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ANALYSIS OF RURAL WOMEN'S PARTICIPATION IN RICE PRODUCTION USING ORDINAL LOGISTIC REGRESSION MODEL

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ABSTRACT

This research was carried out in Fogera district, located in South Gondar Administrative zone, Ethiopia in 2014/2015 production year. In the area, rice is one of the means of livelihood. The objective of the research was to identify the determinants of the level of rural women participation in rice production. Among the 24 rice producing kebeles, four kebeles were selected following simple random sampling technique. Respondents were stratified into women in female and male headed households. Primary quantitative data was collected through household survey. The data were analysed using descriptive statistics such as mean Std. Dev, pair-wise ranking, percentage distribution, F-test and chi-square test. Women's participation was analysed by participation index, and further was categorised into high, medium and low. The ordinal logistic regression model was used to estimate the effects of hypothesised explanatory variables. The results of the econometric model indicated women categorisation, farm size, on-farm income, off-farm income, farm nearness to development centre and rice production training. Based on the findings of the research, capacitating women through training and introduction of cost and burden of women reducing technologies are recommended.

Keywords: Women, Participation, Rice, Fogera District, Extension Service and Ordinal Logit Econometric Model.

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Introduction

In Ethiopia, there is about 17 million hectares of land suitable for rice production; number of rice producing farmers have increased from 53,302 in 2006 to over 2,84,268 in 2009, while the total milled production in 2009 was 3,23,916 metric tons (Dawit and Kiyoshi, 2011). According to Fogera district office of agriculture, the 15,119 hectare rice coverage in 2011 expanded to 20,230 hectare in 2014/2015 production year. In the farm operation, rural women are involved in winnowing, row planting, weeding, fertiliser application, rouging out off-types, bird scaring, harvesting, drying, threshing field and storage preparation and marketing.

Rice farming is the major source of livelihood in Fogera district. According to Self-help Development International (2004), women contributed 50 per cent of transplanting, 26.5 per cent of harvesting, 50 per cent of threshing, 30 per cent of the drying and 67 per cent of parboiling labor. Women's decision-making ability on what type of variety to grow, what farm implements and input to purchase is minimal because of less access to training, technical knowledge, extension services and low education level (Chizari et al., 1997).

In spite of the importance of rice as a means of living for many farmers and cash crop in the study area, it has not been given due consideration. Research studies conducted on women's role particularly in rice production activities are scarce. It is only recently that few studies have been done on value chain adaptation and release of locally adapted varieties (Biruhalem, 2010) and marketing analysis (Astewul, 2010). Nevertheless, in Fogera context, women farmers' level of participation and challenges to participate in rice production is not yet studied. Thus, this study is initiated to sort out skill, extension service, input use, socio-cultural influences and technology related gaps and indicate entry points for future improvement. Therefore, the objective of this study is to identify the determinants of rural women's level of participation in rice production.

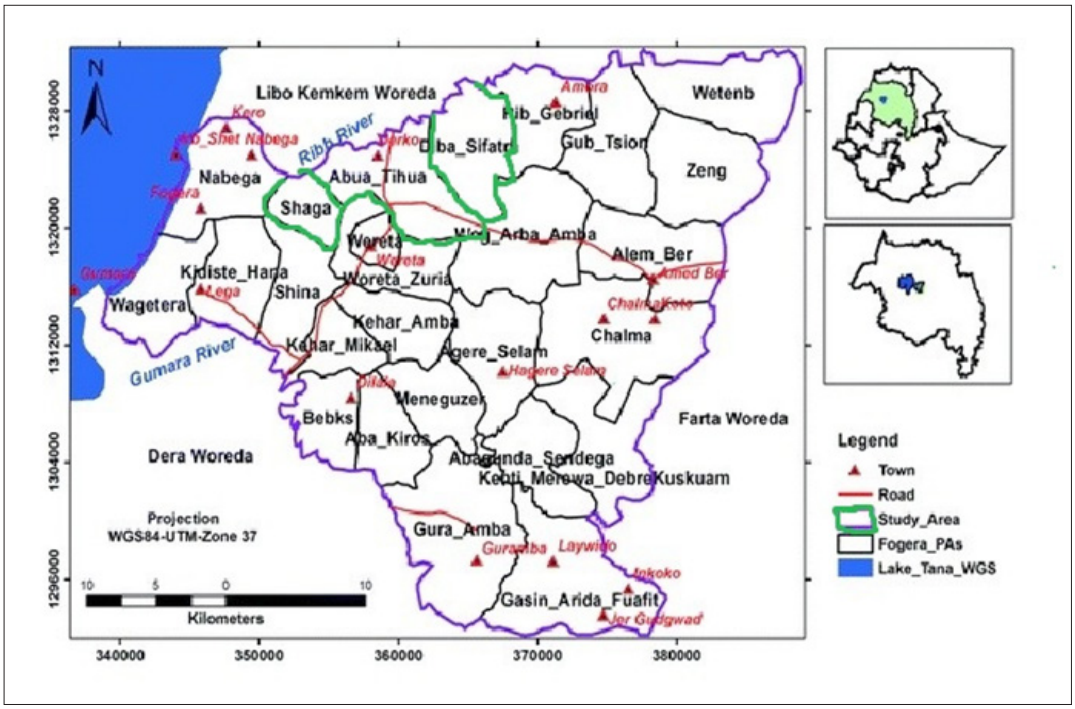
Hypothesis

1. The independent variables like irrigated land, on-farm income and off-farm income have a positive relationship with the level of participation.

2. There is a negative relationship between marital status and distance from the input market and level of participation.

Research Methodology

The study was conducted in Fogera district of Amhara National Regional State located in south Gondar administrative zone. The capital city of the district is Woreta and is located at a distance of 625 km and 55 Km from Addis Ababa and Bahir Dar, respectively (Gebey.et al., 2012).



Source: Amhara Livelihood Zone Report, 2005.

Figure 1: Map of Fogera District

Sampling Techniques

The primary quantitative data was collected from survey. Secondary data was collected from maps, records, reports and review of literature. Fogera district was selected on the basis of its potential for rice production. From the 24 rice producing kebeles, a total of four kebeles were selected using simple random sampling technique. The population in the study area is homogenous, therefore, 10 per cent of the population was used for sample size of the study. MacCallum.R.C.et al. (2001) study showed that the minimum level of 'N' is dependent on the level of communality and results verified when communalities are high, sample factor solutions correspond closely to population solutions even when N is small. Therefore, from the sample frame, 1258 respondents from 126 kebeles i.e., 28 for Kokit, 38 for Shaga, 44 for Debba and 16 for Tihua Zaqena, depending on number of women farmers involved in rice production were selected. . To avoid bias and give equal chance for Women in Female-Headed Households (WFHH) and Women in Male-Headed Households (WMHH), the sample size has the same amount i.e., fifty per cent. Respondents were selected using systematic sampling

technique as it is easier and quicker to carry out research among a large populations from the sample frame.

Efforts were made to keep the questionnaire simple and understandable so as to capture the necessary information. Interview schedules were pre-tested before collecting the actual data and amendments were carried out. Some of the interview schedules were modified to make them fit to the context. Before collecting the data, respondents were informed about the objectives of the survey. Enumerators and supervisors were trained on the objectives of the study, methods of data collection and interviewing techniques, ethics and contents of the interview schedule. While collecting the data, enumerators were supported by the supervisors.

Data Analysis

The collected data has been analysed using the Statistical Packaging Social Sciences (SPSS) software, version 18. To analyse the major rice production activities, the level of participation of women has been categorised and graded as high, medium and low for WFHH and WMHH. The low to high categorisation has been formulated by converting the score value into participation index. Finally, ordered logit model was employed to identify the determinants for women's level of participation in rice production. To analyse and summarise the collected data, descriptive statistics simple measures of standard deviation and frequency were applied for the survey data collected from the sample households. Inferential statistics analysis which includes chi-square has been used to detect the systematic associations of dummy variables and F-test to explain the relationships between the mean values of independent continuous variables.

Definitions of Variables and Hypothesis Setting

Dependent Variables: The dependent variable 'women's participation in rice production activities' was analysed by setting all those levels of participation in to a participation index. The dependent variable, levels of participation was indexed in categorical aspects as either frequently, occasionally, seldom and never as cited by Kefale et al. (2012), Tilahun (2008) and Roman (2010). Points were awarded for each response scoring values as 3, 2, 1 and 0, respectively.

The frequency counts of responses were recorded to compute the Participation Index (PI) of a participant for each of the selected activities. Then Participation Index for each activity is computed by using the following formula:

PI = (N1 X 3) + (N2 X 2) + (N3 X 1) + (N4 X 0), where:

PI = Participation Index for rural women activities in the rice production

N1= Number of women who participate frequently

N2 = Number of women who participate occasionally

N3 = Number of women who participate seldom

N4 = Number of women who never participate

Women's level of participation has been categorised in to high, medium and low. According to Mann (2010), procedure width of the class was determined by subtracting the lowest value from the largest value and divided by the desired number of class. The smallest value in the data set is taken as the lower limit of the first class.

The scores of the rice production activities were calculated for each respondent and converted into a significant index value to measure the status of women's participation. As sited in Kefale et al. (2012), Tilahun (2008) and Roman (2010) have followed the same procedure to measure access to information among rural women. For women's level of participation in the rice production, activities used for this analysis include: seed cleaning and soaking, land preparation, row planting, fertiliser placement, transplanting, weeding, rouging off types, harvesting and drying, smearing and threshing, transporting and storage preparation.

Independent Variables: A number of studies revealed that women's participation in rice production can be influenced by socio-economic, demographic and institutional factors. Different independent variables assumed to affect women's decision to participate in rice production comprise: Farm Size (FARMSZ), Off-farm Income (OFFICM), Access to Credit (CRDT), Market Price (MRKTP), On-farm Income (ONFAIN), Age (AGE), Education (EDU), Marital Status (MARST), Family Size (FASZ), Distance from Input Supplier (DFIS), Decision Maker (DMAKR), Farm Nearness to Development Agent (FNTDA), Leadership Participation (LSHP), Training (TRAG), Experience Sharing (EXPSH), Extension Contact (EXTCONT), Knowledge of Rice Varieties (KNORV), Participation in Field Days (PFD), Participation in On-farm Demonstration (PIOFD) and Interaction with Non-governmental and Community-based Organisation (IWNGCBO).

Results and Discussions

Demographic and Socio-Economic Characteristics of Sample Respondents

Descriptive statistics was applied to study the relation of respondents, access to credit, leadership participation, rice training, farming experience, participation in on-farm demonstration, extension contact, distance from input supplier, participation in field days, interaction with non-governmental and community organisations, market price, farm nearness to development centre, participated in off-farm income activities, decision-making, on-farm income and knowledge of rice varieties related to women's participation in rice production.

Table 1: Summary of variables included in the model

Variable name	Code	Sign	Measurement	Variable type
Farm size	FARMSZ	(+)	Own land measured in ha	Continuous
Marital status	(MARST)	(-)	1 if married and 0 single	Dummy
Off-farm income	OFFICM	(+)	1 if participated and 0 otherwise	Dummy
Access to credit	CRDT	(+)	(1=yes; 0=No)	Dummy
Market price	MRKTP	(+)	Birr	Continuous
On-farm income	ONFAIN	(+)	Birr	Continuous
Age	AGE	(+, -)	In years	Continuous
Level of education	EDU	(+)	1 if literate and 0 otherwise	Dummy
Family size	FASZ	(+)	Adult equivalent	Continuous
Distance from input supplier	DFIS	(-)	Hour	Continuous
Decision maker	DMAKR	(+)	1 if decision maker and 0 otherwise	Dummy
Farm nearness to Development agent	FNTDA	(+)	Hour	Continuous
Leadership participation	LSHP	(+)	1 if participated and 0 otherwise	Dummy
Training	TRAG	(+)	1 if participated and 0 otherwise	Dummy
Experience	EXPSH	(+)	In years	Continuous
Extension contact	EXTCONT	(+)	(1=yes; 0=No)	Dummy
Knowledge of rice varieties	KNORV	(+)	1 if used and 0 otherwise	Dummy
Participation in field days	PFD	(+)	(1=yes; 0=No)	Dummy
Participation in on-farm demonstration	PIOFD	(+)	(1=yes; 0=No)	Dummy
Interaction with non-governmental and community organisation)	IWNGCBO	(+)	(1=yes; 0=No)	Dummy

Age of the Household Head:

Age of the sample households ranged from 22-72 years. As indicated below in Table 1, the number of FHH under 20-49 age range are 43, while in the same range the number of WMHH are 55. This indicates that more aged women are found under the category of FHH and this situation creates labour deficiency.

Table 2: Respondents by Age Category

Age of respondents	Respondents by age category		Total
	FHH	WMHH	
20-24	0	2	2
25-29	3	13	16
30-34	10	9	19
35-39	5	9	14
40-44	14	10	24
45-49	11	12	23
50-54	10	5	15
55-59	6	1	7
>59	4	2	6
	63	63	126

Source: Extracted from own survey data.

Family size is the number of individuals who exist in the respondent's household. Large family size is assumed as an indicator of labour availability in the family and hypothesised to positively influence participation. The number of family size ranges from 1-10.

Table 3 : Family Size of Respondents

Family size	Family size of respondents		
	FHH	MHH	Total
1-3 Female	111	104	215
1-3 Male	66	54	120
Total	177	158	335
4-7 Female	37	81	118
4-7 Male	23	112	135
Total	60	193	253
>7 Female	0	8	8
Total	0	8	8

Source: Extracted from the survey data.

The 126 households comprise a total of 596 families out of which 341 and 255 are female and male family members, respectively (Table 3). However, the share of family for FHH is 237(40 per cent) while the WMHH is 341(60 per cent). From this family composition, it is possible to conclude that FHH has a shortfall of labour as compared to WMHH.

Farm Size:

Land is an important resource, as it is a base for any economic activity in rural areas in the agriculture sector. Farm size influences households' to participate or withdraw in the rice production. Hence, farm size is a continuous variable that can change women's participation in direct field production from cultivating for their own households to working for others was hypothesised to have a positive and significant relationship.

Table 4: Number of Households by Land Holding Size

Women category	Number of households by land holding in hectare		Total
	0.25-1	1.25-2	
FHH	45	18	63
WMHH	28	35	63

Source: Extracted from the survey data, 2014.

The minimum and maximum land holding ranges from 0.25 to 2.25 hectare. Land holding by FHH category 0.25-1hectare was owned by 45 people, while the same size of land owners in the WMHH category were 28. In the other way, cultivable land size of 1.25-2 hectare in the FHH category was owned by 18 and 35 by WMHH. In this situation, it is clear land that holding is influenced by marital status.

Table 5: Role of Women in Deciding on the Size of the Land to be Covered by Rice

Is there a difference between FHH and WMHH to decide on the size of land to be covered by rice				Kebele				Total
				Kokit	Shaga	Debba	Tihua Zaqena	
Yes	Category of interviewee	FHH	N	14	19	20	8	61
			per cent	23 per cent	31 per cent	33 per cent	13 per cent	100 per cent
		WMHH	N	2	8	5	2	17
			per cent	12 per cent	47 per cent	29 per cent	12 per cent	100 per cent
	Total		N	16	27	25	10	78
			per cent	21 per cent	35 per cent	32 per cent	13 per cent	100 per cent
No	Category of interviewee	FHH	N	0	0	2	0	2
			per cent	0 per cent	0 per cent	100 per cent	0 per cent	100 per cent
		WMHH	N	12	11	17	6	46
			per cent	26 per cent	24 per cent	37 per cent	13 per cent	100 per cent
	Total		N	12	11	19	6	48
			per cent	25 per cent	23 per cent	40 per cent	13 per cent	100 per cent

N = Number of respondents.
Source: Own survey computation.

In the two categories of women, FHH has been found strong deciding on the size of the land to be covered by rice. Out of the 63 interviewees, 61 were involved, while from the WMHH 17(27 per cent) have participated (Table 5). The decision for two women in the FHH category was undertaken by their sons, while that of WMHH households was by their husbands.

Women's Participation on Paddy-Rice Price Negotiation:

Market price of rice was suggested to influence women's participation in a positive way. Higher price serves as an incentive for farmers to increase their production. The minimum and maximum price of paddy rice was 550 and 650 ETHB/quintal with a 578.09 average mean. Minimum price has been indicated to the high level of participants compared to others. This might be associated with interest of selling at bulk since their cultivable land size is bigger and in turn production is higher. Moreover, as a result of having better yield, high level participants negotiate to sell their products at their residence than transporting bulk produce to the market or processors. This finding is in agreement with Martey et al. (2014) result, which indicates a unit increase in the market price of rice results with an increase in the probability of participation.

Table 6: Distribution of Household by Paddy Rice Price Negotiation

Who participate more on paddy rice price negotiation (FHH or WMHH				Kebele				Total
				Kokit	Shaga	Debba	Tihua zaqena	
Yes	Category of interviewee	FHH	N	14	17	11	8	50
			per cent	28 per cent	34 per cent	22 per cent	16 per cent	100 per cent
		WMHH	N	13	9	1	7	30
			per cent	43 per cent	30 per cent	3 per cent	23 per cent	100 per cent
	Total		N	27	26	12	15	80
			per cent	34 per cent	33 per cent	15 per cent	19 per cent	100 per cent
No	Category of interviewee	FHH	N	0	2	11	0	13
			per cent	0 per cent	15 per cent	85 per cent	0 per cent	100 per cent
		WMHH	N	1	10	21	1	33
			per cent	3 per cent	30 per cent	64 per cent	3 per cent	100 per cent
	Total		N	1	12	32	1	46
			per cent	2 per cent	26 per cent	70 per cent	2 per cent	100 per cent

N = Number of respondents; Source: Own survey computation.

In price negotiation, 80 households have been found involved; of which 50 (62.5 per cent) are FHH (Table5). Out of the 46 households that do not exercise their power in rice price negotiation 33(71.74) are WMHH. This indicates that FHH had participated more in decision making than WMHH (Table 6).

Distance to the Nearest Input Distribution Centre:

The continuous variable distance was measured in single feet hours from the farmer's home to inputs supplier. The farther a farmer lived from input supplier, lesser would be the probability to participate in production (Martey et al., 2014). Therefore, it was hypothesized to influence participation negatively.

The minimum and maximum feet hour travel ranges from 0.06 to 2.50 hours with mean as 1.06 and standard deviation of 0.687. The average feet hours travel of low, medium and high participants were found to be 1.08, 0.50 and 0.30, respectively. The Result of one way analysis of variance ANOVA result indicated that there was very high significant mean difference (F=6.730, P=.002) implying the presence of significant relationship of nearest input distribution centres with rural women participation in the rice production at 1 per cent significant level (Table 7). This finding is in agreement with the results of (Gerd et al., 1989). Women farmers living nearby input distribution centres are better participants in the rice production because of the advantage that they travelled shorter distances compared to others.

Farm Nearness to the Development Centre:

This variable is considered to see the intensity of extension service. The nearer a farmer is to a development agent, the more frequent would be his/her chance to get an advice. Hence, the expected sign for this continuous variable measured in single feet hours was positive. The minimum and maximum feet hour travel ranges from 0.03-2.00, with a mean value of 0.72 and 0.50 standard deviation. The average feet hours travel of low, medium and high participants were found to be 1.2, 0.73 and 0.32, respectively. The results of one way analysis of variance ANOVA result indicated that there was very high significant mean difference (F=10.483, P=.000) implying the presence of significant relationship of farm nearness to development centres with rural women participation in rice production. The result shows that the mean difference between low, medium and high participants was statistically very high at 1 per cent level (Table 8). This finding is in agreement with the results of (Martey et al., 2014). Farm land nearness of women to the development centre gave them the chance to be better participants in rice production compared to others. This gain is acquired due to the ease of accessibility by extension workers.

Table 7: Distribution of Households to the Nearest Input Distribution Centre

Characteristics	Level of participation			F-value (P-value) 6.730 (.002)***	Total N(126)	
	Low N(28)	Medium N(76)	High N(22)			
	Mean	Mean	Mean		Mean	Std. Dev
Distance in feet Hours	1.08	0.50	0.30		1.06	0.687

Source: own survey computation, N= Number of respondents;

*** Significant at 1 per cent level.

Table 8: Distribution of Household to the Nearest Development Centre

Characteristics	Level of participation			F-value (p-value) 10.483 (0.000) ***	Total N(126)	
	Low N(28)	Medium N(76)	High N(22)			
	Mean	Mean	Mean		Mean	Std. Dev.
Distance in feet hours	1.2	0.73	0.32		0.72	0.50

Source: Own survey computation

***Significant at 1 per cent level; N=Number of respondents.

Experience in Rice Production:

The continuous variable experience measured by number of years was hypothesised to influence participation positively. As farmers got more experience, the probability to participate would be higher (Martey et al., 2014).The minimum and maximum exposure of households in rice production ranges from 2-18 years. Women with high participation in rice production had achieved more experience compared to others. This experience helped them to update their knowledge and be familiar with the current situations. This in turn led them to maintain quality of the rice production and to be productive.

Extension Contact:

This is a variable indicating number of contacts a farmer can have with an extension agent in his farm or village in a year. The contribution of extension service in the dissemination of information and technologies may be influenced by a number of factors such as extension approach, policy, budget, infrastructure, extension program planning, extension monitoring and evaluation (Fisseha, 2009). Therefore, it was hypothesised to influence positively.

Table 9: Distribution of Respondents by Access to Extension Services

Extension contact	Level of participation						x^2-value	Total N(126)	
	Low N(28)		Medium N(76)		High N(22)				
	N	per cent	N	per cent	N	per cent		N	per cent
Yes	26	92.85	66	86.84	20	90.90	0.860^{ns} Sig (0.651)	112	88.90
No	2	7.15	10	13.16	2	9.10		14	11.10
Total	28	100	76	100	22	100		126	100

Source: Own computational result; N=Number of respondents; ns= Not significant.

Access to extension service for rural women is important for entrance point to facilitate input supply and credit which are vital to boost agricultural productivity and in turn attain food self-sufficiency. The survey result showed that 88.90 per cent of the total respondents had contact with extension agents in the 2014 production year, while 11.10 per cent of the respondents do not have any contact with the development agents. The result of chi-square-test (x2= 0.860, p=0.651) relation indicates that there was statistically insignificant difference between frequency of extension contact and rural women participation in the rice production (Table 9).

Level of Education:

Education was hypothesised to have a positive effect on participation since it enables an individual to make independent choices as well as increase the tendency to co-operate with other people and participate in group activities (Enete and Igbokwe 2009). The survey result showed 77.78 per cent of the total respondents (98) were illiterate, while the 22.22 per cent (28) were literate dominantly at read and write capacity. The ratio of the illiteracy among the two strata was nearly the same i.e., 48 and 50 in number for FHH and WMHH, respectively. Nineteen of them can read and write, 11 for FHH and 8 for WMHH and

Table10: Distribution of Respondents by Category

Level of education	Category of interview		Total
	FHH	WMHH	
Illiterate	48	50	98
Read and write	11	8	19
Elementary first cycle 1- 4grade	4	4	8
Elementary second cycle 5-8grade		1	1
Total	63	63	126

Source: Own computational result.

elementary first cycle - four for each category and elementary second cycle - one for WMHH (Table 10).

The result of chi-square-test (x2= 0.483, p=0.127) relation indicates as there was statistically insignificant difference in level of education among low, medium and high participant rural women in the rice production (Table 11).

Household Head Leadership:

Most farmer groups and associations engage in group marketing, bulk purchasing of inputs and credit provision for its members. It is therefore expected that household head leadership of association will positively affect participation (Agwu et al., 2012).

The survey result showed that from the total 126 respondents 36 (28.57 per cent) of them had 'leadership' role in different associations, while 90 (71.43 per cent) were not having any such role. The result of chi-square-test (x2=2.025, p=0.363) relation indicates as there was statistically insignificant relationship with household head leadership and rural women participation in rice production (Table 12). This result is different from Agwu et al. (2012) findings.

Table 11: Distribution of the Respondents by Level of Education

Characteristics		Level of participation						x^2- value	Total N(126)	
		Low(28)		Medium(76)		High(22)				
		N	per cent	N	per cent	N	per cent		N	per cent
Level of education (literate)	Yes	6	21.42	15	19.74	7	31.82	.483^{ns} Sig (.127)	28	22.22
	No	22	78.58	61	80.26	15	68.18		98	77.78

Source: Own computational result, 2014; ns= Not significant; N=Number of respondents.

Table12: Distribution of the Respondents by Access to Leadership

Leadership role	Level of participation						x^2- value	Total N(126)	
	Low N(28)		Medium N(76)		High N(22)				
	N	per cent	N	per cent	N	per cent		N	per cent
Yes	5	17.86	24	31.58	7	31.82	2.025^{ns} Sig (0.363)	36	28.57
No	23	82.14	52	68.42	15	68.18		90	71.43

Source: Own computational result, 2014; N=Number of respondents; ns= Not significant.

Knowledge of Rice Variety:

Knowledge of rice varieties that can be cultivated in any ecology has a higher probability of inclusion in rice production. It was hypothesised to influence participation positively (Amir, 2010).

The survey result revealed from the total 126 respondents, almost all 125(99.21 per cent) of them had knowledge on the rice variety they are cultivating as the number of varieties cultivated are only a few. The variety knowledge gap is narrowed down with the extension service rendered through the extension groups or clusters formed at the village level. The chi-square-test (x2=0.663, p=0.718) result indicated that there is no statistically significant relationship among the knowledge of rice variety with rural women participation in the rice production (Table 13).

Attend Rice Training:

Training measured in frequency of contact is a means by which women farmers can acquire new knowledge and skill. Hence, participation in training was expected to positively influence participation. The survey result revealed that from the total 126 respondents 51(40.48 per cent) had attained training, while 75(59.52) were not exposed to rice production trainings. In this situation, the chi-square-test (x2=4.468, p=0.107) result indicates a statistically insignificant difference among the level of women participation and frequency of training provided (Table 14). This result is in agreement with the findings of Isaiah (2014).

Participation in Field Days:

Participation in field days is measured if one has attended to his/her work on the field or not. It was hypothesised to positively influence women's participation in rice production.

The survey result revealed that from the total 126 respondents, 22(17.46 per cent) had attended rice field day events, while 104(82.54) were not exposed. Thus, the chi-square-test (x2=5.22, p=0.073) result indicates a statistically significant difference at 10 per cent level among women participation and rice field days (Table 15). This result is in agreement with the findings of Isaiah (2014). Field days are ways of creating awareness and transferring practical knowledge to visitors. In this aspect, it has been visualized that women with high level of participation in the rice production are those who were exposed to field days.

Participation in On-farm Demonstration:

Participation in n-farm demonstrations was hypothesised to positively influence farmers' participation (Table 16).

The survey results revealed that from the total of 126 respondents, 47(37.30 per cent) had participated in on-farm demonstration, while 79 (62.70) did not. Thus, the chi-square-test (x2=13.262, p=0.001) result indicates a statistically high significant relation at 1 per cent provability level among women

Table 13: Distribution of the Respondents by Knowledge of the Variety

Knowledge of the variety you own	Level of participation						x^2- value 0.663^{ns} Sig (0.718)	Total N(126)	
	Low N(28)		Medium N(76)		High N(22)				
	N	per cent	N	per cent	N	per cent		N	per cent
Yes	28	100	75	98.68	22	100		125	99.21
No	0		1		0			1	0.079

Source: Own computational result, 2014; ns= Not significant; N=Number of respondents.

Table 14: Respondents by Access to Attending Rice Production Training

Training	Level of participation						x^2- value 4.468^{ns} Sig (0.107)	Total N(126)	
	Low N(28)		Medium N(76)		High N(22)				
	N	per cent	N	per cent	N	per cent		N	per cent
Yes	12	42.86	26	34.21	13	59.10		51	40.48
No	16	51.14	50	65.79	9	40.90		75	59.52

Source: Own computational result, 2014; ns= Not significant; N=Number of respondents.

Table15: Distribution of the Respondents by Access to Attending Field Days

Field days	Level of participation						x^2- value 5.222* Sig (0.073)	Total N(126)	
	Low N(28)		Medium N(76)		High N(22)				
	N	per cent	N	per cent	N	per cent		N	per cent
Yes	2	7.14	13	17.11	7	31.82		22	17.46
No	26	92.86	63	82.89	15	68.18		104	82.54

Source: Own computational result, 2014;* Significant at 10 per cent level; N= Number of respondents.

Table16: Respondents by Access to On-farm Demonstration

On-farm demonstration	Level of participation						x^2- value 13.262*** Sig (0.001)	Total N(126)	
	Low N(28)		Medium N(76)		High N(22)				
	N	per cent	N	per cent	N	per cent		N	per cent
Yes	12	42.86	20	26.32	15	68.18		47	37.30
No	16	57.14	56	73.68	7	31.82		79	62.70

Source: Own computational result, 2014; *** Significant at 1 per cent level; N=Number of respondents.

Table 17: Distribution of the Respondents by Access to Off-farm Income

Access to off farm income	Level of participation						x^2- value 42.603*** Sig (0.000)	Total N(126)	
	Low N(28)		Medium N(76)		High N(22)				
	N	per cent	N	per cent	N	per cent		N	per cent
Yes	2	7.14	11	14.47	17	77.27		30	23.81
No	26	92.86	65	85.53	5	22.73		96	76.19

Source: Own computational result, 2014; N=Number of respondents;*** Significant at 1 per cent level.

participation and involvement in on-rice field demonstration (Table18).This finding was supported by Rahmeto (2007).

Participation in Off-farm Income:

Farmers that earn off-farm income may participate to utilise inputs to increase their production to be able to meet the financial demands associated with participation. Off-farm income was hypothesised to positively influence participation. The strength of women to be active participants in rice production is interlinked with the alternative access they have to in the case of off- farm income, as compared to others.

The survey result revealed that from the total 126 respondents, 30 (23.81 per cent) had access to off-farm income, while 96 (76.19) were not involved in off-farm activities. Thus, the chi-square test (x2=42.603, p=0.000) result indicates a statistically very high significant difference at 1 per cent level among women participation in rice production and accessing off-farm income (Table 17). This finding was in agreement with (Martey et al., 2014).

Access to Credit:

Access to credit serves as an incentive for farmers to increase their production and overcome the financial constraints, which

Table 18: Distribution of the Respondents by Access to Credit

Access to credit	Level of participation						x^2- value	Total N(126)	
	Low N(28)		Medium N(76)		High N(22)				
	N	per cent	N	per cent	N	per cent		N	per cent
Yes	18	64.29	42	55.26	15	68.18	1.521^{ns} Sig (0.468)	75	59.52
No	10	35.71	34	44.74	7	31.82		51	40.48

Source: Own computational result, 2014; ns= Not significant; N=Number of respondents

also has a direct impact on their livelihoods. According to Beckman and Forster (1969), factors related to the participation of credit users includes: credit duration, terms of payment, borrowers characteristics, loan terms and conditions imposed by lenders. Credit was hypothesised to affect participation positively.

The survey result revealed that from the total 126 respondents, 75(59.52 per cent) had access to credit, while 51 (40.48 per cent) were not involved in accessing credit. Thus, the chi-square-test (x2=1.521, p=0.468) result indicates a statistically insignificant difference among women participation in the rice production and access to credit (Table 18). This result is different from the findings of Beckman and Forster (1969).

Decision-making:

Women's decision-making on varietal use was hypothesised to affect participation positively.

Table 19: Respondents by Decision-making on Variety Use

Decision-making	Level of participation						x^2- value	Total N(126)	
	Low N(28)		Medium N(76)		High N(22)				
	N	per cent	N	per cent	N	per cent		N	per cent
Yes	17	60.71	48	63.16	20	90.91	6.732** Sig (0.035)	85	67.46
No	11	39.29	28	36.84	2	9.09		41	32.54

Source: Own computational result, 2014; N= Number of respondents;* Significant at 5 per cent level.

The involvement of women farmers in decision-making on varietal use is paramount to consider some important nutrition related characteristics, which men are not aware. Women, who have high participation in rice production, have high decision-making capability on varietal use, compared to others.

The survey result revealed that from the total of 126 respondents, 85(67.46 per cent) were taking decisions on which type of rice variety to grow, while 41 (32.54 per cent) were not involved. The chi-square test (x2=6.732, p=0.035) result indicates a statistically significant association at 5 per cent among women participation in rice production and decision-making on rice varietal use (Table 19).

From the total 63 FHHs, 61(96.8 per cent) had decided on the type of variety to be grown, whereas from the same amount of respondents of WMHH, only 24(38.1 per cent) were involved (Table 20).

Table 20: Role of Women to Decide What Type of Rice Variety to Grow

Who decides which type of rice variety to grow FHH or WMHH				Kebele				Total
				Kokit	Shaga	Debba	Tihua zaqena	
Yes	Category of interviewee	FHH	N	14	19	20	8	61
			per cent	23 per cent	31 per cent	33 per cent	13 per cent	100 per cent
		WMHH	N	4	10	7	3	24
			per cent	17 per cent	42 per cent	29 per cent	13 per cent	100 per cent
	Total		N	18	29	27	11	85
			per cent	21 per cent	34 per cent	32 per cent	13 per cent	100 per cent
No	Category of interviewee	FHH	N	0	0	2	0	2
			per cent	0 per cent	0 per cent	100 per cent	0 per cent	100 per cent
		WMHH	N	10	9	15	5	39
			per cent	26 per cent	23 per cent	38 per cent	13 per cent	100 per cent
	Total		N	10	9	17	5	41
			per cent	24 per cent	22 per cent	41 per cent	12 per cent	100 per cent

Source: Own computational result; N=Number of respondents.

Interaction with Non-governmental and Community-based Organisations:

A farmer who interacts with non-governmental and community-based organisations has more chance to get information and training in agricultural production. Therefore, it was hypothesised to affect positively.

Women farmers who have contact and interaction with different non-governmental, governmental and community-based organisations have been found participating actively in the rice production, as compared to others. This was assured by the introduction of technologies, providing training on productive improved practices and distribution of learning materials.

The survey result revealed that from the total 126 respondents, 90(71.43 per cent) were involved in governmental, non-governmental and community-based organizations, while 36 (28.57 per cent) were not. The chi-square-test (x2=6.969, p=0.031) result indicates a statistically significant association at 5 per cent among women participation in the rice production and interaction with non-governmental and community-based organisations (Table 21). This result was supported by the findings of Rahmeto (2007).

Category of Interviewee Marital Status:

It is expected that married rural women will have a lower probability of participation which is expected to affect negatively. Married women are normally assisted by their husbands in production and decision-making (Cheater, 1981).

The survey result revealed that from the total 126 respondents, 63(50 per cent) were FHH, while 63(50 per cent) were WMHH. The chi-square test (x2=17.764, p=0.001) result indicates a statistically very high significant association at 1 per cent among women participants in rice production and category of interviewee (Table 22). This result was supported by the findings of Cheater (1981).

Table 21: Distribution of Respondents Involved in Different Organisations

Participation in different organisations	Level of participation						x^2- value 6.969** Sig (0.031)	Total N(126)	
	Low N(28)		Medium N(76)		High N(22)				
	N	per cent	N	per cent	N	per cent		N	per cent
Yes	15	53.57	56	73.68	19	86.36		90	71.43
No	13	46.43	20	26.32	3	13.64		36	28.57

Source: Own computational result, 2014; N=Number of respondents; ** Significant at 5 per cent level.

Table 22: Respondents by Category of Interviewee

Category	Level of participation						x^2- value	Total N(126)	
	Low N(28)		Medium N(76)		High N(22)				
	N	per cent	N	per cent	N	per cent		N	per cent
FHH	10	35.71	34	44.74	19	86.36	17.764*** Sig (0.001)	63	50
WMHH	18	64.29	42	55.26	3	13.34		63	50

Source: Own computational result, 2014; N=Number of respondents;*** Significant at 1 per cent level.

Women's Participation

In the study area, both FHH and WMHH were involved in rice production. Eleven main rice production activities were identified by pair-wise ranking (Table 23). In the activity identification process, a total of forty women were involved. These forty participants were pulled from four kebeles considering two categories. The selection of activities was on the basis of score focus group members for each activity (Table 23).

Following the identification of major production activities, level of women participation have been selected for the following major rice production activities: seed cleaning and soaking, land preparation, row planting, fertiliser application, transplanting, weeding, sorting out off-types, harvesting and drying, smearing and threshing, transporting and storage preparation. Accordingly, the level of women participants in each activity has been found different for each stratum (Table 24 for FHH and Table 25 for WMHH).

Female-Headed Households:

In the study area, rural women are involved in rice production. Their participation level is influenced by the type of activity and the capacity of being coupled or not. The ranges of their participation have been analysed using measures like frequency, occasion, seldom involved and never get involved.

Based on the frequency counts of responses recorded, Participation Index (PI) has been developed. Participation Index for each activity was computed by using the following formula: PI = (N1 X 3) + (N2 X 2) + (N3 X 1) + (N4 X 0). The class interval was calculated using the formula with the three required class width which results. With this category, low is from 0-41, medium 42-84 and high from 85-127. The PI ranges for FHH level of participation in rice production which is 0-0.21, 0.22-0.44 and 0.45-0.62, respectively for low medium and high.

In the FHH stratum, from the 11 activities set to compare, their participation falls down high for seven activities of seed cleaning and soaking, fertiliser application,

Table 23: Women Intervention in the Rice Production Identified by Pair-wise Ranking

CWH=Construction of water harvesting structure	PLG =Plowing	SC= Seed cleaning and Soaking	RP=Row planting	TP= Transplanting	AF= Fertiliser application	WE= Weeding	SOO=Sorting out off-types	UTD=Urea top-dressing	DIPA= Disease and insect	WM=Water management	HD= Harvesting and Drying	STO= Storage construction	ST= Smearing and threshing	TRS =Transporting		Score	Rank
	PLG	SC	RP	CWH	AF	WE	SOO	UTD	CWH	WM	HD	STO	ST	CWH	CWH	3	9
		SC	RP	PLG	AF	WE	PLG	PLG	DIPA	PLG	PLG	STO	PLG	TRS	PLG	7	5
			SC	SC	SC	SC	SC	SC	SC	SC	HD	STO	SC	SC	SC	12	1
				RP	RP	WE	RP	RP	RP	RP	HD	RP	RP	TRS	RP	10	3
					AF	WE	SOO	TP	TP	TP	HD	TP	TP	TP	TP	6	6
						WE	AF	UTD	DIPA	WM	HD	AF	AF	AF	AF	7	5
							WE	WE	DIPA	WE	HD	WE	we	We	WE	11	2
								SOO	SOO	SOO	HD	STO	ST	TRS	SOO	5	7
									UTD	WM	HD	STO	ST	TRS	UTD	3	9
										WM	HD	STO	ST	ST	DIPA	3	9
											HD	STO	ST	TRS	WM	4	8
												HD	ST	HD	HD	12	1
													STO	TRS	STO	8	4
														ST	ST	7	5
															TRS	7	5
																105	

Source: FGD.

storage preparation, weeding, smearing and threshing over lapping with sorting out off-types and row planting securing points of 127,121,120,99,93 and 87, respectively (Table 24). In the medium category, harvesting and drying was recorded with a score value of 74. Three of the comparisons transporting, transplanting and plowing were ranked low with 36, 22 and 0 points in that order (Table 24).

Leave alone the degree of participation, seed cleaning and soaking and fertiliser application were found to be almost the same by both the women categories. This indicates that the two rice production activities are deemed important by both segments.

In the other way round, the level of FHH participation in harvesting and drying, sorting out off-types, smearing and threshing and transporting have been found greater than WMHH. This difference is because of the traditional thinking that the aforesaid activities are supposed to be done by men. The other participation difference is envisaged on weeding and storage construction in which the involvement of WMHH has been recorded greater (Table 25).

The difference arises because of the over burden of FHH by different in-house activities and social obligations which includes: facilitating formalities to take credit and input, to attend kebele level household head meetings with men, to participate social obligations like mourning and marketing.

Women in Men-headed Household's Participation in Rice Production:

Unlike FHH, considering WMHH with three required class widths, the class interval was calculated i.e., 151–0/3=50; with this category low is from 0-49, medium 50-100 and high from 101-151. The difference in category between two strata is because the WMHH high participation in weeding has forced the upper limit to escalate to 151. The PI ranges for WMHH level of participation in the rice production become 0-0.26, 0.27-0.53 and 0.54-0.80, respectively for low medium and high levels of participation.

In the WMHH stratum from the 11 activities set to compare, their participation falls down high for five activities in priority order of securing high points of weeding (151), storage preparation (135) seed cleaning (129), row planting (124) and fertiliser application (122), respectively (Table 25). In the medium category sorting out off-types, smearing, threshing and transplanting were recorded with a score value of 87, 70 and 60, respectively (Table 25), while the rest of the three comparisons harvesting, transporting and plowing were ranked low with 34, 20 and 0 points, respectively (Table 25). Implementation of row planting and transplanting by WMHH exceeds that of FHHs, who are associated with family size, having couple supporter.

Generally speaking, up on the bases of each stratum, class interval categorisation from the 11 activities set for measurement, seven

Table 24: FHH Level of Participation

Rice production activities	Frequently (3)		Occasionally(2)		Seldom (1)		Never(0)		Total		Score value
	N	per cent	N	per cent	N	per cent	N	per cent	N	per cent	
Seed cleaning and soaking	29	46	7	11	26	42	1	1	63	100	127
Land preparation/plowing	0	0	0	0	0	0	0	0	0	0	0
Row planting	12	19	19	30	13	21	19	30	63	100	87
Fertiliser application	25	40	17	27	12	19	9	14	63	100	121
Transplanting	1	1	6	10	7	11	49	78	63	100	22
weeding	17	27	9	14	30	48	7	11	63	100	99
Rouging out off - types	15	24	19	30	10	16	19	30	63	100	93
Harvesting and drying	10	16	17	27	10	16	26	41	63	100	74
Smearing and threshing	18	29	14	22	11	17	20	32	63	100	93
Transporting	0	0	12	19	12	19	39	62	63	100	36
Storage preparation	21	33	15	24	27	43	0	0	63	100	120

N= Number of respondents.
Source: Own survey computation.

Table 25: WMHH Level of Participation in Rice Production

Rice production activities	Frequently(3)		Occasionally(2)		Seldom(1)		Never(0)		total		Score value
	N	per cent	N	per cent	N	per cent	N	per cent	N	per cent	
Seed cleaning and soaking	26	41	14	22	23	37	0	0	63	100	129
Land Preparation/plowing	0	0	0	0	0	0	0	0	0	0	0
Row planting	20	32	28	44	8	13	7	11	63	100	124
Fertiliser application	14	22	37	58	6	10	6	10	63	100	122
Transplanting	5	8	18	29	9	14	31	49	63	100	60
Weeding	35	56	19	30	8	13	1	1	63	100	151
Rouging out off - types	4	6	25	40	25	40	9	14	63	100	87
Harvesting and drying	2	3	7	11	14	22	40	64	63	100	34
Smearing and threshing	6	10	15	24	22	35	20	31	63	100	70
Transporting	1	2	2	3	13	21	47	74	63	100	20
Storage preparation	31	50	11	17	20	32	1	1	63	100	135

Source: Household survey, 2014;

N=Number of respondents.

were high, one medium and 3 low for FHH. The situation is different for WMHH i.e., high is five, medium and low three each. From these circumstances, it is visualised that FHH had more contact and involvement than WMHH in rice production activities.

a. Results of the Estimation of Ordered Logit Model:

This paper used ordered logit model estimates of the determinants of women's participation in rice production. The existence of multicollinearity among independent variables were checked by two techniques namely, Variance Inflation Factor (VIF) and contingency coefficients for continuous and dummy explanatory variables, respectively. This result indicates absence of multicollinearity among continuous and dummy independent variables.

To identify the factors influencing women's participation in rice production, explanatory variables entered into the regression ordinal model. The likelihood estimates of ordered logit model fitting i.e., 117.896 and goodness-of-fit statistics (χ^2) = 119.996, p= 0.000 show that the likelihood ratio for all explanatory variables are different from zero and the model fits the data very well. Wald test in regression is used to determine whether a certain predictor variable X is significant or not. It rejects the null hypothesis of the corresponding coefficient being zero. In this regard, neither of the coefficients is found to be zero which implies that the coefficients estimated are not rejected. Therefore, the regression model is fit to estimate the influence hypothesised explanatory variables.

Regarding the direction of influence of explanatory variables on the dependent variable, five of them showed expected signs in confirmation of the hypotheses, while one is different from the hypothesis set. Out of 20 factors considered in the model, six variables were found to be significantly influencing women farmers' participation in the rice production at 1 per cent and 5 per cent levels of significance. These variables include farm size, off-farm income activities, category of interviewee (marital status), near farm distance to development agent, participation in on-farm income activities and rice training.

Farm land is the natural resource basic for existence of the farming community. Apart from owning, the land size is important to influence women to participate in the rice production in direct field operation from cultivating for their own households to working for others. Reliable size of enough land for the family existence motivates the household and the family to involve in the rice production. Thus, it was hypothesised to be positively associated. On the contrary, smaller farm size doesn't encourage the household or the family to participate, since it does not offer adequate production for family subsistence.

The Result of the econometric model finding indicated farm size was statistically

significant at 1 per cent, closely related to women's participation in the rice production. The direction of the relation is to the negative side implying that as the farm size increases, women participation decreases. This is in line with the findings of Alemitu (2011) and against Gerd et al., (1989). This might be associated with having large farm size, which means producing more and securing better income. It can also be noted that they hire labour with the income they already possess. Moreover, with the large farm size, the intensity of participation in each of the rice production activities for rural women might be difficult, since the labour demand for working on a large area of farm will be high and at the same time, they are responsible for family management which is tiresome and time demanding. One unit increase in the farm size of the household leads to a decrease in the probability of participation in the rice production by 1.205 units. This implies that farm size is negatively related with the probability of women's participation in the rice production.

Farmers that earn off-farm income are not financially constrained to utilise inputs and test technologies to increase their production. They are capable of meeting their financial demands associated with production maximisation. Additionally, farmers with off-farm income have the possibility to diversify, implement and concentrate on the current income sources. By doing so, they become economically strong, which in turn leads to active participation in rice production using inputs, technologies and applying improved productive practices.

Hence, off-farm income was hypothesised to positively influencing women's participation in rice production. The result of ordered logit model shows that off-farm income was positively and significantly related with women's participation in the rice production at 1 per cent significance level. This finding was in agreement with Martey et al., (2013). The finding implies that individuals who are not supported by off-farm income are reluctant to participate in using inputs, testing technologies, accepting new ideas, thereby hinder participation. This implies the need to diversifying sources of income and also indicates that it is vital to take risk to participate in testing and implementing technologies. The probability of women's participation in the rice production was positively influenced by off-farm income. A unit increase in off-farm income of the household leads to increase in the probability of participation in rice production by 1.74 units.

Total on-farm income was hypothesised to positively influence women's participation in the rice production. The model result shows that total on-farm income was statistically significant at < 1 per cent probability level. This finding is in line with the findings of Deribe (2007). This shows that households with a better farm income are found to be better participating in rice production. This

implies that improving productivity and quality of farm income source is vital because if their major income lies on farm income, their participation will increase. The probability of women's participation in rice production was positively influenced by total on-farm income. A unit increase in the on-farm income of the household leads to increase in the probability of participation in rice production by 0.94 units. The result is in agreement with the findings of Deribe (2007).

Efficacy of extension service depends on the frequency of visits made by an extension agent. This in turn is determined by the suitability and nearness of the farm to the development worker. The econometric ordered logit model analysis result showed that farm proximity to a development centre has significant and positive relationship at 5 per cent probability level with women's participation in rice production. From the econometric ordered logit model output, it has been realised that women farmer's participation in the rice production was statistically and significantly related in the positive direction. Those women farmers living near by the development agents get better extension services and relevant information better than those living relatively in distant areas. A unit decrease in distance leads to maximise women's participation in the rice production through extension services by 1.175 units.

This implies that women farmers living near development agents are more likely benefited from the development agents than those living in distant areas. Therefore, the presence of development agents at a reliable distance is important to enhance extension service at a required intensity. This finding is in agreement with the results of (Martey et al., 2014).The result indicates that women farmers living nearby an extension worker have better access to benefit from direct face-to-face leanings; additionally, they have an advantage to learn new things from field visits, demonstrations, trainings and experience sharing events. Moreover, living near to development centre is easier to facilitate credit and input distribution.

It was hypothesised that married rural women have lower probability of participating in rice production, which is expected to affect negatively. Usually, husbands assist their wives in production and decision-making (Cheater, 1981). The econometric ordered logit model indicates that marital status was statistically significant at 5 per cent level in a negative direction. The result is negatively related with the hypothesis that WMHH participation in rice production is lower. WMHH household heads were less likely to participate; this is because of taking the line share of household tasks guaranteeing the well-being of their family members and more of some activities like storage construction, harvesting and drying, sorting out off-types, smearing and threshing

and transporting are performed by husbands. The output of ordered logit model regression analysis proves that when women farmers are married, it leads to a decrease in the probability of participation in rice production by 1.456. The result indicates that WMHH farmers are relatively less involved in the rice production activities. Thus, capacity building aspects of the rice production ought to give emphasis to address in priority for household head women farmers, followed by married once.

Participation in rice training enables women farmers to easily recognise production problems and helps to find solutions for additional improvement. However, in the study area, most of the women rice farmers were not participating in rice production trainings. The probable reason might be that most of the times, male farmers were invited to participate in trainings, farmers' field day, demonstration and on-farm trials and extension exhibitions. As investigated during the focused group discussion, husbands will not share information with their wives. Result of the econometric model indicated training in rice production activities was positively and significantly related to participation of women in rice production at 5 per cent significance level. This result is in agreement with the findings of Isaiah (2014). This implies that due attention should be given to women producers training to improve participation. The relation among training and women's participation in the rice production was hypothesised to be positive and significant. As hypothesised, the relation was found to be positive and significant. The output of the regression analysis confirmed that a unit increase in rice production training would bring about 1.197 units increase in the participation of women in rice production. This implies that, frequency of training and visits to women farmers is crucial to update practical skill and knowledge of producers on different farm practices and technologies. Therefore, participation on rice production training has a significant contribution for boosting rice production. Specifically, participation in training helps women farmers to update their knowledge and raise concerns on rice production activities.

Policy Implications

Based on the research findings, the following recommendations are made:

Women with higher participation in rice production have been found having large cultivable land, when compared to others. In large rice farm size, the intensity of participation in rice production activities for rural women is difficult, since they are responsible for family management which is tiresome and time demanding. To increase the involvement of women in the sector, reducing the time spent for in-house management responsibilities is important. Therefore, it is recommended to access technology in groups to manufacture energy sources (bricks) from rice byproducts (husk).

Table 26: Maximum Likelihood Estimates of Ordered Logit Model

Explanatory variables	Coefficients estimated	Wald value	Significance level
Constant	-11.889	1.929	0.165
CATEGINTE	-1.456**	3.849	0.050
AGE	-0.058	2.488	0.115
FASZ	-0.258	2.333	0.127
LEVEDUC	-0.267	0.295	0.587
IWNGCBO	-0.068	0.011	0.916
LSHP	-0.826	1.447	0.229
FARMSZ	-1.205***	18.759	0.000
MRKTP	-0.001	0.007	0.932
ONFAIN	0.942***	14.005	0.000
OFFICM	1.739***	5.506	0.019
KNORV	2.179	0.274	0.601
DFIS	0.293	0.506	0.477
EXTCONT	1.640	2.059	0.151
FNTDA	1.175**	4.334	0.037
RITRAG	1.197**	3.638	0.056
PFD	-0.617	0.713	0.398
Exp	0.098	1.357	0.244
PIOFD	0.362	0.338	0.561
CRDT	0.577	1.080	0.299
DECMAKER	0.917	1.448	0.229

Model -2 log likelihood =117.896, Chi-square, 119.996, P= 0.000
Source: Model Output ***, represents 1 per cent and **, 5 per cent level of significance, respectively.

Women farmers with better on-farm and off-farm income have been seen financially strong and active participants to utilise inputs, test technologies and improve practices and diversify income sources to increase their production. Additionally, they are eager for new innovations. This in turn leads them to taking risks to test and implement technologies. Therefore, it is recommended to encourage women farmers to boost up on-farm and diversify off-farm income sources.

Efficacy of extension service depends on the frequency of visits made by an

extension agent. This in turn is determined by the suitability and nearness of the farm to the development worker. Women who have high participation in rice production travel short distances to get inputs and extension advice compared to others. Therefore, it is recommended that government and other extension service rendering organisations need to reduce farmer development agent ratio based on need assessments and researches.

Capacitate knowledge and skill of farmers through training and different mechanisms: Participation in rice training enables women farmers to sort out production problems and find better solution for future improvement. In any rice-related training, at least 50 per cent could be from FHH and WMHH. Therefore, training programmes should be pre-arranged and carried out by considering the needs of women (time of the training and duration of the training).

Since the majority of women are illiterate, it is good to consider the training materials to be short, precise and picture supported. Training arrangements could be together for both sexes to create a learning environment among themselves. Rural women are confined to their localities, so they cannot go far from their localities. FTCs are best and suitable institutional mechanisms to reach farm women. Therefore, it is recommended that FTCs should have special women-oriented programmes.

Conclusions

In the farm operation, rural women were involved in seed cleaning and soaking, construction of water management structures, row planting, weeding, fertiliser application, sorting out off- types, harvesting and drying, threshing field preparation, storage preparation and transporting of the produce. For each rice production activity, the level of women participation has been found different for each stratum.

In the FHH stratum and from the 11 activities set to compare, their participation falls down at seven for high, one for medium and three for low categories. On the other hand, in the case of WMHH stratum, their participation falls down at five for high, three for medium and three for low categories. From these circumstances, it is visualised that FHH had more contact and involvement than WMHH in rice production activities.

Participation of women on seed cleaning and fertiliser application was found to be almost the same from both the categories. This indicates that the two rice production activities are considered important by both the groups. The level of FHH participation in harvesting and drying, sorting out off-types, smearing and threshing and transporting has been found greater than WMHH. This difference is because of the traditional thinking that the aforesaid activities are supposed to be done by men. Participation on weeding and storage construction has been found greater

for WMHH than FHH. The difference arises because of the over burden of FHH by different in-house activities and social obligations.

The 126 households surveyed were categorised into low, medium and high participants, each embracing 28 (22.22 per cent), 76(60.32) and 22(17.46), respectively. The categorisation was done on the basis of score value and score value changed into Participation Index

The Ordered Logit Regression econometric model revealed the effect of explanatory variables on level of women's participation in rice production. Thus, women categorisation (marital status), farm size, on-farm income, off-farm income, farm proximity to development centre and rice production training were significantly related to women farmers participation in rice production.

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