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Gender and the rate of Adoption of Maize and Soybeans Technologies in Four Districts of Ghana

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ABSTRACT

The study sought to assess the influence of gender on the extent of adoption of three maize and soybean technologies. Four districts (West Mamprusi, Sawla-Tuna-Kalba, East Gonja and Zabzugu) where maize and soybean are predominantly cultivated were purposively sampled for the study. Questionnaire, Focus Group Discussions, key informant interviews and desktop reviews of reports were used for the data collection. Pearson's Chi-square tests were employed to establish the association between the extent of adoption of the technologies with gender. Over 60% of the farmers adopted the three technologies. Most (99.8%) farmers confirmed that the technologies were used by both men and women. About 42.4% of female and 31.08% of male farmers who used the technologies agreed to getting better market for their produce. Also, 37.84% of the male farmers strongly agreed to recording consistent improvement in the yield of maize and soybeans as against 32.20% of female farmers who said same. Generally, male (30.07%) farmers tend to adopt technologies that will help them increase their output whereas females tend to prefer technologies that will enhance the price of their produce. However, 49.79% of females are more likely to adopt a combination of organic and inorganic soil amendments than males (45.79%). It can then be recommended that technologies should be developed to target the preferences of male and female smallholder farmers. Further research should be conducted to establish the relevance of gender to the adoption of technologies in other staple crops.

Keywords: Gender, Technology, Adoption, Smallholder Farmer

INTRODUCTION

Technology is the practical application of scientific knowledge in the production of materials, tools, techniques, practices and provides sources of power to make life easier or more pleasant and tends to make work more productive (Valenti, 2014). Technology adoption is seen as an important tool in combating food insecurity and increasing agricultural efficiency. This study focuses on three (3) technologies; namely, improved seed technologies through the introduction of hybrid varieties, combination of organic and inorganic soil amendments and, integrated approach to improving and managing soil fertility. Although technologies could have huge potential to considerably reduce the time poverty of women and increase labour productivity in general, empirical studies show that their use and adoption among rural women have not always been high (Doss, 2018; *Theis et al., 2018*). Socio-cultural-appropriateness, physical accessibility, and affordability are the three most common reasons attributed to these gender differences (Maureen, Marlaine, 2007). The adoption of productivity-enhancing technologies in some instances has increased women's time burden (*Theis et al., 2018*; Doss, 2018). It is, however, common knowledge that many smallholder farmers in developing countries (especially so for African countries) still rely on age-old agricultural technologies for their farming activities. It is an acknowledged fact that some of the primitive agricultural technologies are associated with drudgery and poor efficiency and therefore man's continued existence on earth will be under serious threat if humanity continues to rely on such archaic agricultural technologies.

It therefore, stands to reason that improved agricultural technologies which reduce the drudgery, improve soil fertility and improve agricultural efficiency generally will be readily adopted by farmers but this does not happen in some instances. Ragasa *et al.* (2014) posited that the most commonly-cited reasons for this are the relatively weaker participation and engagement of women farmers in priority-setting and research processes. This then further resulted in limiting women's ability and opportunity to influence technologies being adopted. Yet the answers to questions of how gender creates opportunities or obstacles to adopting maize and soybean technology remain elusive. Gender power relations are embedded in technology (Wajcman, 2010). Literature has shown that men and women have different preferences to close the gendered productivity gap in agriculture (Doss, 2018; Mukasa and Salami, 2015; Huyer, 2016). Due to the multidimensional nature of technology adoption, a difference in rates of adoption of technology can be attributed not only to economic and technological factors, but also to gender considerations. It is therefore a trite to state that improved agricultural technologies usually do not reach some of the targeted population especially the women segment of the population. This leaves such technologically "left out" farmers with no other option than to continue with their traditional farming practices. As such this study conceptualized the actors of the agricultural technology system as operating within the larger macro context and institutional context, with its consequential influence on technology adoption. In view of this fact, it is very crucial to investigate the role of gender on technology adoption of maize and soybean technologies. This will help identify outreach strategies and their contribution to the gender adoption of technologies, in order to eliminate barriers to technology adoption, to enhance agricultural productivity. The study focuses on smallholder farmers of four (4) districts in Ghana partly due to proximity and resource constraints and partly due to the fact that these districts serve as one of the food hubs in Ghana. Besides, it is hypothesized that the gender responses of these smallholder farmers will provide recommendations to do other studies in other districts. The study will therefore contribute immensely to maize and soybeans technology literature in Ghana. Also, the research would provide useful information to guide investment decisions in the up-scaling efforts of reaching a greater number of farmers with technologies. Finally, the information generated from the research would subsequently serve as a reference document for policymakers and stakeholders in the agricultural sector, to plan how to develop technologies to benefit all segments of the society interested in agriculture production using appropriate strategies and methodologies.

CONCEPTUAL FRAMEWORK

The issue of gender differences in technology acceptance and use has received the attention of many researchers (Wong & Hanafi, 2007). As a result, numerous studies have been conducted to study the extent of this difference. The debate of Briggs (2005), Teo and Wong (2013) emphasized that research focus on gender differences related to technology acceptance started in the 1980s and still persists. This is because of the growing interest in the impact of gender differences on technology acceptance. This makes the study of gender and technology adoption an important research theme in agriculture. The severity of constraints to adopting technology differs among men and women (Doss, 2018; Ragasa & Mazunla, 2014). The review in this regard seeks to identify and establish how gender influences the behaviour patterns of smallholder farmers in making technology decisions for adoption.

Agricultural technology development and adoption in every country takes place within the macro- environmental context which is constituted by natural conditions such as agro-ecological and climatic factors and national policy and research agenda driving the country's agricultural development. Also, the various actors within the agricultural technology and innovation system such as researchers, extension officers and farmers operate within the national, sectorial and location-specific socio-cultural and gender constraint framework. With all their efforts and operations governed and dictated by specific socio-cultural (such as traditional practices, religious restrictions, taboos and beliefs) and institutional (e.g., government policies and institutional vision and mandates) contexts. As such this study conceptualized the actors of the agricultural technology system as operating within the larger macro context and socio-cultural and institutional context and its implications on the choices made by males and females, with its consequential influence on technology adoption. Farmers' gender is perceived to influence their ability to accept, access and utilize technologies which are captured in the macro-environmental context of the framework.

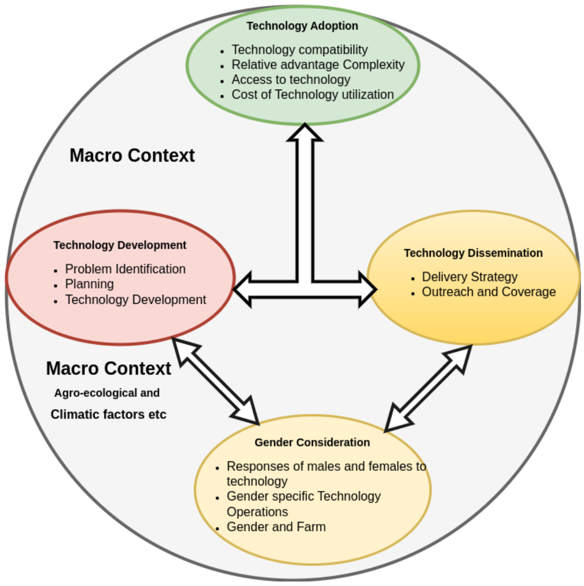

Figure 1: Relationship between Gender and the Adoption of Maize and Soybean Technologies

Source: Author construct, 2017

Gender has a direct linkage with the nature of extension delivery strategy. The study conceived gender as an important component within other internal and external sub-components exerting various degrees of influence on technology adoption. This is illustrated in the conceptual framework with a direct linkage between technology adoption and gender considerations. Again, as illustrated in the framework, technology adoption occurs within a macro-environmental (agro-ecological and climatic) context which intends dictate the kind of technology to develop and which subsequently influences the technology dissemination strategy and other transforming structures and processes within the beneficiary community, region and the nation. Also, the rate of adoption is affected by how effective the innovation supersedes the previous practices, or technologies (Relative advantage); the extent of compatibility of the innovation to past practices, needs and values of the potential adopter (Compatibility); and how difficult the technology is to be understood and used by potential adopters. Gender and government policies relating to technology adoption are also expected to influence and direct the type of technology developed. Government policies with regard to increasing productivity and reducing drudgery and promoting all-inclusiveness in the development and use of technology have been the reason for the mandate of agriculture research institutions. In relation to maize and soybean technologies, the construct has been defined to incorporate gender considerations. This has been identified in the model and proposed to be an important element that influences the way smallholder farmers adopt new technologies making them worthy of investigation. Gender, therefore, is important for maize and soybean technology adoption for the following reasons:

Gender**:** differences in norms relating to men and women are more marked in agricultural technology practices and hence affect their involvement in technology adoption. Traditional gender stereotypes could potentially affect technology adoption by either males or females.

METHODOLOGY

Study Area

The study was conducted in West Mamprusi, Sawla-Tuna-Kalba, East Gonja and Zabzugu districts. The four districts were chosen for this study because the majority of households in the districts are farm households. The study districts can also boast of high production of maize and soybean. The commercial value chains of the study crops seek to promote equitable participation for both men and women in the four districts. In the study districts, male compared to female farmers have relatively sufficient access to arable land although women make up 90% of the labour force engaged in the processing and marketing of farm produce including maize and soybean (Twumasi, 2005). The scope covered two regions, four districts and thirteen communities. Table 1, provides further information on the location and coordinates of the study districts as at the time.

Table 1: Location, and coordinates of the study districts

Name of District	Coordinates of the District of Study	
	X(m)	Y(m)
West Mamprusi	732311	1142915
Sawla Tuna Kalba	568188	1052546
East Gonja	754059	943670
Zabzugu	869891	1009792

Source: Field Survey 2017

Sampling Procedure

The mixed methods research design was employed in the study (*Creswell et al., 2003*). Under this methodology, three (3) different types of agricultural technologies introduced by Savannah Agricultural Research Institute (SARI) namely, improved seed technologies, combination of organic and inorganic soil amendments and, integrated approach to improving and managing soil fertility were intensively investigated and compared in terms of their gender sensitivity in application to maize and soybean production. The four study districts where maize and soybean are predominantly cultivated were purposively sampled. The districts are West Mamprusi, Sawla-Tuna-Kalba, East Gonja and Zabzugu. The population were male and female smallholder farmers within the four geographical districts identified in the research.

Sampling Frame and Size

A total of four thousand, five hundred and fifty-nine (4,559) members in Farmer Based Organizations were disaggregated by sex and constituted the sample frame for the study. Cochran's (1997) sample size determination formula was used to calculate the suitable sample size for males and females in each district as:

$$n = \frac{N}{1 + Ne^2} \qquad (1)$$

Where n denotes sample size, N denotes population and e denotes margin of error. The error of margin was taken as 10% to have a manageable sample size. This choice confirms Dillman (2012) position that, for most social science studies, the margin of error of 3-10% is fine to use in deducing trends or infer results in an exploratory study. Using this formula, a sample size of 631 was obtained out of which 534 questionnaires were administered because some farmers had relocated to other towns/cities.

Also, 6 researchers and 4 district extension officers of MoFA were sampled and interviewed as key informants to triangulate the findings.

Table 2: Sample computation from the four districts

Districts	Number of FBOs	Sampling frame (Total Membership/Pop) (N)			Margin of error (e)	Sample size $n = \frac{N}{1+Ne^2}$		
		Males	**Females**	**Total**		**Males**	**Females**	**Total**
West Mamprusi	33	651	906	1557	10%	87	90	177
Sawla Tuna Kalba	28	199	96	295	10%	67	49	116
East Gonja	22	581	264	845	10%	85	73	158
Zabzugu	52	1038	824	1,862	10%	91	89	180
Total	135	2, 469	2, 090	4, 559	10%	330	301	631

Source: MoFA and Author's Computations,2017

Data Sources

Primary data were gathered from smallholder farmers, SARI and MOFA staff. The secondary data were obtained from websites, SARI policy documents and reports. Using multiple sources and methods was aimed at verifying the data to detect inconsistent answers through the principle of triangulation in both primary and secondary data collection (Polit & Beck, 2014; Hussein, 2009; Creswell & Poth, 2017; *Creswell et al., 2003*).

Data Collection Instruments

The data collection involved the use of a questionnaire, checklist and interview guide Also, methods such as desktop review of documents and reports obtained from SARI, MOFA and other relevant agencies were employed in gathering data. Three sets of questionnaires were designed and used in the data collection from smallholder farmers, SARI and MOFA staff. A checklist was used during the Focus Group Discussion (FGD) with only the smallholder farmers whilst the interview guide was used to solicit in-depth information from SARI and MoFA staff.

Data Analysis

Gender Trend in the use of Maize and Soybean Technologies

The trend in the use of maize and soybean technology was assessed by analysing the responses of farmers surveyed to the question '*Have you used any technology for cultivating maize/soybeans?'* and responses were disaggregated by sex. Results of a cross-tabulation of responses to this question as either 'yes' or 'no' and by sex of respondent were presented as frequencies and Chi-square test was subsequently conducted to test the null and alternate hypotheses that:

H_0: Gender does not have any association with the use of maize and soybean technology.

H_a: Gender has association with the use of maize and soybean technology.

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{c} \frac{\left(O_{ij} - E_{ij}\right)^2}{E_{ij}} \quad (2)$$

χ^2 represents the Chi-square test of independence O_{ij} observed values of two nominal variables E_{ij} expected value of two nominal variables. However, degree of freedom is given by df =(r-1) (c-1), where r is the number of rows and c the number of columns.

Where $E_{i.j}$ is computed as:

$$E_{i.j} = \frac{\sum_{k=1}^{c} O_{i.j} \sum_{k=1}^{r} O_{k.j}}{N} \quad (3)$$

Where $E_{i.j}$ represent the expected value, $\sum_{k=1}^{c} O_{i.j}$ sum of the i_{th} column, $\sum_{k=1}^{r} O_{k.j}$ sum of the k_{th} row and N total number.

Since the research aims at establishing a possible relationship between respondents' sex and their technology used, Pearson's Chi-square test was essential because the variables in question were categorical. At the end of the test, if Chi-square calculated is greater than critical Chi-square value at a pre-determined probability level preferably 5%, the null hypothesis is rejected implying that gender does not have any association with the use of maize and soybean technology.

Extent of Adoption of Maize and Soybean Technologies by Smallholder Farmers

To quantitatively measure the extent to which farmers have adopted improved maize and soybean technologies, the study used a five-point Likert scale, these respectively represent Adopted, Highly Adopted, Tried and Stopped, Did not Try at all, and Undecided. Results of respondents were presented as frequencies and also cross tabulated with farmers' gender. Pearson's Chi-square analysis was further employed to establish the association between the extent of adoption of the technologies with sex. The hypothesis governing this non-parametric test is:

H_o: Gender do not have any association with the adoption of maize and soybean technologies.

H_a: Gender has association with adoption of maize and soybean technologies. The Chi-square model is presented as:

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{c} \frac{\left(O_{ij} - E_{ij}\right)^2}{E_{ij}} \quad (4)$$

χ^2 represent the Chi-square test of independence O_{ij} observed values of two nominal variables, E_{ij} expected value of two nominal variables. However, degree of freedom is given by d.f =(r-1) (c-1), where r is the number of rows and c the number of columns.

Where $E_{i.j}$ is computed as;

$$E_{i.j} = \frac{\sum_{k=1}^{c} O_{i.j} \sum_{k=1}^{r} O_{k.j}}{N} \quad (5)$$

Where $E_{i.j}$ = expected value, $\sum_{k=1}^{c} O_{i.j}$ = sum of the i_{th} column $\sum_{k=1}^{r} O_{k.j}$ = sum of the k_{th} row and N= total number. If Chi-square calculated is greater than critical Chi-square value at a pre-determined probability level preferably 10%, the null hypothesis is rejected implying that gender does not have any association with adoption of maize and soybean technology by farmers.

RESULTS AND DISCUSSION

Gender Trends in the Use of Maize and Soybean Technologies

The use of maize and soybean technology was assessed by analysing the responses of farmers surveyed to the question '*Have you* *used any technology for cultivating maize/soybeans?'* and disaggregated by sex. Result of a cross-tabulation of responses to this question as either 'yes' or 'no' and by sex of respondent is presented in Table 3. A Chi-square test was conducted to test the hypothesis that:

Ho: Sex does not significantly influence use of maize/soybean technology

Ha: Sex does significantly influence use of maize/soybean technology

Table 3: Chi-square test on gender and use of maize/soybean technologies

			Have you used any technology for cultivating maize/soybeans		**Total**
			Yes	No	
Sex	Male	Count	280	17	297
		% within Column	56.3%	45.9%	55.6%
	Female	Count	217	20	237
		% within Column	43.7%	54.1%	44.4%
Total		Count	497	37	534
		% within Column	100.0%	100.0%	100.0%

Pearson Chi-square (df = 1) = 1.507: P<0.05 = 0.22

Source: Field Survey, 2018

With a Chi-square value of 1.507(P<0.05 = 0.22) no significant relationship between sex and the use of maize/soybean technology was established at a 5% level of significance. As such the null hypothesis was upheld. Respondents were asked to indicate those who use the technologies more. Most (99.8%) farmers confirmed that the technologies were used by both men and women farmers. However, more than half (56.3%) of those who said they used maize/soybean technologies were males compared with 43.7% of females who indicated the same (Table 3). The results confirm *Nysveen et al.* (2005) study of 684 mobile chat service users in Norway who found that perceived usefulness in using mobile chat services is stronger for men as compared to women. Furthermore, *Venkatesh et al.* (2003) also revealed that females are more anxious than men when it comes to technology utilization and this nature of the females reduced their self-effectiveness which in turn led to increased perceptions of the effort required to use technology. Literature suggests that the factors influencing the adoption of any technology may differ between men and women. A study by Lavison (2013) further shows statistically significant results that indicated that farmers who are mostly men, with large farm sizes are likely to adopt new technology. This is because they could afford to devote part of their land and income to trying new technologies unlike most women with little farm sizes (Uaiene *et al., 2009*). Although technologies could have huge potential to reduce the considerable time burden of women and increase labor productivity in general, this empirical result shows that their use and adoption among rural women has not been high and has been much lower among men.

Gender Perspective of the Perceived Benefits of Technologies

Results from the Chi-square estimate in Table 4, show that male and female farmers differ significantly (at a 1% level of significance) in their response to the statement 'technology had enabled me to get a better market for my produce'. Although, the Chi-square results also show there is no relation between the response to the statement 'I have recorded a consistent improvement in yield of maize and soybean produced and the sex of the farmer'.

Table 4: Gender perspective of the benefits of maize and soybean technologies used

Variable	**I have recorded a consistent improvement in yield of maize and soybean produced**						**Chi-square test results**
Sex	Strongly disagree	disagree	Undecided	agree	Strongly agree	Total	$\chi2$ = 2.316 df=4
Male	5.74	12.16	10.47	33.78	37.84	100	Pr =0.678
Female	5.51	13.56	13.14	35.59	32.20	100	
Technology has enabled me get better market for my produce							
Sex	Strongly disagree	disagree	Undecided	agree	Strongly agree	Total	$\chi2$ = 12.281 df=4
Male	17.23	12.84	12.5	31.08	26.35	100	Pr =0.015
Female	10.17	13.98	13.98	42.37	19.49	100	
Technology has helped me intensity my maize and soybean production							
Sex	Strongly disagree	disagree	Undecided	agree	Strongly agree	Total	$\chi2$ = 6.506 df=4
Male	9.79	12.16	13.18	35.81	29.05	100	Pr =0.164
Female	9.32	9. 75	19.92	38.14	22.88	100	
Output of maize and soybeans has been increasing since I started using technology							
Sex	Strongly disagree	disagree	Undecided	agree	Strongly agree	Total	$\chi2$ = 11.613 df=4
Male	6.76	11.82	14.87	36.49	30.07	100	Pr =0.020
Female	4.24	18.22	15.25	42.37	19.92	100	
	Income accruing from maize and soybean has increased after using technology						
Sex	Strongly disagree	disagree	Undecided	agree	Strongly agree	Total	$\chi2$ = 8.645 df=4
Male	10.14	12.5	17.57	33.11	26.69	100	Pr =0.071
Female	5.91	14.77	17.72	41.77	19.83	100	Significant

Farm enterprise has been expanding since I tarted Using Technology							
Sex	Strongly disagree	disagree	Undecided	agree	Strongly agree	Total	χ2 = 4.201 df=4
Male	5.41	13.18	21.62	30.41	29.39	100	Pr =0.379
Female	5.08	11.44	24.58	36.02	22.88	100	Not significant

‘1 = Strongly Disagree’; 2 = Disagree’; ‘3 = Undecided’; ‘4 = Agree’ and ‘5 = Strongly Agree

Source: Field Survey, 2018

About 42.37% of the female farmers agreed with the statement that technology has enabled them to get a better market for their produce, compare with 31.08% of males who said the same. Similarly, the results showed that men and women farmers differ significantly (at a 5% level of significance) in their view on the statement ‘output of maize and soybeans has been increasing since I started using technology. About 30.07% of the male farmers strongly agree their output of maize and soybeans has been increasing since they started using technology compare to 19.92% of the female farmers who said the same. Male and female respondents also differ significantly (at 10%) with regard to their responses on the statement ‘income accruing from maize and soybeans has increased after using technology’. Female farmers are more (41.77%) likely to agree that their income accruing from maize and soybeans has increased after using technology than male farmers (33.11%). About 37.84% of the male farmers strongly agree they recorded a consistent improvement in the yield of maize and soybeans produced compare to 32.20% of female farmers who said the same.

Adoption of Maize and Soybean Technologies by Smallholder Farmers

Adoption is defined as the extent of use of a new technology which takes place in a long run equilibrium when the farmer has full information about the technology (Feder & Savastano, 2006). Related to this, the extent of adoption of each technology per district was assessed.

Table 5: Percentage (%) Distribution of the Extent of Adoption by Districts

	Sawla Tuna Kalba	East Gonja	West Mamprusi	Zabzugu	Representation (%)
Improved seed technologies (hybrid varieties)					
Adopted	37.50	26.45	20.72	27.70	28.09
Highly adopted	4.17	68.39	15.32	29.73	32.21
Tried and stopped	1.67	0.65	60.36	6.08	14.79
Did not try at all	51.67	2.58	2.70	32.43	21.91
Undecided	5	1.94	0.90	4.05	3.00
Total	100	100	100	100	100
Adoption of both organic and inorganic soil amendments					
Adopted	29.17	65.81	72.07	25	47.57
Highly adopted	24.17	27.10	27.93	4.05	20.22
Tried and stopped	1.17	2.58	0	4.73	2.43
Did not try at all	31.57	1.29	0	63.51	25.09
Undecided	13.33	3.23	0	2.70	4.68
Total	100	100	100	100	100
Integrated approach					
Adopted	25.83	16.77	73.87	63.51	43.63
Highly adopted	5	3.87	25.23	33.11	16.67
Tried and stopped	0	36.13	0	1.35	10.86
Did not try at all	60.83	23.23	0	0.68	20.60
Undecided	8.33	20	0.90	1.35	8.24
Total	100	100	100	100	100

‘1 = Adopted’; 2 = Highly Adopted’; ‘3 = Tried & Adopted’; ‘4 = Did not Try at All’ and ‘5 = Undecided

Source: Field Survey, 2018

From Table 5, 60.3%, 67.79%, ad 60.3% adopted improved hybrid variety, both organic and inorganic amendment and integrated approach, respectively. This trend confirms that a greater number of smallholder farmers adopted the three technologies introduced.

Gender and Adoption of the Three Maize and Soybean Technologies

Table 6, shows the cross-tabulations of the extent to which gender influences the adoption of the technologies under study. The Chi-square results shows that sex has no relation with the extent of adoption of a combination organic and inorganic soil amendments.

Table 6: Extent to Which Gender Influenced the Adoption Technologies

Response	**Extent of adoption of improved seed technologies (%)**						
Sex	Adopted	Highly adopted	Tried & stopped	Did not try at all	Undecided	Total	**Results/ Interpretation**
Male	33.00	34.34	10.10	19.87	2.69	100	χ^2 = 18.126 df=4 Pr =0.001
Female	21.94	29.54	20.68	24.47	3.38	100	
Total							
Extent of adoption of a combination of organic and inorganic oil amendments							
Male	45.79	19.87	3.03	26.94	4.38	100	χ2 = 2.499 df=4 Pr =0.645
Female	49.79	20.68	1.69	22.78	5.06	100	
Total							
Extent of doption of ntegrated approach							
Male	38.72	17.51	10.44	24.24	9.09	100	χ2 = 8.996 df=4 Pr =0.061
Female	49.79	15.61	11.39	16.03	7.17	100	
Total							

'1 = Adopted'; 2 = Highly Adopted'; '3 = Tried & Adopted'; '4 = Did not Try at All' and '5 = Undecided

Source: Field Survey, 2018

In general, however, females are more (49.79%) likely to adopt a combination of organic and inorganic soil amendments than males (45.79%). The Chi-square results show that sex has no relation with the extent of adoption of a combination of organic and inorganic soil amendments. However, the Chi-square results show there is an association between the extent of adoption of improved seed technologies and integrated approach to improving and managing soil fertility and sex (statistically significant at 10%) of the respondents.

CONCLUSIONS

The main objective of the study was to examine the extent to which gender influences the adoption of maize and soybean technologies by smallholder farmers. The study observed that a greater number (above 60%) of farmers across all four districts adopted the three technologies. More than half (56.3%) of those who said they used maize/soybean technologies were male compared with 43.7% of females who indicated the same. This is because the men could afford to devote part of their land and income to trying new technologies, unlike most women with fewer farm sizes. Also, 37.84% of the male farmers strongly agreed to record consistent improvement in the yield of maize and soybeans as against 32.20% of female farmers who said the same.

The role of gender in the adoption of technologies is dependent on the nature and perceived benefits of the specific technology involved. Meaning that male and female farmers tend to have different preferences for technology. Generally, male (30.07%) farmers tend to adopt technologies that will help them increase their output whereas females tend to prefer technologies that will enhance the price of their produce. About (42.4%) of female farmers agreed that technologies had enabled them to get a better market for their produce as against 31.08% of male farmers. However, 49.79% of females are more likely to adopt a combination of organic and inorganic soil amendments than males (45.79%).

Although, gender did not have any significant influence on the adoption of both organic and inorganic soil amendments technology; suggesting that the adoption of these technologies did not matter if one was a male or female. Gender however had a significant effect on the adoption of improved seed. Male farmers reported increased output in maize and soybeans production since they started using technologies compared with females.

RECOMMENDATIONS

The following recommendations can be drawn from the study:

1. Generally, in developing technologies researchers should be guided by the fact that male farmers tend to adopt technologies that will help them increase their output whereas females tend to prefer technologies that will enhance the price of their produce.
2. Technologies should be developed by researchers to target the different preferences of male and female smallholder farmers. This can be done if male and female farmers are contacted and a thorough need assessment done in a participatory way to understand and appreciate their needs to ensure that technologies developed benefit all.
3. The government should subsidize the cost involved in accessing technologies, make extension services available, create market opportunities and to create better opportunities to accessing technologies to ensure equal benefits for men and women.
4. Further research should be conducted to establish the relevance of gender to the adoption of technologies in other staple crops.

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COMPETING INTEREST

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