, $p = .002$, $r = .24$).

SUMMARY OF RESULTS

Q1. TO WHAT EXTENT ARE EMPOWERMENT DIFFERENCES INFLUENCED BY SES, EDUCATION, HOUSEHOLD TYPE, MARITAL STATUS & RELIGION?

Regarding our first research question (above), we found that — even after controlling for SES and education — significant gender empowerment gaps remained persistent among women farmers as compared to the male counterparts. For example, we found that men farmers are 4.65 times more likely than women farmers to have adequate empowerment in *Input in Productive Decision-Making*. Men farmers are 16.67 times more likely than women farmers to have adequate empowerment in *Purchase, Sale, or Transfer of Assets*. Men farmers are 4.35 times more likely than women farmers to have adequate empowerment in *Speaking Up in Public*.

We also found that households with male-only heads are 16.67 times less likely to have adequate empowerment in *Group Membership* than households headed by married couples. This may simply be due to the relatively young age of male-only household heads. We found that significant empowerment differences existed among Muslim and non-Muslim respondents such that Muslims are 2.07 times more likely than non-Muslims to be “adequate” in *Autonomy in Production*, and were 4.00 times more likely than non-Muslims to have adequate empowerment in *Speaking Up in Public*. In contrast, we found that non-Muslims are 1.61 times more likely than Muslims to have adequate empowerment in *Group Membership*.

EMPOWERMENT GAPS

Men farmers are
16.67 TIMES MORE LIKELY
than women farmers
to have adequate
empowerment in *PURCHASE,
SALE, OR TRANSFER OF ASSETS*

Men farmers are
4.65 TIMES MORE LIKELY
than women farmers
to have adequate
empowerment in *INPUT IN
PRODUCTIVE DECISION-MAKING*

Men farmers are
4.35 TIMES MORE LIKELY
than women farmers to
have adequate
empowerment in *SPEAKING
UP IN PUBLIC*

Q2. TO WHAT EXTENT DOES EMPOWERMENT DIFFER ACROSS TOLON, SABOBA, CHEREPONI & KARAGA DISTRICT?

Regarding our second research question (above), we found significant empowerment differences among the four districts included in the study. For example, Karaga and Chereponi Districts have significantly fewer individuals who have inadequate empowerment across a number of indicators as compared to Tolon and Saboba Districts. Karaga and Chereponi Districts have significantly fewer individuals who have inadequate empowerment in *Input in Productive Decision-Making*, *Group Membership*, and *Speaking Up in Public*. Additionally, Karaga District has significantly fewer individuals who have inadequate empowerment in *Autonomy in Production*. Interestingly, as compared to the other three districts, Tolon District had significantly more individuals who have inadequate empowerment in *Purchase, Sale, or Transfer of Assets*, *Group Membership*, and *Speaking Up in Public*.

We also found that Saboba District had significantly more individuals with inadequate empowerment in *Input in Productive Decision-Making*, but significantly fewer individuals with inadequate empowerment in *Purchase, Sale, or Transfer of Assets*. Although Saboba District contained a majority of non-Muslims (85%), whereas the other four districts contained a majority Muslims — ranging from 97 percent in Karaga District to 90 percent in Chereponi District — the indicators with significant empowerment differences between Muslims or non-Muslims in Saboba District did *not* include *Purchase, Sale, or Transfer of Assets* and did *not* include *Input in Productive Decision-Making*. These findings suggest that the district-level differences identified in Saboba District are a result of factors beyond religious affiliation.

Q3. TO WHAT EXTENT DOES EMPOWERMENT DIFFER AMONG MEN FARMERS AND WOMEN FARMERS WITHIN THE SAME HOUSEHOLDS?

Regarding our third research question (above), we found that the gender empowerment gap favoring men farmers remained, even when comparing men and women from the same household. While there was evidence of this across the overall WEAI, it was especially apparent within the domains of *Production* and *Leadership*, such that men had significantly higher empowerment scores than women in the same household.

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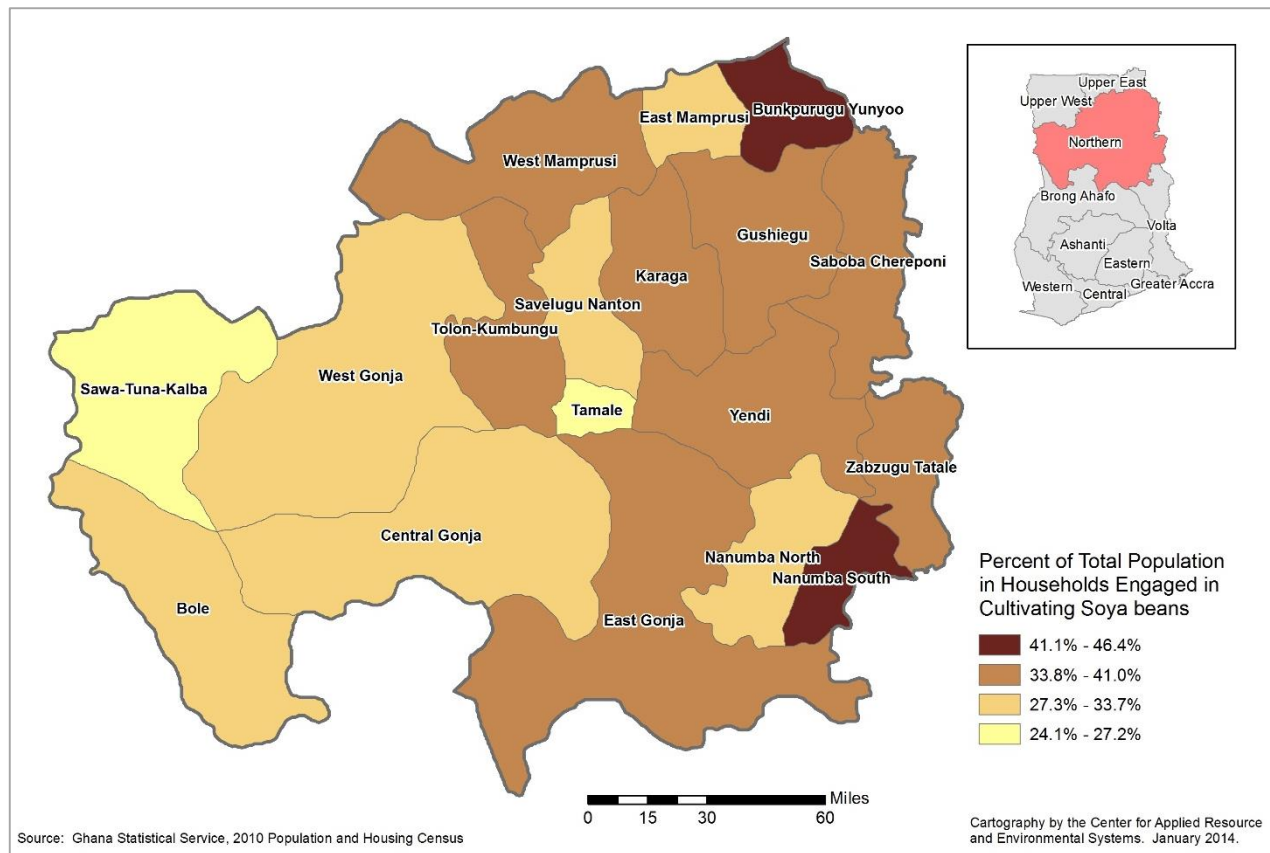
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APPENDIX I: HOUSEHOLDS CULTIVATING SOYBEAN IN GHANA'S NORTHERN REGION



Source: Ghana Statistical Service. 2010 Population and Housing Census. Cartography by the Center for Applied Resource and Environmental Systems. January 2014. Retrieved March 30, 2014 from <http://staging.communitycommons.org/groups/smartfarm-ghana/>