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Original Research

Determinant Factor of Rural Women Households' Participation in Agricultural Extension Service: The Case of Vegetables and Crops Production Under Irrigation Condition in Horo Guduru Wallaga Zone Western, Oromia Regional State.

Birhanu Chalchisa Werku[1], Basha Gedefa Bulto[2], Tadesse Weyuma Bulto[3] and Hika Wana Fufa[4]

[1]Department of Rural Development and Agricultural Extension, Shambu Campus, Wollega University, Ethiopia
[2]Department of Natural Resource Management, Shambu Campus, Wollega University, Ethiopia
[3]Department of Environmental Management, Kotebe University of Education, Addis Ababa, Ethiopia
[4]Department of Agricultural Economics, Shambu Campus, Wollega University, Ethiopia

Abstract

The main objective of the study was to evaluate the variables affecting rural women's involvement in irrigation-assisted agricultural activities. A sample of 185 women participated in the descriptive statistical analysis, which used a number of important techniques to collect and analyze data. The study highlighted the familial framework in which these women function, with a typical household size of almost 5.5 individuals. The income from cereal production was highly skewed, highlighting the differences in agricultural income among rural women and showing that while some households prosper economically, many others struggle. The results showed that 72% were actively engaged in agricultural activities indicating a notable participation gap. Critical barriers that these women encountered were also found by the investigation, including a lack of government incentives, a shortage of land, and insufficient training and extension services. These limitations were assessed as significant impediments to productive agricultural engagement, indicating that structural problems limit rural women's agricultural potential. A startling 78% of participants had negative opinions about the use of irrigation for crop production, citing potential obstacles as the expense and complexity of irrigation equipment. The associations between different socioeconomic characteristics and women's involvement in irrigation techniques were also investigated using logistic regression analysis. Education and income level had a big impact on engagement. Lower participation was associated with higher income levels, possibly as a result of a change in agricultural focus or resource allocation. The amount of land holdings was found to have a substantial negative impact on participation.

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***Corresponding Author:**
E-mail: birehanu2013@gmail.com

INTRODUCTION

In a scenario of steady economic growth, the global population is projected to surpass 10 billion by 2050, resulting in an anticipated 50% increase in agricultural demand compared to 2013 (FAO, 2017).The word agriculture is the most inclusive of all the ways that domestic animals and agricultural plants provide food and other products to the world's population (Diao *et al.*, 2010; Team & Doss, 2011; Harris and Fuller, 2014). A market for industrial sector goods, the development of jobs, food for the continent's growing population, and the generation of foreign exchange are just a few of the many ways that agriculture contributes significantly to Africa's economy (Francis & David, 2012; Khyade & Khyade, 2016; Lyly , 2016).

As noted by Muzari(2016), agriculture remains the primary source of both employment and income for low-income populations in rural areas, despite the generally limited financial returns associated with the sector. Since the late 1980s, technology and communication strategies that are appropriate for sustaining farmers' livelihoods have replaced top-down approaches to agriculture support (Waddington *et al.*, 2014). Since rural extension programs have been the catalyst for increased farming production in many nations, they are extremely important to efforts to reduce poverty (Maulu *et al*., 2021). The primary role of agricultural extension services is to offer technical guidance and support to farmers and farmer organizations, with the overarching aim of improving their livelihoods and overall well-being (Goshu, 2019;Amisnawati, 2023).

The Ethiopian agricultural extension service has evolved through at least five distinct developmental stages, each characterized by unique approaches and objectives. These stages include the Comprehensive Package Programs, the Minimum Package Projects, the Peasant Agricultural Development Program (PADP), the Participatory Demonstration and Training Extension System (PADETES), the Land Grant Extension System initiated by the Imperial Ethiopian College of Agriculture and Mechanical Arts, and subsequent iterations of the Comprehensive Package Programs. This progression reflects a dynamic response to the changing needs of the agricultural sector and the rural communities it serves (Omer and Hassen,2020). The global community is increasingly recognizing and addressing gender-related challenges in agriculture through concerted efforts and collaborations at national, regional, and international levels, to foster sustainable and inclusive agricultural growth (Patil & Babu, 2019). Women in rural communities must perform a variety of tasks, including cooking, cleaning, ordering water, and working on fields, according to a study by Multani (2017). According to Temesgen *et al*. (2015), rural women farmers contribute significantly to subsistence farming and labor in all facets of the agricultural industry. According to a study conducted by Ozcatalbas and Akcaoz (2014), women's contributions to global development have grown in importance during the previous three decades. In Ethiopia's Central Rift Valley, smallholder irrigated vegetable farming plays a pivotal role in ensuring a consistent supply of fresh vegetables to local markets (Etissa *et al*., 2014). Globally, rural residents, both men and women, actively participate in diverse productive activities that are integral to the welfare, economic development, and agricultural productivity of their households (Gemechu, 2023; Kumar *et al*., 2023). About 75% of subsistence production is done by women, who make up around 50% of the global population(Ahmad *et al.*, 2007;Amparo *et al.*, 2015; Nahusenay and Tessfaye, 2017; Gashaw & Tsehay, 2016; Etefa, 2020).

In Sub-Saharan Africa, women agricultural managers encounter discriminatory land tenure laws, cultivate smaller plots of land compared to their male counterparts, have limited access to essential inputs, advisory support, and extension services, and utilize modern agricultural inputs at a significantly lower rate (Mukasa & Salami, 2016). A substantial proportion of women engaged in irrigation activities remain constrained by structural inequalities that limit their access to safe, reliable, and affordable irrigation water (Leza, 2017; Pattnaik *et al.*,2017; Imburgia *et al*., 2021; Ogeto, 2023). Despite their significant contributions to agriculture in developing countries (Ogunlela & Mukhtar, 2009; Oumer *et al*., 2014), women often have limited access to formal sources of agricultural information and tend to prefer interactive communication through informal channels (Williams *et al.*, 2018). Women serve as indispensable partners in crop and livestock production and management, while simultaneously shouldering the primary responsibility for ensuring food security, nutrition, and the overall well-being of their families and communities (Nazir *et al.,* 2013).

The global community is increasingly recognizing the imperative to address gender-related challenges in agriculture through coordinated efforts and collaborations at national, regional, and international levels, aiming to achieve sustainable and inclusive agricultural growth (Patil & Babu, 2018). Women rarely engage with extension services and have minimal interaction with extension service organizations (Sitachew *et al.*, 2018). Agricultural extension services are vital for providing farmers with the knowledge and skills needed to adopt new technologies and improve productivity. Many rural women still face low productivity and restricted adoption of innovative methods, despite the availability of agricultural extension services and contemporary technologies. Despite the critical role of rural women in agriculture, there is a significant paucity of comprehensive data on the factors influencing their participation in agricultural extension services, particularly concerning irrigated crops and vegetable production in the Horo Guduru Wallaga Zone of Western Oromia, Ethiopia. Therefore, this study was design to fill the gap

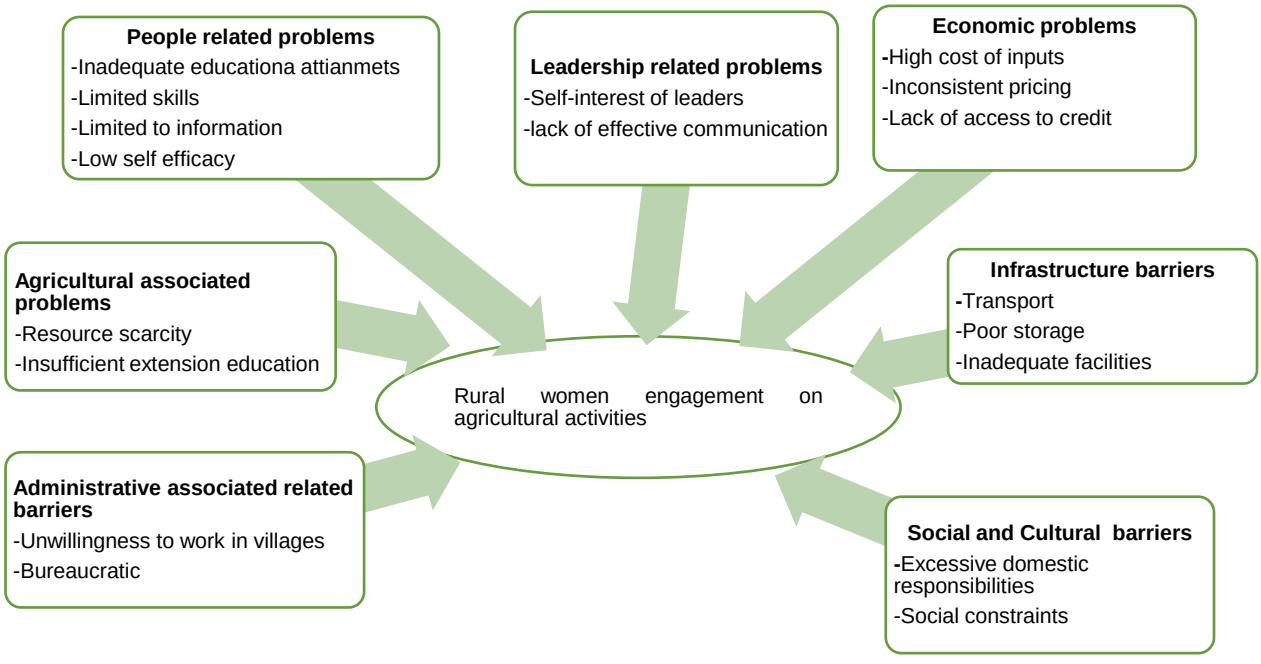

Figure 1: Barriers of rural women's household's participation

Materials and Methods

Study area and period

Jima Rare Woreda, located within the Horro Guduru Wollega Zone of the Oromia Regional State, was selected for this study. It is situated approximately 96 kilometers east of Horo Guduru Wollega, with geographic coordinates of 9°24'N latitude and 37°21'E longitude. The Woreda encompasses a total area of 34,078 hectares, comprising both rural settlements and administrative divisions. Jima Rare is subdivided into two urban kebeles and eighteen rural kebeles.

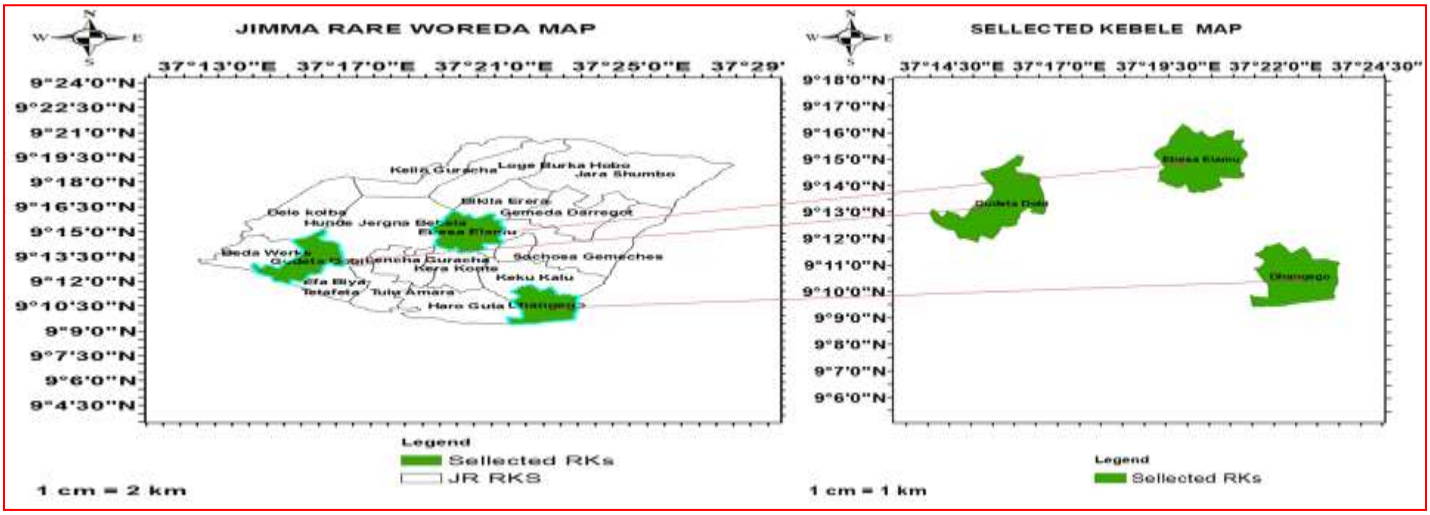

Figure 2: Geographical distribution of selected kebeles in Jimma Rare district

Research design

The study's research design was a cross-sectional survey, which meant that both qualitative and quantitative data were gathered simultaneously. This approach is particularly useful for assessing the variables that affect rural women's utilization of agricultural extension services, with an emphasis on irrigated vegetable farming and crop productivity. Qualitative and quantitative research methodologies were combined in a mixed-methods approach to give a comprehensive understanding of the issues at hand.

Scope of the study

The primary objective of this study was to examine the factors influencing rural women's participation in agricultural activities in Jima Rare District, located in the western region of Oromia, Ethiopia. This district was selected due to its high potential for agricultural activities and its status as a model location for vegetable and crop production. The study concentrated on particular kebeles, such as Dhangago, Ibsa Ilamu, and Gudeta Dobi, which are recognized for their vast water supply and agricultural potential.

Sampling procedures and sample size determination

To construct a descriptive sample, the study employed purposive sampling to select Jima Rare District, owing to its exemplary farming practices. Three of the eighteen rural kebeles in the district were chosen based on their irrigation capability. The sample size from each selected kebele was determined using a probability proportional to size technique, and the population was stratified based on women's involvement in agricultural extension programs.

Population

Source of population

The source population for this study consisted of all households led by rural women in the selected kebeles.

Study population

The study population consisted of selected households within the study area.

Sampling unit

The sampling unit targeted rural women households, particularly those with members aged 18 years and older for quantitative data

Inclusion criteria

Participants had to have lived in the kebeles for at least six months prior to the start of the study in order to meet the inclusion criteria, which required a degree of familiarity with local agricultural techniques. This requirement was intended to increase representativeness, but it also required an explanation of how it might impact the generalizability of the findings.

Exclusion criteria

Among the exclusion criteria were those who were unable to reply because of illness. The sample size was calculated using Yamane's formula (1967) resulting in a preliminary sample of 126 households selected from a total of 185 households in the district. The final sample size, which took into consideration a 10% non-response rate and a correction factor for small populations, was determined to be 134 homes. To choose families proportionately from the three kebeles, systematic sampling approaches were used.

$$n = \frac{N}{1 + N(e)^2} = \frac{185}{1 + 185(0.05)^2} = 126 \ from\ three\ kebeles$$

Where, n is sample size, N is number of household heads in the district and e is the desired level of precision and taking e as 5%.

Since the number of house hold is 185 (<10000) correction formula used as follow:

$$nf = \frac{n}{1+\frac{(n)}{N}} = \frac{126}{1+\frac{(126)}{185}} = 8$$

A total of 134 households participated as respondents, accounting for a 10% non-response rate. The sample size was proportionally stratified across three kebeles, and households were selected using a systematic sampling method.

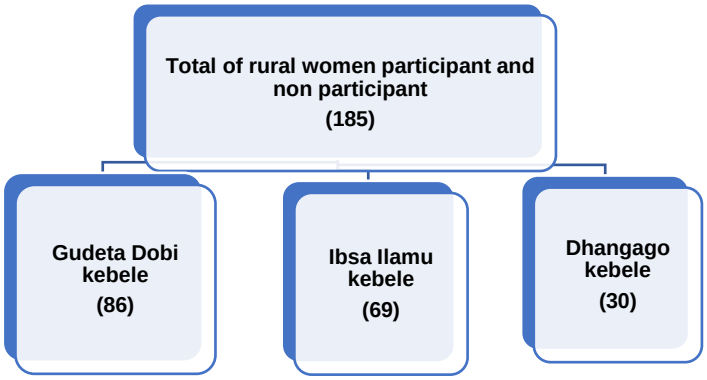

Figure 3: Rural women participant and non-participant

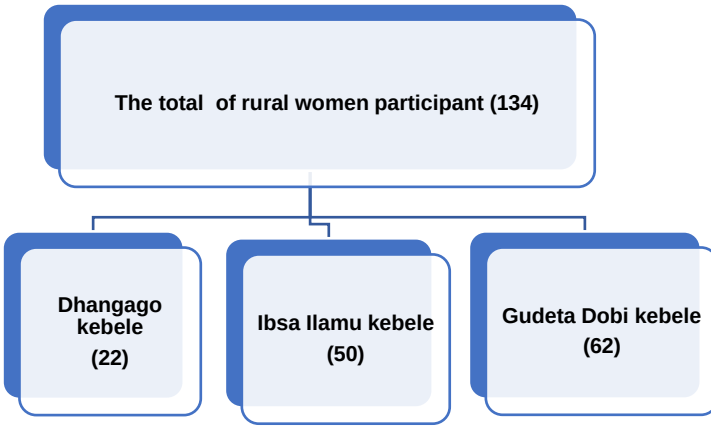

Figure 4: Proportional allocation of rural women participant from each kebeles

Data type

The study's objective was to investigate the factors that, specifically in crop production and irrigated vegetable farming, affect rural women's usage of agricultural extension services. Using a combination of qualitative and quantitative methodologies, a mixed-methods research approach was employed to effectively tackle a variety of research concerns.

Data sources

Data was gathered from primary and secondary sources. To gather primary data, focus groups, key informant interviews, and structured questionnaires were employed. The survey was designed to gather responses from heads of rural households and was translated into the local language to ensure clarity. After discussions to reach consensus on the study's objectives prior to the meeting, knowledgeable research assistants distributed the surveys.

Primary and secondary sources of data

Data gathering strategies and tactics Interviews, questionnaires, and documentary sources were used as data gathering methods in this study. For the empirical studies, two data sets primary and secondary were used. While the secondary data was gathered by searching papers at the Jima Rare district of the agricultural and natural resource office, the primary data was gathered through interviews and the distribution of field questionnaires. The study emplo yed a semi-structured interview schedule to gather quantitative data from primary sources through a household survey. Qualitative data were collected through key informant interviews and focus group discussions. The secondary data was gathered by reviewing pertinent reports from both public and unpublished sources, including district agricultural and rural extension offices.

Key Informant Interview

Key informants for the study were carefully chosen based on their training and background. Using pre-made checklists, 15 key informants from different administrative levels were questioned, making sure that each interview was organized at a time that worked for the participants.

Focus Group Discussion

Focus group discussions for men and women were conducted separately to mitigate cultural factors that could hinder open and candid communication. In the selected kebeles, two focus group discussions (FGDs) were organized to provide participants with a platform to share their perspectives and experiences regarding agricultural practices and extension services.

Data Processing and Analysis

In order to summarize the findings, descriptive statistics like averages and percentages were employed in the data analysis process and presented in tables and graphs. Quantitative information from the questionnaires was imported into STATA for statistical analysis, while theme analysis was used to the qualitative information from focus groups and key informant interviews. With a more sophisticated knowledge of the factors impacting rural women's engagement in agricultural extension programs, this mixed-method approach improved the study's overall conclusions.

Econometric analysis

The investigative model employed in this study is the binary logit model, which identifies the factors that significantly influence rural women's household participation in agricultural extension services, specifically regarding crops and vegetables grown under irrigation. Non-linear statistical models, such as the probit and logit models, are commonly used to model decision probabilities within the 0-1 interval (Griffiths et al., 1993). The logistic function is chosen for its simplicity and its close approximation to the cumulative normal distribution. While the logit and probit models yield statistically similar results, the logit model is preferred in this study due to its ease of estimation and the added interpretative advantage of expressing the factor change in the odds of an event occurring (Aldrich and Nelson, 1984). Logistic regression is often preferred over probit analysis due to its straightforward interpretation as the logarithm of the odds ratio, its ability to be associated with other models such as the Linear Probability Model (LPM), and its effectiveness in analyzing retrospective data. The logistic distribution for rural women's household participation in agricultural extension services can be specified according to the formal described by Gujarati (2004)

Results and Discussion

Women's character and contribution in vegetable and crop production during irrigation conditions are described by descriptive statistics on rural women. Using descriptive statistics like mean, standard deviation, minimum, maximum and skewedness, descriptive analysis provides information on basic demographic and socioeconomic features of respondents.

Table 1: Summary of descriptive statistics

Variables	Obs.	Mean	Std. Dev.	Min	Max	Skew.	Kurt.
Age	185	2.133	.667	1	3	-.157	2.232
Income from cereal production	185	6.261	.981	1	7	-2.873	15.68
Family size	185	5.479	1.467	3	8	.088	2.033
Marital status	185	1.352	.868	1	4	2.285	6.674
Education status	185	2.473	.77	1	4	-.23	2.589
Total land owned in hectares	185	6.212	1.464	4	9	.19	1.843
Size of crop land in hectares	185	4.582	1.419	2	8	.148	2.512
Land size of backyard in hectares	185	1.715	.723	1	3	.486	2.035
Income from animals	185	4.067	1.06	1	5	-1.15	3.673
Income from off farm	185	2.073	.816	1	3	-.134	1.524
Main water source	185	4.776	1.992	2	10	.943	3.889
Frequency of extension interaction	185	2.921	.27	2	3	-3.127	10.78
Specific guidance on utilizing irrigation technologies	185	1	0	1	1	.0	.0

A total of 185 observations were included in the sample for all variables analyzed in this study, as summarized in Table 1. The participants have an average age of 33.133 years, with a standard deviation of 6.667, indicating that they fall within the expected age range. There is notable variation in income from cereal production, with a mean of 6.66 and a standard deviation of 0.981. On average, households consist of 5.479 individuals, with a standard deviation of 1.467. Marital status also shows considerable variation, with a mean of 1.352 and a standard deviation of 0.868. The average education level across households is 2.473, with a standard deviation of 0.77. The typical total farm size is 6.212 hectares, with a standard deviation of 1.464 hectares. The average area of crop land is 4.582 hectares, with a standard error of 1.419 hectares. Income from non-agricultural activities averages 2.073, while income from animal sales averages 4.067, with respective standard deviations of 0.816. The primary water supply has a mean of 4.776, with a standard deviation of 1.892. Lastly, the frequency of extension contacts varies considerably, with an average of 2.214 and a standard deviation of 0.732.

Table 2: Socio-economic characteristics of respondents (N=185)

Items	Respondents	Participant		Non participant	
		Frequency	**Percentage**	**Frequency**	**Percentage**
	Females	134	72	51	28
	Less than 20	0	0	0	0
	21-35	38	28	16	31
Age	36-45	72	54	30	59
	Greater than 46	24	18	5	10
Religion	Orthodox	12	9	3	9
	Muslim	8	6	0	0
	Protestant	104	78	45	82
	Catholic	10	7	3	9
	Other	0	0	0	0
	Married	78	58	21	41
Marital Status	Unmarried	0	0	0	0
	Divorced	33	25	12	24
	Widowed	23	17	18	35
	None	87	65	30	59
Educational	Primary	32	24	21	41
Status	Secondary	15	11	0	0
	<2 years	12	8	7	14
Farming experience	2 to 5 years	34	25	13	25
(in year)	6 to 10 years	20	15	10	20
	>10 years	68	51	21	41

The data provides awareness into the varied socio-economic characters of individuals who participated in the intervention versus those who did not. In our study, there are a total of 185 female respondents' households. Among them, a significant 72% are participants, while 28% chose not to take part. When we examine age, we find that over half of the participants, approximately 54%, fall within the 36 to 45-year age rangeNotably, 59% of non-participants belong to the same group as the participants. In terms of marital status, a greater proportion of participants, 58%, are married, compared to only 41% of non-participants. Education levels show that merely 24% of participants have completed primary education, while a larger 41% of non-participants achieved this level of education. Furthermore, over half of the participants, around 51%, possess more than ten years of farming experience, which is particularly higher than the 41% of non-participants.

Table 3: Assessment of constraints affecting rural women's participation

Barriers	Mean*	Std. deviation	Remark
Insufficient land	3.12	0.72	Significant restraint
Lack of incentives from government	3.20	0.64	Significant restraint
Lack of infrastructures in rural areas	2.6	0.45	Significant restraint
Inadequate training and extension services	4.5	0.67	Significant restraint
Frequency of low contact with extension agent	2.5	0.84	Significant restraint
Lack of access to credit	3.5	0.35	Significant restraint
Inadequate extension agent	5.2	0.95	Significant restraint
Others	1.65	0.35	Not significant

*Serious (>2.5)

A study conducted by Jayakumar and Surudhi (2015), along with Gebremariam et al. (2021), highlighted the critical role rural women play in agriculture, particularly in developing countries. They emphasized that advancing gender equality is fundamental to agricultural progress and ensuring food security. The findings revealed that most respondents perceived various constraints as significant, with insufficient training and extension services, as well as a lack of extension agents, identified as the most critical issues, with mean responses of 4.5 and 5.2, respectively. Traditionally, agricultural extension services have predominantly targeted men, resulting in only 15% of extension agents globally being female. Additionally, the absence of government support, limited access to land, and difficulties in securing credit were highlighted as major obstacles, with mean scores exceeding 3.0.

According to Schaffnit (2014), factors such as under-investment, inadequate infrastructure, insecure land tenure, unfavorable pricing policies, and weak institutions are some of the key reasons why Sub-Saharan Africa remains the only region that has not seen significant improvements in agricultural productivity. Moreover, limited interaction with extension workers and inadequate infrastructure in rural areas were identified as notable issues, with mean scores of 2.5 and 2.6, respectively. Previous research by Team (2011) has shown that agriculture can play a pivotal role in alleviating poverty and promoting economic growth. Women, often central to agricultural production and the rural economy, face numerous barriers that reduce their productivity, further impeding the sector's performance in several countries. In line with this, both labor productivity and production have increased, leading to significant migration away from rural areas and a decline in the percentage of the population employed in agriculture (Collier & Dercon, 2013). The category labeled "others" received a mean score of 1.65, indicating that it was the only constraint not regarded as a major concern. Similarly, the expansion of extension services to female farmers in rural Ethiopia remains a significant challenge (Mossie, 2015).

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Table 4: Levels of attitude toward vegetables and crop development under irrigation

Perceptions rural women using irrigation for vegetable and crop production	Level frequency	Percentages (%)
Unfavorable	105	78
Favorable	29	22
Total	134	100.00

This information provides insight into community perceptions regarding the use of irrigation for growing vegetables and crops. Among the 134 individuals surveyed, a remarkable 78% expressed negative views toward irrigated agriculture, while only 22% held a favorable outlook. This suggests that many participants encounter significant challenges

when attempting to implement irrigation technologies for their crops and vegetables. Such a high proportion of unfavorable views indicate potential substantial issues at play, which might include factors like costs, complexity, water availability, or even cultural barriers that hinder the acceptance of irrigation practices within this group. To gain a more comprehensive understanding of the situation, it would be advantageous to explore the underlying reasons behind these sentiments. Conducting interviews could offer valuable insights into the factors influencing these perceptions. Addressing these concerns will be essential for formulating effective strategies to encourage the adoption of irrigation technology for vegetable and crop production.

Table 5: Regression analysis of factors influencing awareness of irrigation for rural women in vegetable and crop production

Access to information and rural women involvement	Odds Ratio	St.Err.	t-value	p-value	95% Conf	Interval	Sig
Family_size	1.122	.112	1.15	.249	.923	1.364	
Livelihood_index	.924	.188	-0.39	.699	.62	1.378	
Credit	.752	.285	-0.75	.453	.358	1.583	
Income status	1.05	.369	0.14	0.043	.527	2.093	**
Education	.797	.143	-1.26	0.034	.56	1.133	**
Constant	1.159	1.123	0.15	0.049	.174	7.735	**
Mean dependent var	.475	SD dependent var			.501		
Pseudo r-squared	.016	Number of obs			185		
Chi-square	4.157	Prob > chi2			.527		
Akaike crit. (AIC)	261.092	Bayesian crit. (BIC)			280.349		

**** p<.01, ** p<.05, * p<.1*

The probability ratio for education is 0.797, with a standard error of 0.143 and a p-value of 0.034. This value, below the 5% significance threshold, underscores the importance of education in raising awareness. As noted by Worku (2016), the agricultural sector must provide scientific information and technological support to stakeholders. The current analysis also reveals that the odds ratio for the constant term is 1.159, with an error of 1.123 and a p-value of 0.0449, indicating statistical significance at the 5% level. Studies by Didana (2019) and other research emphasize that rural women's economic empowerment in agriculture is significantly influenced by access to information and community participation

The standard error of 0.112 corresponds to a p-value of 0.256, and the odds ratio for family size is 1.122. Since the p-value exceeds the conventional significance threshold of 0.05, family size does not exhibit statistical significance in raising awareness. For the livelihood index, the standard error is 0.188, the odds ratio is 0.924, and the p-value is 0, which reflects a significant relationship. Credit has an average score of 0.752 with a standard error of 0.285, and its probability of being present is 0.453. Regarding income status, the odds ratio is 1.05, with a standard error of 0.369 and a p-value of 0.043. This indicates a statistically significant association with income status at the 5% significance level, consistent with empirical findings and supporting the assertions made by Taye and Zebene (2023). The probability ratio for education is 0.797, with a standard error of 0.143 and a p-value of 0.034. This value, below the 5% significance threshold, underscores the importance of education in raising awareness. As noted by Worku (2016), the agricultural sector must provide scientific information and technological support to stakeholders. The current analysis also reveals that the odds ratio for the constant term is 1.159, with an error of 1.123 and a p-value of 0.0449, indicating statistical significance at the 5% level. Didana (2019) and other research emphasize that rural women's economic empowerment in agriculture is significantly influenced by access to information and community participation

Table 6: Factors affecting rural women engagements in vegetable and crop production under irrigation condition

Rural women using irrigation for vegetable and crop production	**Odds Ratio**	**St.Err.**	**z**	**P>|z|**	**95%Conf**	**Interval**	**Sig**
Age	.993	.021	-0.33	.74	.953	1.034	
Education	1.204	.247	0.91	.37	.806	1.8	
Land size holding	.602	.112	-2.74	.01	.419	.866	***
Income status	.638	.239	-1.20	.023	.306	1.331	**
Credit	1.358	.62	0.67	.50	.555	3.322	
Constant	.699	.763	-0.33	.74	.082	5.94	
Mean dependent variable	.224	SD dependent vari				.418	
Pseudo r-squared	.072	Number of obs				185	
LR chi2(5)	13.922	Prob > chi2				.016	
Akaike crit. (AIC)	192.782	Bayesian crit. (BIC)				212.039	

**** p<.01, ** p<.05, * p<.1*

The odds ratio for age is 0.993, suggesting that with each additional year of age, the likelihood of rural women engaging in the cultivation of vegetables and crops under irrigation decreases by 0.7%. However, this association is not statistically significant, as the p-value of 0.74 exceeds conventional significance thresholds. Abebe & Yazie (2019) and Belay & Oljira (2019) highlight that factors such as farming experience, the gender of the development agent, and access to credit are significantly and positively associated with participation. The odds ratio for education is 1.204, indicating that an increase of one unit in education corresponds

to a 20.4% increase in the likelihood of rural women's involvement in agricultural activities.

The odds ratio for land size is 0.602, indicating that a one-unit increase in land size results in a 39.8% reduction in the likelihood of rural women's participation. This relationship is statistically significant at the 1% level, as evidenced by a p-value of 0.006. The odds ratio for income status is 0.638, suggesting that higher income status is associated with a 36.2% decrease in the likelihood of engagement. This relationship is statistically significant at the 5% level. Despite women constituting approximately 75% of the agricultural workforce in the Niger Delta, predominantly as smallholders and labor providers, their agricultural prospects are constrained by prevailing cultural norms. Additionally, their lower productivity relative to men can be attributed to limited access to agricultural land and resources, as emphasized by Joseph *et al*.(2019). The odds ratio for access to credit is 1.358, indicating that access to credit is associated with a 35.8% increase in the likelihood of rural women's engagement. The model's fit, as indicated by a pseudo R-squared value of 0.072, reveals that the included variables explain only a small portion of the variation in rural women's participation. This finding aligns with the results of previous studies by Alemu *et al*.(2022) and Maake & Antwi (2022).

CONCLUSION

This study conclusion emphasizes the necessity of a comprehensive strategy to overcome the gender-based barriers in irrigation-based agriculture. Although the majorities work in agriculture, they face significant socioeconomic obstacles that restrict their productivity. Among the rural women respondents, there were 185 respondents. The majority of them, 72%, are actively participating, while the rest 28% are not. The primary limitations identified in this study were a lack of extension agents, insufficient training, and inadequately delivered extension services, with average ratings of 5.2 and 4.5, respectively. Furthermore, the survey yielded mixed findings. Among the 134 respondents, 78% strongly opposed the use of irrigation for cultivating crops and vegetables, while only 22% expressed a positive view towards its adoption. The econometric model analysis revealed that the odds ratio for income status is 1.05, with a p-value of 0.043 and a standard error of 0.369, indicating that, at a 5% significance level, income status is a significant predictor of participation. Additionally, the odds ratio for land size holdings is 0.602, suggesting that each additional unit increase in land size is associated with a 39.8% decrease in the likelihood of rural women engaging in agricultural activities. Targeted initiatives are greatly needed to improve these women's livelihoods and advance sustainable farming methods. These ought to consist of enhanced training accessibility, more agricultural extension services, and calculated assistance from both public and private entities. In order to empower rural women, increase their contributions to food security, and promote economic growth in rural communities, these challenges must be addressed.

Consent to participate

The ethics committees at Wollega University and Kotebe University of Education granted approval for this study. Throughout the research process, strict confidentiality of all participants' information was upheld.

Consent for publication

All participants in the study provided written, informed consent, which was valid and up-to-date.

Availability of data and materials

This manuscript includes all pertinent information.

Conflicting of interests

There are no competing interests related to this publication.

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Author's role

BCW, BGB, TWB and HWF formulated the research idea, drafted the manuscript, and reviewed the final version.

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ORCID: Birhanu Chalchisa Werku *(https://orcid.org/0000-0002-3146-3302) and Tadesse Weyuma Bulto (https://orcid.org/0000-0001-7993-1788)*

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