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Assessment of Irrigation Access, Challenges, and Opportunities in Wolaita, Kembata Tembaro, and Hadiya Zones of SNNPR, Ethiopia

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Abstract

In the Wolaita, Kembata Tembaro, and Hadiya zones, this study evaluated irrigation access and the difficulties that come with it. The data in this study were analyzed using an econometric model in addition to descriptive statistics. The study region yielded both primary and secondary data. For this investigation, the multi-stage sampling technique was used. Using a pre-tested questionnaire, 139 sample household heads were chosen at random and questioned. To support the formal data, informal techniques including focus groups and key informant interviews were used. The results of analysis indicated that about 16.5% those who have their own irrigation water harvesting technology whereas 83.5% did not have this technology. The majority (79.1%) of the sample respondents were using modern irrigation type whereas the remaining 20.1% were use traditional irrigation type. Of the sample 57.6% respondents indicated access to water which limit the area to cultivate in any season of the year whereas 42.4% did not agree. Attitude toward the use of irrigation by the male and female sample household head has no significant mean difference between them. As access to irrigation increase, the probability of farmers having own irrigation water harvesting technology decrease by 48.4% which is negatively significant at 5% of significance level. High input costs, lack of money and labor shortage were the main factors in affecting irrigation use of sample respondents in the study area. Therefore, an intervention is needed to improve irrigation facility, infrastructural development and canal maintenance for efficient irrigation water utilization to enhance production and productivity in the study area.

Keywords: Irrigation, constraints, econometric model, descriptive statistics

INTRODUCTION

Land, varied agro-ecology, water resources, biodiversity, and human resources are the main resources needed for agricultural development. There are numerous prospects for the agriculture sector to transition from subsistence to a more modern and commercialized level of output. However, the industry faced several obstacles in producing enough food for both internal consumption and export revenue. The agriculture sector is dominantly depends on rain fed production and also dominated by smallholder farming systems [1].

In order to solve subsistence farming problem, the economic performers adopted a national strategic plan in 1991, Agricultural Development Led Industrialization (ADLI) that gives focus on irrigation, cooperative societies and agricultural technologies to respond the food demand and bring socioeconomic development in the country. One of the policies in the ADLI strategy is the promotion

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of small-scale irrigation. As a result, rural farmers have received substantial support from the federal and regional governments, as well as from various international and local nongovernmental organizations (NGOs), to engage in and employ irrigation farming [2]. Because of this, the country's irrigated farmland, irrigation output, and number of farmers who profited from irrigation have significantly increased, reaching 80% between 1990 and 2010 [3]. According to some calculations, the country has enough water to develop almost 4.5 million hectares, but only 0.16 million hectares, or 5% of the potential, are fully irrigated in Ethiopia. But in terms of output, irrigated agriculture only makes up around 3% of the entire production of food crops, and it has only used 5% of its estimated capacity. But just 640,000 hectares (5%), comprising 128,000 hectares of rainwater collection, 383,000 hectares of small-scale irrigation, and 129,000 hectares of medium- and large-scale irrigation of arable land, are irrigated in Ethiopia at the moment [2]. Between 1.8 and 3.4 million hectares of land might be irrigated on a local, medium, and large scale nationwide [4]. To increase irrigation throughout the nation, the present administration has undertaken a number of initiatives. Irrigation development is seen as a key component of sustainable development in the nation's ADLI policy [5].

The regional government of SNNPR (Southern Nations, Nationalities, and Peoples' Region) is encouraging irrigation development in accordance with the nation's development policy in order to boost and stabilize food production in the area. To ensure food security in rural households, the regional government is putting several agricultural development programs into action. The government's primary responsibility among these initiatives is irrigation development. This program involves the supply of inputs (fertilizer, improved seeds, pesticides, insecticides, and farm equipment), access to credit, and various irrigation technologies. Government agencies, microfinance institutions, the private sector, and farmers are all involved at different levels with different tasks.

The Zonal Governments of Wolaita, Kembata Tembaro, and Hadiya are also encouraging irrigation development in accordance with the region's development policy in order to boost and stabilize food production in their respective zones. In Wolaita Zone, the total area cultivated for irrigation was 42,329 hectares and its production 4,952,493 quintals with 169,316 beneficiaries participating.

Agricultural production in the study area is low predominantly due to the erratic rainfall distribution. However, the study site lacks in-depth studies on assessing the challenges and opportunities and assessing the status of irrigation technology. Therefore, this study assessed irrigation access and its associated challenges in Wolaita, Kembata Tembaro, and Hadiya zones.

RESEARCH METHODOLOGY

Sample Size and Sampling Procedure

The study area was purposefully chosen based on the degree of irrigation technology acceptance and utilization, as well as accessibility and study relevance. The sample respondents were chosen using a multistage sampling technique.

The study was conducted in three zones such as Wolaita, Kembata Tembaro, and Hadiya zones. In the first stage of sampling, Boloso Sore, Humbo, Hadaro, The Woredas of Tunto, and Mirab Badawacho were purposefully chosen using the corresponding zonal data on irrigation water usage. Two Kebeles with irrigation availability were chosen at random from each woreda in the second stage. The number of sample households from each sample in the third stage Kebeles were calculated using proportional to size from the most recent listings of households. Therefore, given the relative homogeneity of households in terms of their socioeconomic characteristics and livelihood style, sample households were drawn using simple random sampling method from each Kebele. Thus, sample size determination formula of Yamane [6] which is described below was used to determine the number of sample respondents.

$$N = N/ (1+N*e^2)$$

where, n = the sample size, N = total number of households in the Woreda, e = acceptable margin of error was 0.05 and confidence level is 95%.

Source and Method of Data Collection

Both qualitative and quantitative data were collected from primary and secondary sources. Primary data related to household's demographic, socioeconomic characteristics, irrigation practice, type of technologies was being used, and farmers' perception in the use of the technology for irrigation. The study gathered data through field observations, focus groups, interviews with key informants (development agents, Woreda irrigation development experts, peasant women development association members, and committee members of associations), and a household survey from a chosen sample of households. Written records from the Woreda Agriculture and Natural Resources Office as well as other published and unpublished resources were used to gather secondary data. For the household survey, a systematic questionnaire was created and tested beforehand.

Data Analysis

Descriptive method of analysis was used. Descriptive statistics such as frequency tables, graphs, charts, percentage, standard deviations and means were used to analyse the quantitative data. The qualitative data were analyzed using triangulation and narration methods.

RESULTS AND DISCUSSION

Socioeconomic and Demographic Characteristics of the Respondents

Sex of Household Respondents

The total sample households of farmer respondents considered during the survey was 139. Out of the total household heads interviewed, 88.5% were male headed households while 11.5% were female headed households.

Education Level of the Respondents

In the study area according to sample respondents the mean grade level achieved by respondents was about grade 6. The minimum grade achieved was grade 1 and the maximum was grade 12; however, a few respondents are degree holders in the study area.

Education level is crucial in guaranteeing that households have access to necessities like clothing, food, and shelter in both theoretical and practical contexts. Skills and education enhance the working efficiency on the irrigation resulting into more income and food security. Furthermore, education is important to manage the business as well as in decision making.

Age of the Household Respondents

An indication of the working ages of homes was given by the survey on this important demographic component, expressed in years. The sample household heads' minimum and maximum ages were 20 and 75 years, respectively, with a mean age of 39.6 years. This result is almost similar with that of Zekarias (2012) [7] who found the mean age of the sample household was 40 years. The result is also similar with Asmera and Yidnekachew (2021) [8] who conducted socioeconomic impact of small-scale irrigation on household's livelihood improvement in Bena-Tsemay district of South Omo zone, Southern Ethiopia.

Family Size, Marital Status, and Experience

The mean family size of the total sample households was 7 persons ranging from 3 to 15 with standard deviation of 2.21 and this might help them for a better irrigation utilization of households during crop production because of family labor availability. The respondents have an average 6.92 years of experience in irrigation practices with a standard deviation of 6.1. The majority, about 90%, of sample respondents were married (Table 1).

Resource Ownership of the Respondents

Land Holding

The total land size of sampled farmers varies from 0.06 to 9.1 hectares and the average farm size for sampled farmers is found to be 1.3 hectares with standard deviation of 1.05. From the total land size,

Table 1. The socioeconomic and demographic characteristics of sample households.

Variables	N	Minimum	Maximum	Mean	Std. deviation
Age of the households	139	20	75	39.6	10.18
Total family size	139	3	15	7.5	2.21
Total family <15 years	139	1	7	2.86	1.36
Total family between 15 and 64 years	139	2	11	4.78	2.12
Total family >64 years	139	1	2	1	0.57
Educational level	139	1	12	6.3	4.11
Experience in irrigation practice (years)	139	1	30	6.2	6.08
Valid N (listwise)	139				

Source: Survey Results, 2022.

Table 2. Land holding of household heads in hectares.

Variables	N	Minimum	Maximum	Mean	Std. deviation
Total land holdings in hectare	139	0.06	9.10	1.3036	1.04727
Annual allocation land for crops	139	0.04	4.00	0.6251	0.49210
Perennial allocation land	139	0.001	3.00	0.2694	0.28827
Irrigable allocation land	139	0.001	5.00	0.5829	0.59053
Tree allocation land	139	0.001	2.00	0.1843	0.22494
Grassland allocation	139	0.001	0.50	0.1097	0.08670
Number of farm plots/parcel	139	0.50	4.00	1.5388	0.67781
Valid N (listwise)	139				

Source: Survey Results, 2022.

Table 3. The livestock ownership of the sample respondents.

Variables	N	Minimum	Maximum	Mean	Std. deviation
Number of oxen	87	1.00	3.00	1.2759	0.47470
Number of cows	103	1.00	5.00	1.2718	0.64465
Number of heifers	51	1.00	4.00	1.3725	0.74728
Number of bulls	24	1.00	2.00	1.1667	0.38069
Number of calves	50	1.00	4.00	1.3600	0.72168
Number of goats	39	1.00	10.00	1.9231	1.64452
Number of sheep	11	1.00	3.00	1.7273	0.90453
Number of poultry	65	1.00	35.00	4.4615	5.00024
Number of horses	0				
Number of donkeys	17	1.00	2.00	1.0588	0.24254
Number of mules	0				
Valid N (listwise)	0				

Source: Survey Results, 2022.

the land allotted to annual crop, perennial crop, irrigable land, tree land, and grass land were on average 0.63, 0.3, 0.6, 0.2, and 0.1 hectares, respectively, as shown in Table 2.

Livestock Ownership

From Table 3, it can be seen that the sample respondents in the study area owned different types of livestock such as ox, cow, heifer, bull, calf, goat, sheep, poultry, and donkey. However, there was no practice of rearing horses and mules in the study area.

Major Livelihoods

From Figure 1 about 94.5% of the sample respondent's livelihood mainly depend on both crop and livestock production (mixed) whereas about 5.7% depends only in crop production. This result might be similar to Asmera and Yidnekachew (2021) [8].

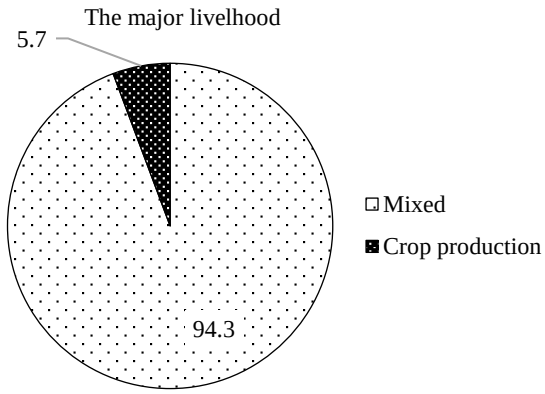

Figure 1. The livelihood of sample respondents.

Access to Institutional Service of Farm Households

The distance in kilometers to different institutional services were important determinant factors in accessing services. The average distance of the residence from the nearest market, farmer training center (FTC), main road, and irrigated land was 5.3 km, 3.1 km, 1.8 km, and 0.42 km, respectively.

Access to Credit Service

The sample respondents indicated that about 77% of sampled producers had access to credit while 23% had no access to credit for irrigation purpose in the study area. Although the majority of sample respondents indicated existence of credit access, they did not receive for the irrigation purpose due to bureaucratic procedures to get credit and fear. This result might be contrary to Yeshambel (2019) [9]. As access increased the use of irrigation also increased.

Access to Basic and Extension Service

All the respondents have access to extension in the study area. However, with regard to average frequency of extension contact per month regarding irrigation was 1.8 times. This might indicate that the farmers are not been strongly supported with technical aspects for efficient utilization of irrigation water to enhance crop production and productivity in the study area. With regard to training, about 50% of the sample respondents have been taken training on the irrigation use while the rest did not take training. The trainings were provided mostly by agricultural office 48 (77%) while trainings by NGOs were 10 (16%) and by university and research center were 3 (5%) and 1 (2%), respectively. According to sample respondents, the training was provided on average two times per year. The sample respondents indicated that about 80.8% did not visit any irrigation management practices whereas only 19.2% of the sample respondents had visited some irrigation areas such as model farmers field and other places where irrigation activities were mainly implemented [10].

Irrigation Water Management and Agronomic Practices

The sample respondents indicated that about 16.5% were those who have their own irrigation water harvesting technology whereas 83.5% did not have this technology. According to sample respondents from those who own their irrigation water harvesting technology but not using was about 28% those who did not use the technology because of un functionality.

From Figure 2, majority (79.1%) of the sample respondents were using modern irrigation type whereas the remaining 20.1% were using traditional irrigation type. The sample respondents indicated that the majority use surface water and furrow irrigation in the study area. The method of water abstraction that the sample respondents were using gravity and surface water.

From Figure 3, the sample respondents indicated that about 70.5% have water access for irrigation practice while 29.5% did not. According to sample respondents when there was scarcity of water, the majority

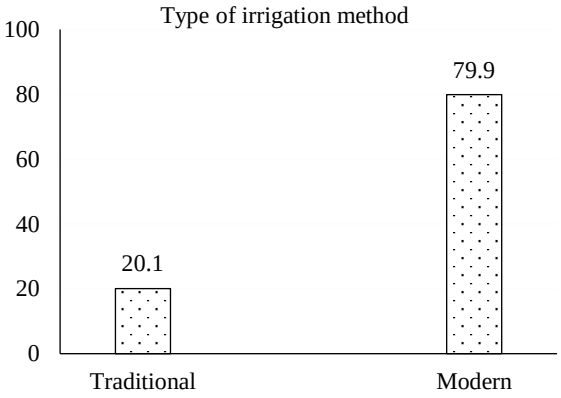

Figure 2. Type of irrigation in the study area.

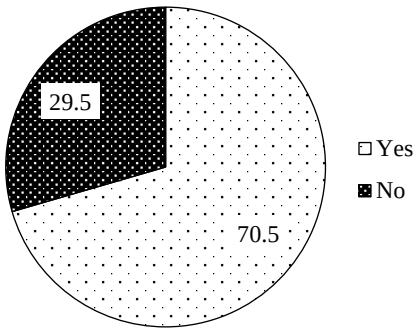

Figure 3. Water access for irrigation practices.

of sample respondents use the river/stream. A total of 57% of the sample respondents indicated that access to water limit the area to cultivate in any season of the year whereas 42.4% did not agree. Accordingly, about 58.2% of the sample respondents indicated irrigation water availability affect the decision the type of crop to be grown while 41.8% did not affect the decision in which type of crop to be grown. However, when there was a limitation of irrigation water access, the majority of sample respondents give priority to maize, tomato, wheat and other vegetable crops which are cultivated mostly once per year using irrigation in the study area. According to sample respondents, majority (87%) sow their crops in time according to the sowing date, while 13% of the sample respondents revealed that they did not keep the sowing date due to water shortage and inability to get input (seed and fertilizer) on time. With regard to seed source, about 25.9% was bought from the market, 18.7% from government agency whereas 29.5% were own farm saved, from the market, and government. A few NGOs have been providing agricultural seed to the farmers. A total of 32% of the sample respondents who use irrigation water indicated that there was a moderate or low salinity problem in their farm land whereas 68% did not face the problem. This might be identified by observing white crust at the top surface of the land. However, majority (52%) of sample respondents did not take the training on the salinity management whereas only 5% those who took training mainly through agricultural office mainly on the alternative crops to be grown on affected soil as well as reclamation methods. According to sample respondents those who use irrigation about 39.6% did not use the information provided on how to reduce the effect of salinization whereas only 5% use this information to reduce salinization on their farm lands this might be due to inaccessibility mainly. The sample respondents indicated that the salinity problems have direct effect on their livelihoods by reducing farm productivity.

With regard to chemical improvement mechanism, majority (97.9%) did not use any chemical improvement mechanisms on their farm lands while only 2.1% of the sample respondents use the chemical improvement on their farm lands using calcium carbonate which has an advantage of increasing yield from time to time after application on the farm lands.

The reliability test has been made to check the internal consistency of the questionnaire on the farmers' perceptions in irrigation use. Accordingly, in order to maintain the homogeneity of the items (internal consistence) of the instruments, a coefficient alpha at 0.05 was used. Accordingly, the pilot test result indicated that the reliability of the questionnaires of this study is 0.282 which is in the range of acceptable.

Farmer's Attitude Toward the Use of Irrigation Methods

As depicted in Table 4, the sample respondents indicated complete agreement that the use of irrigation have both economic and social benefit whereas some sample respondents showed agreement that the use of irrigation needs high initial costs. However, the sample respondents indicated their complete disagreement on the use of irrigation water did not require trained labor.

Table 4. Respondents' responses on the use of irrigation methods.

No.	Items	Respondents	Responses												Mean
			CA		*A*		*UD*		*DA*		*CDA*		*Total*		
			N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	
1.	Trained labor not required	hds	11	7.8	27	22.5	-	-	45	33.6	50	37.8	139	100	4.2
2.	Easy to implement	Hhds	6	1.7	27	19.2	-	-	76	60	27	19.2	139	100	3.8
3.	Needs high initial costs.	Hhds	20	13.3	91	72.5	9.8	5	13	7.5	6	1.7	139	100	2.1
4.	Difficult to apply fertilizer and pesticides	Hhds	8	6.2	13	6.7	14	8.3	65	50.8	8	3.3	139	100	3.2
5.	Can deliver water to all parts of the field uniformly and efficiently	Hhds			35	25.2	12	5.9	72	56.3	20	12.6	139	100	3.6
6.	May wash away the soil	Hhds			38	27.4	25	16.2	63	49.6	13	6.8	139	100	3.4
7.	Save time, effort, and energy	Hhds	5	1	38	32.2	20	13.6	53	41.5	24	16.1	139	100	3.4
8.	Cause water wastage	Hhds	15	8.5	54	42.4	15	9.3	43	33.1	12	6.8	139	100	2.9
9.	Reduce infestation of weeds and disease	Hhds	7	2.5	53	41.5	17	11	52	41	9	4.2	139	100	3.03
10.	Economic and social benefits	Hhds	71	56.3	53	41.2	6	1.7	5	1			139	100	1.5

Key: 1 Completely agree (CA), 2 Agree (A), 3 Undecided (UD), 4 Disagree (DA), 5 Completely disagree (CDA). The mean range value 1–1.8 CA, 1.81–2.6 A, 2.61–3.4 UD, 3.41–4.2 DA, and 4.21–5 CDA.

Table 5. Farmers' attitude toward the use of irrigation by sex and agro-ecology of sample household head.

Variable	Male (123)		Female (16)		Total (139)		*t* Value
	Mean	***SD***	***Mean***	***SD***	***Mean***	***SD***	
Farmers attitude toward irrigation use sample household head	3.1245	0.564	2.99	0.3077	3.11	0.54	(1.3255) NS
	Midland			*Lowland*			(4.75) ***
	3.24	0.59	2.85	0.31	3.11	0.54	

Source: Survey Results, 2022. NS = Nonsignificant.

As depicted in Table 5, attitude toward the use of irrigation by the male and female sample household head has no significant mean difference between them. However, there was a significance mean difference in attitude toward the use of irrigation between midland and lowland farmers. This might be due to the fact that in the lowland area there was erratic rainfall which enforces the farmers to use irrigation.

As depicted in Figure 4, the farmers' attitude to use irrigation based on agro-ecology might be different because sample respondents indicated their agreement with the use of irrigation more in lowlands as compared to midlands.

Factors Affecting Irrigation Technology Usage (Yes/No)

As depicted in Table 6, high input costs, lack of money, and labor shortage were the main factors in affecting irrigation use of sample respondents in the study area.

Crop Production

As depicted Table 7, majority of sample respondents get income from the sale of cereal, pulses, and vegetables. According to the sample respondents they mainly produce vegetables using irrigation water whereas production of cereals and pulses were using both rainfed and irrigation in the study area.

The Production and Marketing Costs for the Crops

As depicted in Table 8, the major production costs for the sample respondents were seed, ploughing, and fertilizer costs which have been determining factors in production and productivity for the study area.

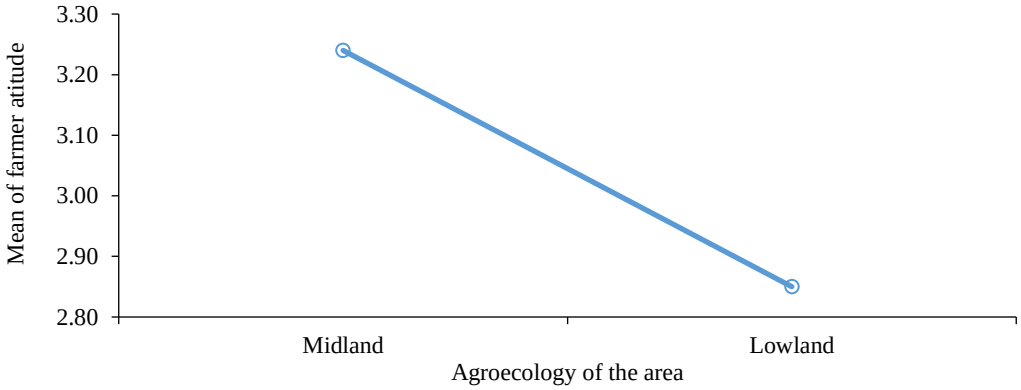

Figure 4. Sample respondent attitude toward the use of irrigation.

Table 6. Factors affecting irrigation use.

Variables	% (Yes)	Variables	% (Yes)
Labor shortage	79.7	Expansion of salinity on farm lands	22.2
Lack of money	93.2	Shortage of irrigation water	62
Lack of extension support	43.7	Lack of inputs	73
Lack of irrigation water source	36.4	High input cost	96.6
Poor maintenance	64.1	Market linkage problem	59.3
Poor quality of irrigation technique	62.4	Infrastructure problem	48.7

Source: Survey Results, 2022.

Table 7. Crops grown and production status in 2014 E.C. production year.

No.	Type of crops	Irrigated area (ha)	Rain fed (ha)	Produced (Qt)	Sold	
					Amount	*Price/qt*
1.	Onion	0.14		11.8	9.5	2425
2.	Tomato	0.18		14.3	12.9	7131
3.	Garlic					
4.	Hot pepper	0.05		2.2	2.1	2331
5.	Haricot bean	0.15	0.32	4.1	2.5	1.9
6.	Soya bean	0.5	0.5	3.8	6.3	1010
7.	Wheat	0.4	0.23	5.8	4.5	3422
8.	Maize	0.3	0.41	6.9	6.6	2860
9.	Banana	0.1	0.6	14.2	11.14	3754
10.	Mango		0.3	5.2	7.7	1868
11.	Avocado	0.13	0.2	6.9	8.3	3828
12.	Ginger	0.13	0.19	19	18.6	3700

Source: Survey Results, 2022.

Table 8. Production and marketing costs.

Variables	Min.	Max.	Mean	Std. deviation
Seed cost (in birr)	140.00	90000.00	3841.86	9030.79
Ploughing (1st, 2nd, 3rd) cost (in birr)	200.00	40000.00	4390.74	8159.64
Weeding (1st, 2nd, 3rd) cost (in birr)	200.00	20000.00	2117.70	3307.817
Irrigation water application cost (in birr)	300.00	30000.00	3692.31	6172.79
Fertilizer cost (in birr)	250.00	30000.00	3965.04	4593.32
Chemicals cost (in birr)	100.00	30000.00	1987.34	4758.67
Other (harvesting, winnowing, threshing) cost (in birr)	100.00	20000.00	2738.33	4167.39
Transport cost (in birr)	70.00	20000.00	1534.17	3496.04
Broker cost (in birr)	100.00	3000.00	1000.00	1344.12
Valid N (listwise)				

Source: Survey Results, 2022.

Table 9. Income sources.

Variables	Min.	Max.	Mean	Std. Deviation
Off-farm	800.00	40000.00	14015.38	10525.19
Non-farm	2000.00	60000.00	15956.52	14046.93
Remittance	5000.00	23000.00	10550	8532.87
From animal products	1500.00	25000.00	5483.3	5754.28
From sale of animals	1000.00	65000.00	18677.36	12493.95
From sale of trees and other plantations	1000.00	30000.00	9057.58	7472.87
Aids	200.00	11400.00	2475	3534.16
Valid N (listwise)				

Source: Survey Results, 2022.

Table 10. Dependent variable was farmers' own irrigation water harvesting technologies.

Marginal effects after probit y = Pr (own irrigation) (predict) = 0.01532091							
Variable	***dy/dx***	***Std. err.***	***z***	***P> |z|***	***95%***	***[I]***	***X***
sex	-.0207214	.03551	-0.58	0.58	-.090322	.048879	1.11679
age	-.0009434	.00079	-1.20	0.231	-.002486	.0006	39.3796
educ	-.0000265	.00176	-0.02	0.988	-.003469	.003416	6.29197
totfam	.0045064	.0037	1.22	0.224	-.00275	.011763	7.54015
exprrig	.0042262	.0025	1.68	0.093	-0.00071	.009162	5.78832
lntotl~d	.0151463	.01624	0.93	0.351	-0.016682	.0046974	.025389
distmrkt	.0006796	.00212	0.32	0.748	-.003467	.004826	4.40949
accirrig*	-.483657	.20264	-2.39	0.017	-.880834	-.08648	.693431
extcont	-.000391	.00029	-1.36	0.175	-.000956	.000174	15.5985
training*	-.0670512	.04623	-1.45	0.147	-.157652	.023549	.430657
visited*	.3431761	.18473	1.86	0.063	-.018896	.705248	.20438
watacc~s*	.057514	.04591	1.25	0.210	-.032465	.147493	.70073
hghinp~t*	-.8758593	.14966	-5.85	0.000	-1.16918	-.582536	.970803
lntoti~m	.0001579	.00204	0.08	0.938	-.003848	.004164	7.11409

Source: Survey Results, 2022.

As depicted in Table 9, majority of sample respondents mainly get income from the sale of animals and some amount of income through aid from government.

Probit Model Estimations of Own Irrigation Water Harvesting Technology

The irrigation experience was found to be positively and significantly influenced using their own irrigation water harvesting technology (Table 10). As experience on irrigation increase by one year, the probability of farmers having their own irrigation water harvesting technology increases by 0.4% which is positively significant at 10% of significance level.

The irrigation access was found to be negatively and significantly influenced by using own irrigation water harvesting technology. As access to irrigation increase, the probability of farmers having own irrigation water harvesting technology decrease by 48.4% which is negatively significant at 5% of significance level. This might be similar to results of Abebaw and Mesfin (2016) [11].

Visiting irrigation management practice was found to be positively and significantly influenced using their own irrigation water harvesting technology. As the farmers visit different irrigation management practices more, the probability of farmers having own irrigation water harvesting technology increases by 34% which is positively significant at 10% of significance level.

The inflated cost of input was found to be negatively and significantly influenced using own irrigation water harvesting technology. As input cost increase by one birr, the probability of farmers having own

Table 11. Challenges and opportunities in Wolaita, Kembata Tembaro, and Hadiya zones.

Opportunities	Ranks	Constraints	Ranks
High demand of the farmers to use irrigation	1st	Shortage of water/inaccessibility of river for some areas	1st
Availability of irrigation in the kebele	2nd	Inflated input cost and low income	2nd
New construction of irrigation facility	3rd	Shortage of provision of improved seed for vegetables	3rd
Provision of wheat seed from government free of cost	4th	Input provision delay	4th
Possibility to produce crops in dry season	5th	Poor maintenance of canals	5th
Dry season		Lack of storage facility	6th
		Infrastructural problems	7th

Source: Survey Results, 2022.

irrigation water harvesting technology decrease by 86.7% which is negatively significant at less than 1% of significance level. This might indicate that the inflated cost of agricultural inputs discourages the farmers not to use their own irrigation practices in the study area.

Opportunity and Constraints of Irrigation Access

The sample respondents in the study area indicated that there was high demand of farmers for irrigation use, availability of irrigation user in the kebele, different crop production potential, ability to produce vegetables in the nearest market, availability of river or water, possibilities of crop production during dry season including cash crops and increased income for the farmers in the study area could be mentioned as the major opportunity. Also, there was an opportunity to get wheat input provided by the government free of cost as well as new irrigation facility was being constructed in some study areas. However, there were constraints with regard to irrigation access, facility, and utilization in the study area. Those major constraints were lack of water, long distance or inaccessibility of river, lack of income for input purchase, poor canal construction, absence of projects to support irrigation, delay of input provision, inflated cost of input, high cost for motor pump, infrastructural problem, absence of mechanization, lack of storage facility, shortage of improved vegetables seed, no water pump, and shortage of money to buy lubricants. As seen in Table 11, the sample respondents prioritized the major opportunities and constraints in the study area.

CONCLUSIONS

This study mainly aimed at assessing irrigation access, challenges and opportunities in Wolaita, Kembata Tembaro, and Hadiya zones. The specific objectives are to identify the status of irrigation practices in the study area, assess farmer's attitude towards the irrigation in the study area, to assess opportunities and constraints in the use of irrigation in the study area. The information collected from those methods were substantiated with conducting focus group discussions and key informant interviews in the study area. A total of 139 sample household heads have been randomly selected and interviewed using structured questionnaire.

The sample respondents indicated that about 57.6% have access to water limit the area to cultivate in any season of the year whereas 42.4% did not agreed. This might indicate that water access was the major limiting factor for large area cultivation. Accordingly, about 58.2% of the sample respondents indicated irrigation water availability affects the decision the type of crop to be grown while 41.8% did not affect the decision in which type of crop to be grown. The attitude toward the use of irrigation by the male and female sampled household head has no significant mean difference between them. This might indicate that both male and female were aware of the benefit of using irrigation for crop production. There was high demand of farmers for irrigation use might be considered as opportunities whereas there were constraints with regard to irrigation access, facility, and utilization in the study area. Therefore, designing appropriate intervention strategies to improve the irrigation utilization of the farmers to enhance the production of crops that can benefit the farmers in the study area.

Author Contributions

Both authors contributed to the preparation of data collection tools, data collection, analysis, and report writing.

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Competing Interests

The authors declare that they have no competing interests.

REFERENCES

1. Mutsvangwa T, Doranalli K. Agriculture and Sustainable Development, Netherlands The Hague University Press of Koro Irrigation Scheme Arsi Zone. MSc Thesis presented to Haramaya University. Participation. Addis Ababa, Ethiopia: Forum for Social Studies; 2006.
2. Awlachew SB, Merrey DJ, Kamara AB, Van Koppen B, Penning de Vries F, Boelee E, Makombe G. Experiences and opportunities for promoting small scale micro-irrigation and rainwater harvesting for food security in Ethiopia. Working Paper 98. Colombo, Sri Lanka: IWMI.V.86; 2005.
3. Central Statistical Authority (CSA). Agricultural Sample Survey for Strategic Household Income. MSc Thesis. Alemaya, Ethiopia: Alemaya University; 2012.
4. Kidane D. Conservation tillage implementation under rain-fed agriculture: implication for soil fertility, green water management, soil loss and grain yield in the Ethiopian Highlands. Int J Agric Sci. 2014; 4: 268–280.
5. Getachew A. Water Harvesting: A Water Security Strategy for Mitigating the Impact of Drought in Ethiopia. [Online]. Addis Ababa, Ethiopia. 1999. Available at http://www.uccow.siu.edu/W8D.pdf
6. Taro Y. Statistics: An Introductory Analysis. 2nd edition. New York, NY, USA: Harper and Row; 1967.
7. Zekarias SM. The impact of foreign direct investment (FDI) on economic growth in eastern Africa: Evidence from panel data analysis. Appl Econ Finance. 2016;3(1):145–60. DOI: 10.11114/aef.v3i1.1317.
8. Asmera A, Yidnekachew A. Socio-economic impact on small -scale irrigation in Southern Ethiopia. Int J Agric Res Innov Technol. 2021; 11 (2): 139–146.
9. Yeshambel Y. Impact of Small Scale Irrigation Schemes on Household Welfare: The Case of Mecha District, Ethiopia. Master's thesis. Bahir Dar, Ethiopia: Bahir Dar University; 2019.
10. Gensa S, Woldemichael A, Zewdie M. Performance evaluation of Woybo Irrigation Scheme: Wolaita Zone, Southern Ethiopia. Am J Water Sci Eng. 2024; 9 (4): 64–73.
11. Abebaw A, Mesfin T. Challenges and opportunities in small-scale irrigation utilization. J Econ Sustain Dev. 2016; 7 (1): 56–64.

