

Smallholder farmers participation in small-scale irrigation: The case of Emba Alaje district, Tigray regional state, Ethiopia

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Phogella MG, Anbaw WS. Smallholder farmers participation in small-scale irrigation: The case of Emba Alaje District, Tigray regional state, Ethiopia. *AGBIR*.2023; 39(2): 467-469.

Introduction: Small-scale irrigation has direct and indirect impacts in enhancing the livelihood of farm households through diversification of crops grown, increased agricultural production, increased household income, and increased employment opportunities.

Objective: This study was conducted to identify determinant factors of household's participation in irrigation in the Emba Alaje district.

Methodology: In this study, multi-stage sampling technique was used to select 137 target respondents. The primary data were collected using an interview schedule and conducting focus group discussions and key informant interview. Various documents were reviewed to collect the secondary data.

Result: The probit model result indicates that participation in small-scale irrigation is positively and significantly influenced by livestock holding, total cultivated land size, and frequency of extension contact. Whereas, participation in small-scale irrigation is negatively influenced by age of the household head, distance to irrigation water and distance to farmer training center, participation in small-scale irrigation.

Conclusion: In the study area the participation in small-scale irrigation was significantly affected by different socio-economic, demographic and institutional factors.

Recommendation: To solve the problems and improve small-scale irrigation participation, the government, especially irrigation development office of the district should create awareness to farmers about utilization of irrigation scheme.

Key Words: *Small-scale Irrigation; Participation; Probit*

INTRODUCTION

Agriculture, the main source of livelihood in Ethiopian economy is mainly rain-fed and it depends on erratic and often insufficient rainfall despite its high-water potential. As a result, there are frequent failures of agricultural production and this forced many of the societies to lead their live dependent on assistance from different organizations for food [1].

Agricultural irrigation has been regarded as a powerful factor for providing food security, protection against adverse drought conditions, increased prospects for employment and stable income, and greater opportunity for multiple cropping and crop diversification. Irrigation in Ethiopia contributes to increase farmers' income, household resilience and buffering livelihoods against shocks and stresses by producing higher value crops for sale at market and to harvest more than once per year. In turn this provided them to build up their assets, buy more food and non-food household items, educate their children, and reinvest in 16 further increasing their production by buying farm inputs or livestock. However, the benefits are very unevenly distributed [2].

Like other countries, the Ethiopian government gives more emphasis to small-scale irrigation as a means of achieving food self-sufficiency Small-scale irrigation schemes enable greater agricultural production than is achieved with rain-fed agriculture, help poor farmers overcome rainfall and water constraint by providing a sustainable supply of water for cultivation and livestock, strengthen the base for sustainable agriculture [3].

In Emba Alaje Woreda, Studies on determinant factors affecting the participation of smallholder farmers in small-scale irrigation are very limited. A few studies had been done in the area regarding on determinant factors affecting the participation of smallholder farmers in small-scale irrigation. For instance, a study conducted by Aregawi [4] and Kinfe Aseyhegn [5] on the effect of small-scale irrigation on the income of farm households in Laelay Maichew, Tigray focus on technical aspects of

irrigation schemes and very little is known for the socio-economic factors that have implications on irrigation participation.

Therefore, this study aims to fill this research gap by studying the determinant factors affecting the participation of smallholder farmers in small-scale irrigation. This may encourage the farmers to participate in irrigation and utilize water resource on their farming to boost their production directly.

METHODOLOGY

Sampling technique and sample size determination

This study uses both survey design and a multi stage sampling technique. Purposive sampling technique was used to select the study area (Emba Alaje district) due its implementation of small-scale irrigation scheme. Then, out of the total 21 Kebeles found within the woreda, two Kebeles (Ayba and Atsela) was purposively selected mainly based on the current practice and potential for irrigation, and their accessibility in terms of road. Then, to select the representative respondents from each two Kebeles, lists of all farmers in the two Kebeles were obtained and stratified into two: irrigation users and non- users. Finally, a total of 137 sample household (67 irrigation users and 70 non users) are selected from the list by simple random sampling procedure.

To determine the required sample size, the study was employed a formula developed by Yamane (1967) at 95% confidence level, 8.5% margin of errors because of limit of financial and difficulty to manage large sample size.

Data source and methods of data collection

Both primary and secondary data sources were used. To generate the required primary data from different primary sources, such as household survey questionnaires, key informant interview, focus group discussions and

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Received: 04-Feb-2023, Manuscript No. AGBIR-23-88680; **Editor assigned:** 08-Feb-2023, Pre QC No. AGBIR-23-88680 (PQ); **Reviewed:** 23-Feb-2023, QC No. AGBIR-23-88680; **Revised:** 03-Mar-2023, Manuscript No. AGBIR-23-88680 (R); **Published:** 10-Mar-2023, DOI:10.35248/0970-1907.23.39.467-469



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were employed. The questionnaire was first prepared in English and later translated into the local language (Tigrigna), so that the respondents can easily understand the questions. In addition to the structured survey schedule, seven key informant interviews those who have more knowledge about the area, which include elders, experts from agricultural office and development agents working in the Kebele were conducted by the researcher to obtain additional information on the determinants of use of small-scale irrigation.

Methods of data analysis

Descriptive analysis: Descriptive statistics such as, frequency, mean, maximum and minimum, percentage and standard deviation were employed to analyze the quantitative data. As inferential statistics such as, chi square was used to identify the associations between categorical variables while independent t-test was used to compare mean differences between two groups across the study variable.

Econometric analysis

In this study, participation to small-scale irrigation status is a dichotomous variable (1=irrigation participant and 0=non-participant). So, in this study probit model method was employed to explore the probability of farmer's participation on small-scale irrigation.

RESULTS AND DISCUSSION

Determinant factors affecting farmer's participation on small-scale irrigation

Results presented in Table 1 below showed that the estimated model appears to perform well for the intended matching exercise. The likelihood ratio chi-square value 73.50 revealed that the overall fitness of the model was found significant at 1% significance level. This indicates the model's estimate fit the data at an acceptable level. Moreover, the small value of Pseudo-R² (0.77) showed that irrigation user households do not have much distinct characteristics over non-user households and as such finding a good match between irrigation user and non-user households becomes easier.

Out of the total 12 independent variables only six variables were significant such as, Households with large livestock holding, large cultivable land and, and frequency of extension contact were identified using probit regression found to have positive relationship and significantly affecting probability of participation in small-scale irrigation. However, age of the household, distance to FTC and irrigation water sources was found to influence participation in small-scale irrigation negatively and significantly.

TABLE 1

Probit model for the determinants of participation in small-scale irrigation

Variable	dy/dx	Std. err.	z	P>z
Agehh	-0.03796	0.01182	-3.21	0.001***
educlehh	0.046741	0.28352	0.16	0.869
Famiz	0.080461	0.05952	1.35	0.176
Ttlansize	0.746751	0.18006	4.15	0.000***
Tlu	0.232053	0.07712	3.01	0.003***
credit	0.08964	0.19173	0.47	0.64
Freqextncont	0.229897	0.09145	2.51	0.012**
Disftc	-0.01355	0.00607	-2.23	0.026**
Diswars	-0.85318	0.15865	-5.38	0.000***
partsa~g	0.25102	0.18769	1.34	0.181

annino~t	3.27E-05	0.00003	1.01	0.313
accmar~o	-0.01215	0.22704	-0.05	0.957

Note: Number of obs. =137; Wald Chi-Square Test (12)=73.50; Prob >χ²=0.0000; Log pseudo likelihood=-21.494; Pseudo R²=0.7740; **, *** means significant at 5% and 1% significance level respectively.

Age of the household head: Age of household head influences the probability of participation in small-scale irrigation negatively and significant at 1% level of significance. This may be because the use of irrigation is labor intensive and exhaustive work that the older household heads cannot tolerate this challenge.

Distance of residence from irrigation scheme: Distance to irrigation scheme influence small-scale irrigation participation decision negatively and statistically significant at 1% significance level and. The negative relationship tells us that when the household head's residence is far from the irrigation scheme, the household heads have less participation in irrigation. The finding of this study is similar to the findings by Hamda [6] that household's residence to water sources is found to have a significant and negative relationship to the probability of participation in small scale irrigation.

Distance to farmers training center: Distance to FTC has negative relationship with irrigation participation and it is statistically significant at 5% significance level. This indicates that the longer the distance from home to the farmer training centers and/or development agent offices, the lower is the probability to start and use irrigation. This is consistent with Aregawi [4] found that the farmer training center is a source of information for the Tibia resident.

Size of cultivated land: Farm size influences the probability of participate in small-scale irrigation positively and significant at 1% significance level. This means that households who have more land are more likely to participate in small-scale irrigation as compared to households who have less land. This result is consistent with the finding of Muleta and Milkias [7] who also obtained that farm size influenced the household heads decision to participate in agricultural projects.

Livestock holding: Livestock holding influences the probability of participation in small-scale irrigation positively and significant at 1% level of significance. This relationship implies that household with more livestock possession might have the capacity to generate cash income to purchase input and could be able to take more risk associated with use of irrigation. The same result was reported by Daniel [8] that livestock holding has positive influence on participation decision in small-scale irrigation.

Frequency of extension contact: Extension contact has positive association with irrigation participation and significant at 5% level of significance level. The possible explanation is that development agents are the major sources of information, provides technical support, advice on use of the availability of technology, facilitate the use of input to farmers, encourage for extension package participation and other development issues for rural farmer which may have positive aggregated impact for enhancing production and productivities. This result is consistent with that of reported by Gebrekidan [9].

CONCLUSION

This study examined the factors determining participation in small-scale irrigation by the farm households. The samples of 137 farm households selected by multi-stage sampling technique were used in the analysis. Descriptive results indicated that irrigation user and non-user households showed a statistically significant mean difference in terms of family size, cultivated land size, livestock holding, access to credit use, distance from irrigation water sources and frequency of extension contact.

The result of the probit model indicated that, Households with large livestock holding, large cultivable and, and frequency of extension contact found to have positively and significantly affected probability of farmers participation in small-scale irrigation. However, age of the household

distance to FTC and irrigation water sources was found to influence participation in small-scale irrigation negatively and significantly.

To solve the problems and improve small-scale irrigation participation, the government, especially irrigation development office of the district should attempt to hamper factors that hinder participation in small-scale irrigation and enhance factors that initiate participation in small-scale irrigation identified in the study area.

ACKNOWLEDGEMENT

Let me use this opportunity to thank Mekelle University for offering me a scholarship to pursue my MSc study and NORAD project for granting and allowing me to do my thesis research project. I deeply appreciate the support of the Department of Rural Development and Agricultural Extension (RDAE) and Mekelle University for the institutional support to get the scholarship.

I am very glad to acknowledge the sample households and staff of Ayba and Atsela kebelles for their willingness and patience in responding to my questionnaire at the expenses of their invaluable time.

AUTHORS' CONTRIBUTION

Moges Girmay A was involved in literature search, figures, development of overall research plan, study design, data collection, data analysis, data interpretation hypothesis generation and idea development, he provided the validated questionnaires; Workie Sahlu was involved in data collection, data analysis, data interpretation, supervision and data analysis and revision of the paper; and she Wrote the paper. We have read, agree and approved this final manuscript.

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