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Analysis of Female-Headed and Male-Headed Households' Participation in Public Agricultural Extension Services: The Case of Meskan Woreda, Gurage Zone, Ethiopia

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Abstract
The study analyzed female-headed and male-headed households' participation in public agricultural extension services: The Case of Meskan Woreda, Gurage Zone, Ethiopia .The objectives were to assess participation of female-headed and male-headed farmers in major crop and livestock extension packages, and to identify determinants of participation of female-headed and male-headed households in major crop and livestock extension packages. A multi-stage purposive sampling technique was employed to select Kebeles: Wita, Yimariwacho 3rd, Mesrak meskan and Welansho 2nd were used based agro ecology. Samples were allocated across the four Kebeles using probability proportional to size sampling technique. Finally, a total of (143) sampled male (92) and female-headed households (51) were selected by using stratified and systematic random sampling method. Sampled household heads survey data were collected using pre-tested structured interview schedule, focus group discussions and key informants interview. Descriptive and econometric were employed to analyze the collected survey data. Among 14 explanatory variables included in to the logit model, land size, Development agent contact, and mass media exposure had shown positive and statistically significant influence while sex, age and market distance had shown negative and statistically significant influence on farmers' household head participation in crop and livestock extension services. The findings indicate that younger household age, the better the asset holdings (farm size), frequent Development agent contact, more mass media exposure, and shorter market distance was improved female-headed and male-headed households participation the in crop and livestock extension services. Thus, enhancing efficient delivery of services and increasing young age of household head farmers in terms of equal sex participation, farm size, Development agent contact, and mass media access would improve household head farmers' participation in public agricultural extension services.
Keywords: crop and livestock extension packages; female-headed, male-headed

Introduction

Background and justification of the study

The statistics shows that about three-quarters (75%) of world population still live in rural areas and have something to do with agriculture. About 70% of poor people in Africa live in rural areas, 90% of the labor force among those people is employed directly or indirectly in agriculture and most of them depend on it for their livelihoods. Hence, in the 21st century, it remains fundamental to economic growth, employment, poverty alleviation, food security, environmental sustainability and development process in general (FAO, 2011 cited in Amare, 2014).

The quality of agricultural extension services is an especially important issue in Ethiopia, where agriculture dominates the economy. Over 80 percent of the country's 91 million people live in rural areas (FAO, 2010) and most are extremely poor, with a daily per capita income of less than $0.50, and access to one hectare or less of land (IFAD, 2011). Eighty-three percent (83%) of the population of Ethiopia depends directly on agriculture for their livelihoods, while many others depend on agriculture-related cottage industries such as textiles, leather, and food oil processing. Agriculture contributes 85 % of employment, 46.3 percent of gross domestic product (GDP), and up to 90 percent of foreign export earnings (World Bank Group, 2008 cited in Kristin *et al*., 2009).In recognition of the centrality of agriculture in most Ethiopians' lives, government policy emphasizes what it calls agricultural development–led industrialization (ADLI). To implement its ADLI strategy, in the 1990s the federal government commenced a big push to disseminate agricultural technology packages to farmers. These include fertilizer, improved seeds, credit, and the provision of extension services (EEA and EEPRI, 2006). Agricultural extension service provision falls under the agricultural development subsector and is further subdivided into extension on crops, livestock, and natural resources management (Gebremedhin *et al.,* 2006; Cohen, Rocchigiani *et al.,* 2008).

In Meskan woreda major agricultural activities practiced are focused on crop and livestock production (mixed farming system). The division of tasks between women and men varies according to the types of crop

grown, the farming system, the technology used and the wealth of the households. In general, both men and women are substantially involved in a series of productive activities starting from seed preparation to post-harvesting and marketing, and women also play critical role in livestock production, processing and marketing activities. Yet, women's contribution to the agricultural production has been mostly undervalued. As a result, women have limited access agricultural knowledge/information, input/technology and supportive services.
The specific objective of the study is:

1. To assess participation of female-headed and male-headed farmers in major crops and livestock's extension packages, and
2. To identify determinants of participation of female-headed and male-headed households in major crops and livestock's extension packages.

Review of Literature

Empirical Studies on Gender Differences in Access to Agricultural Extension services

A 2010 review of selected regions of Ethiopia, Ghana, and India found that the levels of access to agricultural extension varied by region and by type of crop or livestock, but that women's access was regularly less than men's. In Ethiopia, women's access was 20 percent compared with men's at 27 percent; in Ghana, only 2 percent of women headed households and 12 percent of men-headed households, in India, levels were 18 percent of women headed households and 29 percent of men-headed households reported receiving extension advice. For livestock extension, 79 percent of female-headed households had contact with an extension agent, compared with 72 percent for male-headed households (World Bank and IFPRI, 2010).

Edlu, (2006) Study on Extension program coverage and utilization by different categories of farmers, the major output of the study indicates that utilization of technological packages was significantly influenced by the households' resource level, particularly size of land holding and TLU owned, gender differentials, participation on areas of human resource development including education, training, planning, field day, exhibition, on farm trial and demonstration, level of awareness, access to credit, and extension advice. The major constraints identified in access and utilization of technological packages was unavailability of input on the right time, insufficient, and poor quality of inputs delivery.

Gurmessa Umeta, and Daniel Temesgen (2013), the study tried to look into participation of agro-pastoralists in cattle fattening package at Fentale Woreda of East Showa Zone, Ethiopia. Binary logistic regression mode was used to identify determinants of participation. Based on the study result, the majority of respondents (77.1%) did not participate in improved cattle fattening package whereas few respondents (22.9%) ever participated on cattle fattening activity. Binary logistic regression model showed that three variables namely; fattening experience, access to credit service and training are found to be significantly influencing agro pastoralists participation in cattle fattening package respectively at 10%, 5% and 1% probability levels.

Gurmessa, (2013) survey of assessing female headed households' participation in agricultural extension package program and assessing major constraints to participation in agricultural extension packages. The study result showed that participation of female headed households of the zone in agricultural extension package program is very low (only 44.4% of households participated in one or more package of agricultural technology whereas the majority (56.6%) of respondents did not participate in agricultural extension package program available in the zone) during the two years from the survey period. The study identified that inputs supply related problems, lack of capability to purchase inputs, low level of awareness towards technology recommendations and biasness of development workers towards progressive farmers while input delivery processes were among the constraints to participation. Correlation analysis is also employed to see the association between variables. The result of Cramer's V test showed that oxen ownership, access to radio, extension contact, access to training, field days and access to credit services are positively and significantly correlated with households' participation in agricultural extension package.

Aisha *et al.,* 2013, a study on participation of women in agriculture sector (crop and livestock activities): A case study of Tehsil Tounsa Sharif of Southern Punjab (Pakistan). The regression results revealed that age, education, extension contacts, farm income, access to credit, landholdings, experience, family size and working hours and livestock participation were significant factors influencing the involvement of women in crop production activities. Moreover, age, education, experience, family type, working hours and agricultural participation were significant factors influencing the involvement of women in livestock activities.

Berhanu *et al.,* 2013, study examined farmers' perception of their level of participation in Public Agricultural Extension Service (PAES) in Soddo-zuria Woreda in Southern Ethiopia vis-à-vis seven selected farmers' characteristics; namely, sex, age, educational status, wealth status, farming experience, experience with extension and frequency of contact with extension agents. The study showed that farmers in Soddo-zuria Woreda perceived their level of participation to be low, and had significant correlation with sex, educational status, wealth status and frequency of contact with extension agents. Female, illiterate and poor farmers' perception of participation in the PAES was found to be lower than their male, literate and resource-rich counterparts. In a

regression analysis, sex, educational status and wealth status explained 42.2% of the variance in farmers' perceived level of participation in the PAES, with educational status alone contributing about 35%.

Gashaw, (2014) study on Gender Disparity in the Utilization of Agricultural Extension Services in Bure Woreda, North Western Ethiopia. The survey result showed that on average 60.76% Male headed and only 29.71% female-headed households respectively utilized the selected agricultural extension services in the last three years (2009/10-2011/12). The analysis result depicted gender differences related to FHHs which include illiteracy, less ownership of productive resources plus less utilization of extension services. Therefore, adult education, efficient extension service systems, intervention to improve livestock sector via livestock credit, creating strong linkage with extension contacts, and giving reasonable place for women in farmers' organizations were strongly recommended to boost agricultural development in the study area.

Methodology

Description of Study Area

The studies were conducted in Southern Nation Nationalities and peoples Regional State, Gurage Zone, Meskan District, Ethiopia. Meskan District is far from capital city of Addis Ababa 133km, 155km from regional capital city of Hawasa and 233km Zonal capital city Weliqite. Meskan District The capital city of the Meskan district is Butajira. The district has total 42 kebeles out of these 40 rural kebeles and 2 urban kebeles .The estimated total population of the woreda is 179,719; of this 87,933 are men and 91,786 are women .The total house hold number of 36,377. Of this 23,004 are men headed households and 13,373 are women headed households (Meskan Woreda Agricultural office, 2014).Meskan District is located at an altitude range of 1501-3500 masl. The mean annual rainfall of the area between is 1001-1200mm. The district topographical aspect land of the area is 10% highland, 55% leveled land and 35% sloppy. The location agro-ecology weather condition is 20%Dega, and 80% Wena Dega. The total area coverage of the district is 50,177 ha. Total hectare of land used for cultivation 13,579.Total land covered with annual crop 31.3ha covered, 9.9ha perennial crop and 25.22ha grazing, forest and shrubs land, and 26.73ha covered with others.

Sources Types of Data and Sampling techniques

Primary and secondary data sources were used through quantitative and qualitative types of data also employed for this study**.** Qualitative data was collected through focus group discussion (FGD), informal discussion with farmer households, woreda experts and Development Agents (DAs).Quantitative data was collected through personal interview using interviews schedule. Key informant was used woreda level agricultural extension officers; kebeles level DA, and kebeles managers. After stratified Kebeles into dega and wonea dega only four was selected from both agro ecology using simple random techniques due to financial and time limitations. The selected four kebeles are: Wita, Yimarwacho 3rd, Misrak meskan and Welansho 2nd. Systematic random sampling technique were employed to select 143 samples households out of 2149 total household in four sample frames of the kebeles. The principle of probability proportional to size (PPS) was use as a basis to fix the number of sample households to be selected from each Kebeles.

Method of Data analysis

The households' data was analyzed using descriptive statistics and binary logit model, and STATA 12. Descriptive statistics like mean, standard deviation, frequency, chi-square tests, and independent sample T-test was employed for analysis. Simple statistics like descriptive and binary logistic regression (marginal effect) were computed using STATA 12. The t-test was used to test the significance of the mean value of continuous variables of the groups of female-headed and male headed household farmers. Similarly, potential dummy explanatory variables were tested using the χ^2 test. Following Gujarati (2004) the functional form of logit mode (logistic distribution function for the participation in Public Agricultural extension service can be specified as follows:

$$Pi = \frac{1}{1+e^{-(\beta_0 - \beta_1 X_i)}} \quad \text{..... (1)}$$

For ease of expression, we can write equation (1) as follows:

$$Pi = \frac{1}{1+e^{-zi}} \quad \text{..... (2)}$$

Where, Pi is the probability of participation in public Agricultural extension service *for* the i[th] farmer and it ranges from 0 to 1. It is the observed response of the i[th] farmer (i.e. the binary variable, P=1 for participant, P=0 for non-participant). The probability that a given Household participate in public Agricultural extension service is expressed by **(2).**

$Z_i = \beta_0 + \beta_1 X_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots + \beta_n X_n$

β_0 = is an intercept/constant

$\beta_1, \beta_2, \beta_3 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots, \beta n$ = are slopes of the equation

X_i= n explanatory variables or $X_1 \ldots\ldots\ldots\ldots X_n$ are independent/explanatory variables

If Pi, the probability of participating in public Agricultural extension service, is given by equation (**2**), then (1-Pi), the probability of not participating in public Agricultural extension service, is:

$$1 - Pi = \frac{1}{1+e^{zi}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Therefore, we can write: $\frac{Pi}{1-Pi} = \frac{1+e^{zi}}{1+e^{-zi}} = e^{zi} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$

Then, $\frac{Pi}{(1-Pi)}$ is simply the odds ratio in favour of MHH and FHHs participation in public Agricultural extension service (i.e. the ratio of the probability a household head will participate in public Agricultural extension service to the probability a household head will not participate in public Agricultural extension service. Finally, taking the natural logarithm of the equation **(4),** we obtain:

$$Li = in \frac{Pi}{(1-Pi)} = Z_i = \beta_0 + \beta_1 X_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

If the disturbance term (Ui) is introduced, the logit model becomes or for estimation purpose, we write equation **(5)** as follows:

$$Li = in \frac{Pi}{(1-Pi)} = Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_n U_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Xi= Vector of relevant explanatory variable

Li= is log of the odds ratio, which is not only linear in X_1 but also (from the estimation view point) linear in parameters.

L is called the logit, and hence the name logit model for models likes equation (**5**).

Here under summarized on **table 1** below is the lists of independent variables used on one of the models mentioned above with their own expected or hypothesized sign.

Table 30. Independent/explanatory variables code, type, definition and measurement

No.	Variables code	Variable Type	Variables and measurement	Sign of the variables	
				Expected	**Observed**
1	SEX	Dummy	Sex of household head 1=male,2=female	-	-
2	HHAGE	Continuous	Age of the household head (in years)	-	-
3	EDUCALEHH	Dummy	Education level of the household head (0=Illiterate, 1=Literate)	+	+
4	FAMLSIZ	Continuous	Family size in number of family member	+	+
5	FARMSIZHH	Continuous	Farm size of the household head in hectare	+	+
6	TLU	Continuous	Total livestock owned by household head in TLU	+	+
7	TANNINCOM	Continuous	Total Annual income of the household head in Birr	+	+
8	ACCECR	Dummy	Access to credit of the household head in types of credit received(No=0,1=Yes)	+	+
9	DACON	Dummy	DA contact of the household head in days /week/year(strong=1,weak=0)	+	+
10	MASSMEXP	Dummy	Mass media exposure of the household head to radio or TV, print materials and public meetings (No=0,Yes=1)	+	+
11	ACCINP	Dummy	Access to Agricultural inputs of the household head in types received	+	+
12	DACENDIS	Continuous	DA center distance from household head in minute	-	-
13	MARKDIS	Continuous	Distance of market from household head residence in minute	-	-
14	FARMDIS	Continuous	Farm distance of farm from household head residence in minute	-	-

Source: own construct, 2014

Results and Discussions

This study was included a total of 143 households from Gurage zone Meskan district. Households were randomly selected from four kebeles: Wita, Yimarwacho 3rd, Misrak meskan and Welansho 2nd. The result of the survey shows 51female household head and 92 male household head was included in the survey. T-test (for continuous variables) and χ2- test (for dummy/categorized variables) were also employed to test the significant level of the explanatory variables.

Table 31. Characteristics of respondent by continuous independent variables (n=143)

Variable	Respondent category	N	Mean	S.D.	t-value	p-value
Age of the sampled respondents(years)	Male headed	92	43.71	10.06		
	Female headed	51	45.25	9.13		
	Total	143	44.26	9.74	-0.910^{NS}	0.182
Family size(numb)	Male headed	92	7.12	2.04		
	Female headed	51	5.92	1.71		
	Total	143	6.68	2.01	3.525***	0.000
Land size(heck)	Male headed	92	1.22	0.62		
	Female headed	51	1.03	0.57		
	Total	143	1.15	0.61	1.803**	0.036
Total livestock unit(converted value of TLU)	Male headed	92	4.33	2.77		
	Female headed	51	3.31	1.89		
	Total	143	3.96	2.53	2.355**	0.009
Total annual income(birr)	Male headed	92	22682	10470		
	Female headed	51	20387	8744		
	Total	143	21863	9919	1.328*	0.093

Source: Own survey result, 2014

Note: ***= Significant at 1%, 5% and 10% probability level, n= number of sample respondents, S.D. = Standard Deviation, NS=non significant

Table 32. Characteristics of respondent by dummy/categorized independent variables (n=143)

Variable	Respondent category				Total		χ^2	p-value
Response	MHH		FHH					
	F	%	F	%	F	%		
Educational status of HH Literate	70	76.1	20	39.3	90	62.9	19.122***	0.000

Source: Own survey result, 2014

Note: ***= Significant at 1% and 5% probability level, **F**=Frequency, NS=Non-significant

Personal and Demographic Characteristics of respondent

According to survey result, the mean age of male and female-headed households were found to be 44 and 45 years, respectively. The t-test result also revealed that there is statistically no significant difference between the mean age of household head in two categories (t-value = -0.910, p-value = 0.182) (Table 2). The mean family size of the male and female headed households was found to be 7.12 and 5.92 persons, respectively in the study area during 2013/14 cropping season. The result of t-test also indicated that there was statistically significant mean family size difference between male and female-headed households at 1% probability level (t-value = 3.525, p-value = 0.000) (Table 2). Literacy status (i.e. grade one and above and ability to read write) was relatively higher in male households head group (76.09%) than in female (39.22%) and illiterate one were male (23.91%) and female (60.78%). The chi-square test result also indicated that there is statistically significant difference between the two categories with regard to education status at 1% significance level (χ2-value=19.122, p-value=0.000) (Table 3).

Economic Characteristics of respondent

Economic factors are related to the position of the farmers in society which is determined by various social and economic variables such as land size, total annual income (on-farm, off-farm and non-farm income sources) and Total livestock unit of the female and male headed households in study area. This study shows the mean land size of the male and female household head was found to be 1.22 and 1.03 hectares, respectively. The t-test also showed that there is statistically significant mean difference between the male and female headed at 5% probability level (t-value=1.803, P-value=0.036) (Table 2). According to FGD discussion, probable reasons for higher land size for male head was inherited land from their parents. This agreed with findings of Gurmesa 2013,

many rural women lack access to land or to have insecure land tenure due to customary laws, culture and tradition. According to the result, 4.33 and 3.31 TLU was mean average for male and female headed households, respectively. The result t-test also showed that there was statistically significant TLU mean difference between male and female at 5% probability level (t-value=2.355, P-value= 0.009) (Table 2). Annual income is other economic factor, the survey result revealed out that 22,682 and 20,387 ETB mean total annual income for male and female head, respectively in the study area during 2013/14 production season. The result of t-test also indicated that there is statistically significant difference between the mean total annual income in two groups by total annual income at 10% probability level (t-value = 1.328, P-value = 0.093) (Table 2).

Participation in Public Agricultural Extension Services

For the purpose of this study, the major components of public agricultural extension service of crop and livestock package given in the study area in 2013/14 production season were identified and valued with the help of woreda experts and Development Agents and focus group discussion, based on each components contribution to participation extension package service, discussed as follows: Major crop production package activities components in Meskan districts are maize, wheat, *teff*, and garden vegetables crop production activities. Main extension packages activities under crop packages production in Meskan districts given to farmers were advice on different agricultural practice, participation in training, field day participation, and participation in extension visit. The Farmers that are were participated at least three times a year (*mehir and belg* season) he/she can be considered as participant in the activities. Under Livestock production package major components are dairy management, honey bee production, poultry production, forage production, cattle and small ruminant fattening. From the major components of crop and livestock extension package service identified for the purpose of this study, if a given farmer received the average and above from the total values of the given components, s/he considered as a participant of public agricultural extension package service. If score household heads farmers make average and above he /or she considered as participant take the value 1 and if the score below average take the value 0 nonparticipant (Table 4).

Table 4: Participation value given for of each agricultural extension component

No	Major extension packages /extension event	Weight (%)
A	**Crop packages**	**40**
	Maize	10
	Teff	10
	Wheat	10
	Garden vegetables	10
B	**Livestock packages**	**40**
	Cattle fattening	10
	Sheep and goat fattening	10
	Dairy production management	10
	Poultry production	8
	Honey bee production	2
C	**Extension event**	**20**
	Demonstration	10
	Field visit	10
	Total score	**100**

Table 5.Distribution of female and male household head by their participation in Crop and Livestock extension packages (n=143)

Extension packages or extension event	Response category	Respondent category						χ^2	P – value
		Male		Female		Total			
		F	%	F	%	F	%		
Maize package	Yes	86	93.5	45	88.2	131	91.6	1.173^{NS}	0.279
Teff package	Yes	84	91.3	37	72.5	121	84.6	**8.866*** **	**0.003**
Wheat package	Yes	72	78.3	28	54.9	100	69.9	**8.513*** **	**0.004**
Garden vegetables	Yes	57	61.9	22	43.2	79	55.3	**4.699** **	**0.030**
Cattle fattening	Yes	72	78.3	36	70.6	108	75.5	1.044^{NS}	0.307
Sheep and goat fattening	Yes	68	73.9	26	50.9	94	65.7	**7.661*** **	**0.006**
Beekeeping package	Yes	45	48.9	14	27.5	59	41.3	**6.236***	**0.013**
Poultry package	Yes	64	69.6	33	64.7	97	67.8	0.355^{NS}	0.551
Forage production	Yes	56	60.8	21	41.2	77	53.8	**5.120***	**0.024**
Field day participation	Yes	53	57.6	27	52.9	80	55.9	0.290^{NS}	0.590
Demonstration (FTC or on farm)	Yes	76	82.6	38	74.5	114	79.7	1.331^{NS}	0.249

Source: Own survey result, 2014,

Note: ***, ***** = Significant at 1% and 10% probability level, respectively F=Frequency, NS=Non-significant

Maize, wheat and *teff* are the major cereal crops produced in the study area to enhance food security. Additionally, a Garden vegetable is also the major package produced in small land and used by farmers to enhance the income of the household (Meskan woreda agricultural office, 2014). Hence, a study was conducted to examine farmers' participation in crop package (Table 11). The study result shows that 93.5%, 91.3%, 78.3% and 61.9% of male and 88.2%, 72.5%, 54.9% and 43.14 of female was participated in maize, teff, wheat and garden vegetables crop packages, respectively. The χ^2-test result shows ,there is statically significant difference between male and female in participation in teff, wheat and garden vegetables at 1% and 5% probability level (χ^2=8.866, p-0.003 χ^2=8.513, p-0.004, and χ^2=4.699, p-0.030, respectively)(Table 5). But, for maize package participation no significant difference between male and female in maize extension packages during 2013/14 production season. The same result had been found by Edlu (2006) on a survey conducted in Enemore and Ener Woreda, Gurage Zone. The result clearly proved the dominancy of male head in utilizing crop production packages.

Major livestock packages practiced in the Meskan district were cattle fattening, sheep and goat fattening, poultry, beekeeping and, forage production. The study result shows, from the total (143) sampled households head 78.3%, 73.9%, 48.9%, 69.5%, and 60.8% of male head was participated in cattle fattening, sheep and goat fattening, beekeeping, and poultry, forage production, respectively. On the other, 70.6%, 50.9%, 27.4%, 64.7%, and 41.2% of female head was participated in cattle fattening, sheep and goat fattening, beekeeping, and poultry, forage production, respectively. There χ^2-test result shows that there is statically significant difference between male and female in participation of sheep and goat fattening, beekeeping and forage production packages at 1%,and 10% probability level (χ^2=7.661, p-0.006, χ^2=6.236, p-0.013 and, χ^2=5.120, p-0.024 respectively)(Table 5).

Participation in various areas of extension event, like on field day(on farm or Farmers training center) and extension visit enables farmers to identify their farm problems and to set sound solutions for further measure (Meskan woreda agricultural office, 2014).Demonstration is an important method of extension to create concrete awareness among the farm community, thereby facilitating the adoption process. It is also a means of diffusing information to neighboring farmers to see and then adopt the practice into their farm. Field day is one of the most popular methods of technology transfer that conducting field days on farmers' field is a good way of convincing other farmers to adopt new technology. During field day neighboring farmers will get an opportunity to observe

how the new technology is put into practice in the field (Usman,2011).The survey result indicated that, from total respondent, 57.6% and 82.6% male was participated in field day and extension visit, respectively. Whereas, 52.9% and 74.5% female was participated in field day and extension visit, respectively in the 2013/14 cropping season. There is a no significant mean difference between male and female head in participating on extension event like field day and extension visit, (χ^2 =0.290, p-0.590 and χ^2 =1.331, p-0.249) (Table 5), respectively.

Determinant for participation of in public agricultural extension services

In order to identify variables determining participation of female and male headed farmers in public agricultural extension services, the binary logistic regression econometric model was estimated using maximum likelihood estimation procedure. Out of the total fourteen (14) explanatory variables considered in the model, six (three continuous and three dummy) of them have significant influence on farmers' participation in public Agricultural extension services in the study area. These include, age , land size and market distance were found to be significant at 1%,10% and 5% significance level, respectively and sex ,Development agent contact and mass media exposure were significant at 10% , 10% and 10% significant level, respectively (Table 6).

Table 6.Results of the maximum likelihood estimates of the binary logit model (n=143)

Explanatory Variables	Coefficient	Standard error	Marginal effect dy/dx	P-value
Sex(M/F)	**-2.900023***	**.228404**	**-.2077084**	**0.093**
Age(years)	**-.5734845*****	**.1633096**	**-.0387436**	**0.000**
Education(illiterate/literate)	.7645197	1.274211	.0569244	0.549
Family size(number)	.2978965	.3191004	.0201254	0.351
Land size(heck)	**1.895038***	**1.138037**	**.1280256**	**0.096**
TLU(converted value in TLU)	.0691761	.1962275	.0046734	0.724
Total income(birr)	.000216	.0001291	0.000147	0.523
Access to credit(yes/no)	-.1975515	1.526415	-.13195	0.897
DA contact(yes/no)	**3.902021***	**2.175768**	**.0985097**	**0.073**
Mass media exposure(yes/no)	**2.665259 ***	**1.43931**	**.2778485**	**0.064**
Access to input(yes/no)	4.48287	2.731201	.6573438	0.101
DA center distance(minute)	-.0099404	.0622382	-.0006716	0.873
Market distance(minute)	**-.0785164***	**.0397954**	**-.0053044**	**0.048**
Farm distance(minute)	-.1057139	.0852292	-.0071418	0.215
Cons	29.35732	8.672971		0.001

Source: Survey data and model output, 2014

Log likelihood = -12.619479 LR chi^2 (15) = 158.6, Prob > chi^2 = 0.0000

Number of obs = 143 Pseudo R^2 = 0.8627 (correctly predicted overall sample = 86.27%)

Note: *, ** and *= Significant at 1%, 5% and 10% probability levels, respectively.

Sex of household heads: The model analysis result (Table 6) showed that sex of the household head has negatively and significantly affected participation of female household heads farmers in public agricultural extension services at 10% significance level. The possible explanation is that as sex of the household head become female, the tendency to participate in public agricultural extension services decreases. The marginal effect for this variable indicates that a sex of HH become female would decrease the probability of female participation in public agricultural extension services by 0.093(9.3%) assuming all other factors keep constant. This result similar with findings of previous literature (Edlu, 2006) indicates that female-headed households have less access to improved technologies, credit, land, and extension service. But, male-headed households might use greater combination of technological packages than female-headed households.

Age: The model analysis result (Table 6) showed that age of the household head has negatively and significantly affected participation of female and male household head farmers in public agricultural extension services at 1% significance level. The possible explanation is that as age of the household head increases, the tendency to participate in public agricultural extension services decreases. The marginal effect for this variable indicates that a one year increase in age would decrease the probability of female and male household head farmers' participation in public agricultural extension services by 0.038(3.8%) assuming all other factors keep constant. This result agrees with the findings of Amare (2014), who reported that young and middle aged farmers are dedicated, more active, and participates in and spends much of their time on agricultural production activities.

Land size: The analysis result (Table 6) indicated that farm size of the household head had positive and significant influence on the likelihood of household head farmers' participation in public agricultural extension services at 10% significance level. Thus, household with larger cultivated land are more willing to participate in crop and livestock production activities and allocate better proportion of land as compared to farmers with small farm size. The marginal effect of farm size shows that a one hectare increases in the size of cultivated land would result in the probability of increasing female and male household head farmers' participation in public

agricultural extension services by 0.13 (13%) keeping all other variables constant. This result is goes in line with the findings of Kaba (2009), Amare (2014), and Addisu (2013) that identified farm size as the most important variable explaining participation decisions by farm household head in agricultural innovations. This suggests the need to support female and male household head farmers who had small farm size to enhance participation in the study area.

DA Contact of household heads (DACON): The result of Logit model shows that extension contact positively and significantly related with participation of household heads in public agricultural extension service at 10% probability level for MHHs and FHHs. The marginal effect of DA contact shows that a frequency of DA contact by one unit increases would result in the probability of increasing female and male household head farmers' participation in public agricultural extension services by 0.07 (7%) keeping all other variables constant(Table 6). The result of this study goes along with the findings Daribe (2007), Mikinay (2008), Kaba (2009), Addisu (2013) and Daniel (2015) reported that DA contributed positively to farmers" participation decision in agricultural technologies and modular training.

Mass media exposure of household heads (MASSMEDEX): The household heads have access to mass media is associated positively and significantly with the participation in public agricultural extension service of household head of farmers at less than 10% significant level in the study area. Household with more mass media exposure are more willing to participate in crop and livestock production activities .The marginal effect of Mass media exposure shows that a one unit increases in the Mass media exposure would result in the probability of increasing female and male household head farmers' participation in public agricultural extension services by 0.27 (27%) keeping all other variables constant (Table 6). The probable reason for this study result might be the role of mass media in disseminating information about new agricultural technologies and practices increase the participation of FHH and MHH farmers in public agricultural extension service. This result is goes in line with the findings of Kaba (2009) that farmers who have mass media exposure were have more participation in public agricultural extension services.

Market distance of household heads (DISTNCE): Distance to the nearest input market is, which has a negative and significant influence on the probability of participation of agricultural extension services at less than 5% significant level for MHH and FHH. The negative association suggests that the likelihood of participation public agricultural extension services declines as the distance from market center increases. The marginal effect of market distance shows that a as market distance decrease by one minute would result in the probability of increasing female and male household head farmers' participation in public agricultural extension services by 0.01 (1%) keeping all other variables constant(Table 6). This finding agrees with Yenealem (2006) and Addisu (2013) in that farmers who live far away from market place have limited access to input market and tend to be reluctant to take up new technologies as compared to those farmers who live near to input market places.

Summary, Conclusions and Recommendations

This study was initiated with the following objectives: 1.To assess participation of female-headed and male-headed farmers in major crop and livestock extension packages, and 2.To identify determinants of participation of female -headed and male headed households in major crop and livestock extension package in the study area. Both primary and secondary data sources were used in this study. Primary data was collected from the sampled respondents using pretested structured interview schedule. Secondary data were obtained from various relevant sources such as documents, reports of DAs, and district agricultural and rural development office. Descriptive statistical tools such as frequency of occurrence, percentages, mean and standard deviation were used to analyze the quantitative data. Binary logistic regression model was used to determine the relative influence of the explanatory variables on female and male head household farmers' participation of in public agricultural extension services.

The result of Participation on extension packages shows , from the total (143) sampled households, 93.5%, 91.3%, 78.3% and 61.9% of MHH and 88.2%, 72.5%, 54.9% and 43.14 of FHH was participated in maize, teff ,wheat and garden vegetables crop extension packages, respectively. The study result shows, from the total (143) sampled household heads ,78.3%, 73.9%, 48.9%, 69.5%, and 60.8% of MHH was participated in cattle fattening, sheep and goat fattening, beekeeping, and poultry, forage production, respectively. On the other hand, 70.6%, 50.9%, 27.4%, 64.7%, and 41.2% of FHH was participated in cattle fattening, sheep and goat fattening, beekeeping, and poultry, forage production, respectively.

A total of fifteen (14) explanatory variables were included into the model of which six (6) of them had shown statistically significant influence on male and female head household farmers' participation in agricultural extension services at different significance level. Accordingly, land size, DA contact, and Mass media exposure were found to have positive and significant influence on female and male household head farmers' participation in public agricultural extension services at 10%, 10%, and 10% significance level, respectively. Contrary to this, sex, age, and market distance of the sampled respondents and had shown negative and significant influence on

the participation of female and male household head farmers in agricultural extension services at 10%, 1% and 5% significance level, respectively.

The following points were recommended for consideration in improving farmers' participation in public Agricultural extension services so as to benefit both household heads men and women farmers from this in the study area:

Strengthen awareness creation for high aged group farmers and empowerment for young and middle aged household head farmers should be done to enhance participation in agricultural extension services in the study area.

Household head farmers who had small farm size (specially, female farmers households head) should be supported through different land acquisition mechanisms, i.e., local land sharing and land renting in the study area.

Farmers contact with DA access or advice was determines their participation in agricultural extension services. The farmers those live in rural areas cannot sustain efficiently without support from development agents and inputs delivering institutions. The farmers should have strong linkage with the development agents, to be benefited from the advice, and sharing of idea between them. DAs should be aware of gender aspects to increase the participation of women farmers in agricultural extension services. Moreover, employing female DAs is crucial to help the female farmers' participation in public agricultural extension service.

Mass media is crucial in disseminating information about new technologies and practices. It is possible to increase female-headed farmers' participation on improved agricultural technologies through improving their exposure to mass media. As mass media has positively influence the participation of farmers in agricultural extension service, the types and means of media disseminating, and farmers' understandable printed material in local language and time of broadcasting radio should be paid attention.

Market distance was one of basic institutional factor that promote to access different agricultural input. Government body in study area should be support for better market infrastructure condition for rural farmers through construction of short and suitable rural road.

Gender mainstreaming strategy in different agricultural extension packages program should be given to women farmers in FHHs, and as well as women (wives) in male-headed households to equal benefit with male counterpart in the study area.

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