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Opportunities and Challenges of small-scale irrigation in Adiha Irrigation Scheme, Kola- Tambien Woreda, Central Zone of Tigray, Ethiopia

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Abstract

The main objective of this study was to assess existing Challenges and opportunities of small scale irrigation in Adiha kebelle, Kola- Tembien Woreda, Central Zone Of Tigray, Ethiopia. Data for this study was collected via household survey. The stratified random sampling method was employed to select samples. A total of 123 samples involved in this study Data was gathered using Questionnaire, Key Informants Interview, Focus Group Discussion (FGD) and direct Observation. Descriptive statistics that include regression, ANOVA, chi-square and paired sample t-test were used to analyze the data. Study findings revealed that the area has a significant issue of small scale irrigation. The finding of this research was statistically significantly associated between potential and actual irrigation practice in ha ((t= 3.516) degree of freedom was 4, p< 0.05)), .025 less than 0.05. In addition to this, 46.30%, 76.60%, 74.50%, and 92.00% of the variance in training, fertilizer per kg, best seed, and land size were influenced for Irrigation per ha respectively. The results of the study show that small scale irrigation positively affects the economic aspects of the users. Therefore, it will need further investigation and will be sharing the experience for those non-users.

Keywords: *small scale irrigation, Adiha kebelle, Ethiopia.*

Introduction

Irrigation farming plays an important role in food production and food security in the world. About 30% of the world's food production comes from about 18% of the total cultivated land under irrigation. There are wide variations in the proportion of irrigated agricultural land in the developing world, with 37% in Asia, 15% in Latin America, 6% in Africa, and 4% in Sub-Saharan Africa. Therefore, Irrigation plays a less significant role in African agriculture compared to other regions as Africa's irrigated cultivated land is why lower than the world average (FAO, 2012).

Globally, irrigation farming plays a crucial role not only in food production but also, livelihood improvement. Although the current irrigated land area is less, irrigation farming provides more than one-fifth of the world's food (Sebastian, 2014). Ethiopia is endowed with ample water resources with 12 river basins with an annual runoff volume of 122 billion m3 of water and an estimated 2.6-2.65 billion m3 of groundwater potential (MoARD, 2011). Due to this endowment, the economic actors of the country gave attention and designed a national strategic plan in 1991, ADLI which gives more emphasis to small-scale irrigation success stories of Asian countries such as China, India, motivated the Ethiopian government to give more weight to the development of irrigation schemes (MoFED, 2012). The development of irrigation practices was the main pillar in the Five-Year Growth and Transformation Plan (2011-2015) of Ethiopia as a means of achieving food self-sufficiency.

According to the Ethiopian Growth and Transformation Plan (GTP 2010/11-2014/15), the main objectives of the water sector development plan are to develop and utilize water for different social and economic priorities in a sustainable and equitable way to develop irrigation schemes so as to ensure food security, to supply raw materials for agro-industries and to increase foreign currency earnings. In the irrigation sub sector, the country is believed to have the potential of 5.1 million hectares of land that can be developed for irrigation through the pump, gravity, pressure, underground water, water harvesting and other mechanisms. Thus, irrigation development, particularly small scale irrigation will be accelerated (MoFED, 2010).

Accordingly, the Adiha Irrigation Project was constructed with the objective of increasing agricultural productivity to improve the food security situation of the farming communities as a

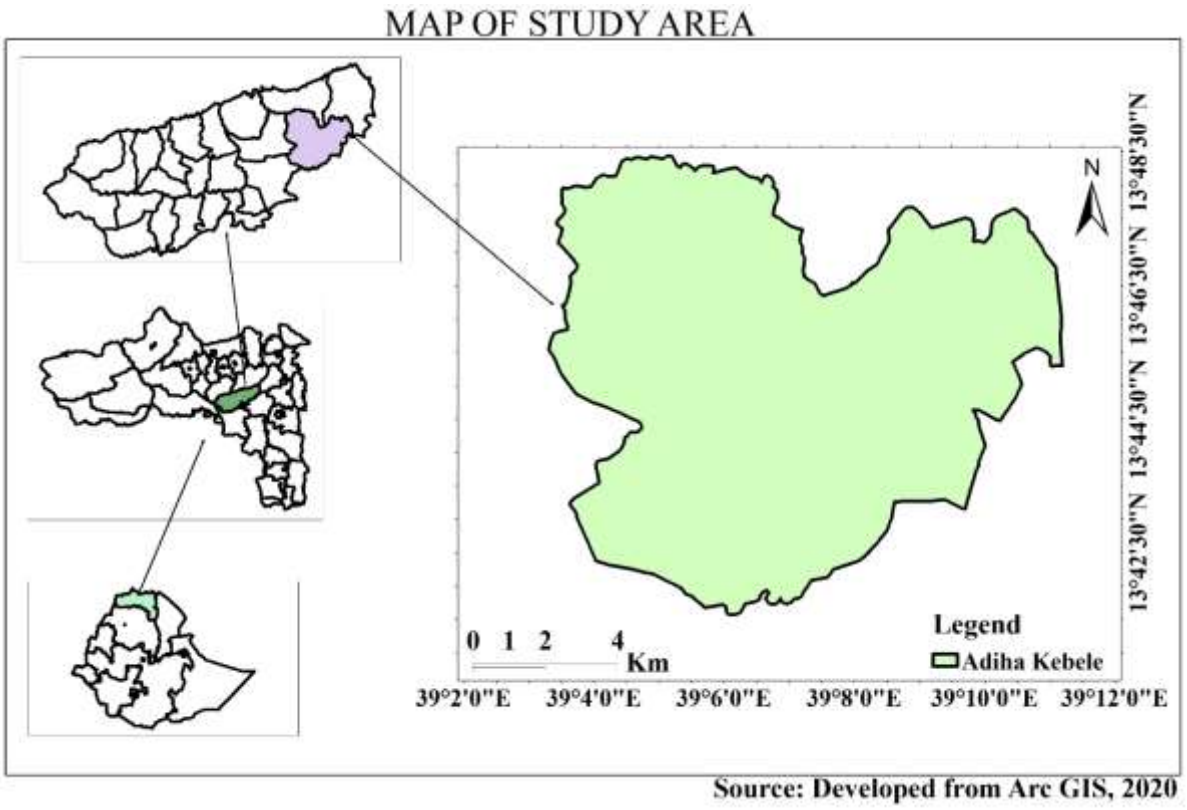
social solution to combat the repeated drought and to reduce dependency on the erratic rainfall. However, in spite of some indications of improvements on the ground, in the study area, there are not sufficient studies undertaken to assess the challenge and opportunities of small scale irrigation in Adiha kebele. Hence, this study was undertaken to evaluate the challenge and opportunities of small-scale irrigation on the food security status of the beneficiaries' by filling the knowledge gap.

The General Objectives of the study is to assess the challenges and opportunities of small scale irrigation in Adiha.

MATERIALS AND METHODS

Study area

Kola Tembein Woreda is located at the southern part of central zone of Tigray. It has 27 Tabias, 83 Kushet and found in the nearby town, AbiyiAdi which is 908 kilometers away from Addis Ababa. The Woreda of Kola Tembein is an enclave inside Tembein Woreda. The Woreda is bordered on the North by Weri-Leke, in the East Hawzen and Dega Temein, in the south Tanka Abergele and in the West Tse1emti and Naeder Adet. The woreda is one of the populous woreda in the zone. It has an estimated total population of 138,115 of which 68,377 are male and 69,738 are female. The woreda has a total of 26,494 households with an average family size of five people. Total area of the woreda is 147,000 hectare of which 31,021 ha., is arable, 2,252 ha bush land, 69,624 ha., grazing, 20,150 ha wasteland and others are natural forest, areas and residences (KTWARDB,2007). From the information above, it can be said that the majority of the population is living in rural areas making their livelihood from agricultural production. The major cereal crops grown in the area are maize, sorghum, teff and millets. Topographic condition of the woreda is mountains, plateaus, undulating and rugged characteristics. Its elevation ranges from 1200 - 2300 mas 1. Annual rainfall of the woreda ranges from 550 - 800 mm (the research site ranges from 400 0mm - 600mm) and rainfall type is erratic and uneven. Therefore, it is clear that moisture shortage is broadly seen in the woreda. Soil type of the area is mainly sand, and clay and silt loam that cover 62%,26%,3% and 9% respectively (KTWARDB, 2007).



Sample size and Sampling technique

To make the study more accurate and viable, determination of the appropriate number of sample size is important for the researcher. Therefore the researcher proposed (Kothari (2004), assuming 95% confidence level and e =0.05)) sample size of the study.

$$n = \frac{Nz^2PQ}{E^2(N-1) + z^2PQ}$$

$$n = \frac{1065\ (1.96)^2(0.9)(0.1)}{(0.05)^2(1065-1) + (1.96)^2(0.9)(0.1)}$$

$$n = 123$$

The researcher selected Adiha kebelle as a research site using purposive sampling techniques because of the no study has been conducted in the woreda regarding the challenge and opportunities of small scale on irrigation users.

The sample population was stratified into three groups, small landholder, medium landholder and large landholder as per the irrigation users only. Then, the sample has been drawn proportionately by using a simple random sampling technique. The overall sample size was

120 irrigation households. 60 from the small landholder, 52 from medium landholders, and 11 from large landholders. The sampling population has been drawn from a total of 1065 households in the irrigation group. Therefore, the sample size is believed to be representative and can generate reliable and empirical information since each group of households is homogeneous in their socioeconomic settings.

Data source and analysis

The study was used in both primary and secondary sources of data collection. To obtain the sufficient primary data, the researcher has used a well-designed;

Questionnaire (household survey) covered crop yield, cropping pattern, crop diversification, cropping intensity, landholding per household, number of labour days and household members engaged in the irrigated.

Key informant interview: choosing the experts and cluster coordinators of agrarian and DA's purposely to participate in detail on the study.

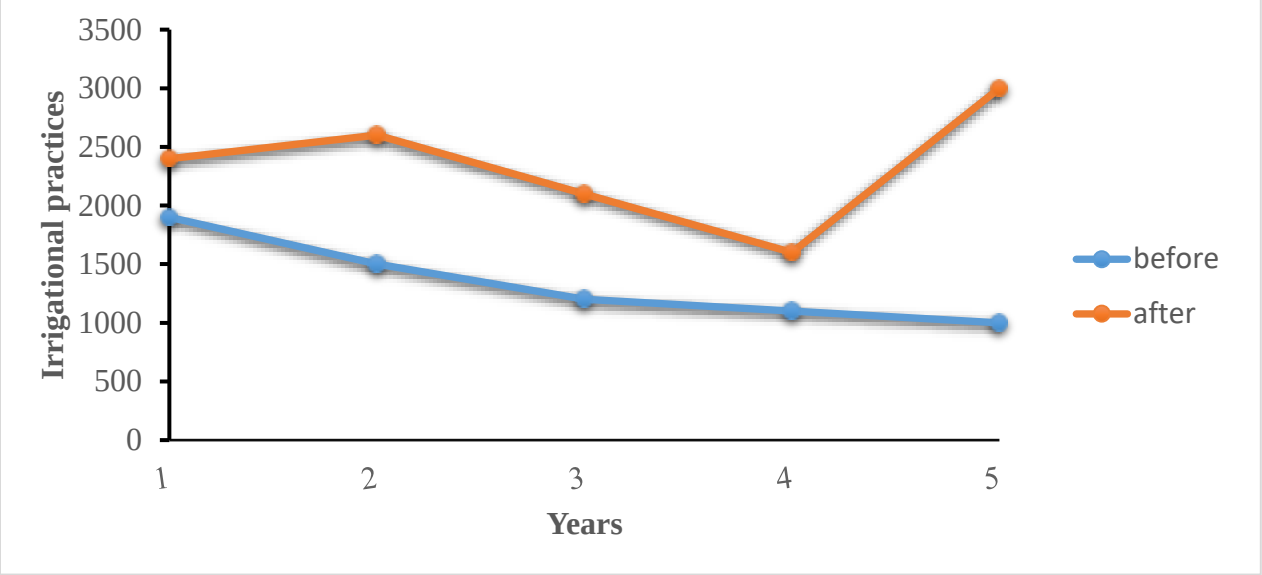
Direct observation: Observing the environment and lifestyle of the community.

Focus group discussion: Each focus group comprised six to nine individuals who are from the three irrigation landholders separately, that have something in common together with the information that had combined perspectives (opinions).

The research was employed a mixed approach and was generated in both qualitative and quantitative data. Qualitative research such as descriptive statistics (mean, median, standard deviation and pie charts, bar graphs) was used to describe the general characteristics and to compare the challenges and opportunities of small scale irrigation in the area. Quantitative research, such as statistical techniques, such as paired-sample t-test was employed to compare before and after irrigational practices per livelihoods of the irrigator households, the ANOVA was employed to compare the mean of three landholders per income, chi-square (x2) was applied to show the association of challenge and opportunities of small scale irrigation variables. Regression was applied to evaluate the dependent (irrigational product per kg) with independent variables such as; composed of Fertilizer per Kg, best seed, land size and trained manpower factors of small scale irrigation. Finally, the researcher was used Statistical Package for Social Science (SPSS) version 20 Software employed to analyze the data obtained.

RESULTS AND DISCUSSIONS

Figure 1. Before and after irrigational practice (types of crop, vegetation and fruit)



The interview questionnaire had a question which asked the key respondents on the current irrigational practice (such as types of crop, vegetation, and fruit) over the previous years (consecutive five years i.e. 2015-2019 which were respectively with 1-5 years). 100% of the respondents answered that; the current irrigational practice is better as compared to the previous years. They also pointed out that, previously, there was discourage irrigational practice every day for the whole day but currently they have irrigational practice more than twice a year. The findings show that the previous irrigational practice is worse compared to the current years.

Table .1 Numbers of potential and actual irrigational practice per ha

Paired Samples Test					
	Mean	SD	T -TEST	DF	P –VALUE
Potential irrigational practice	3298	720.95	-3.516	4	.025
actual irrigational practice	1702	442.18			

As defined by the pair of variables, there are five consecutive years to illustrate the average potential irrigational practice was 3298 and the standard deviation of potential irrigational practice was 720.95. While the mean of actual irrigational practice was 1702 and the standard deviation of

actual irrigational practice in m3 was 442.18. Since, it was statistically significantly associated with potential and actual irrigational practice in ha ((t= 3.516) degree of freedom was 4, p< 0.05)), .025 less than .05, to accept Ha. That implies that there was sufficient evidence to conclude that the irrigational practice in ha of potential and actual was deferent.

Table.2 ANOVA of income

Dependent Variable: income

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	6283225333.333[a]	2	3141612666.667	20.237	.000
Intercept	30312032666.667	1	30312032666.667	195.256	.000
Irrigational per land size	6283225333.333	2	3141612666.667	20.237	.000

a. R Squared = .771 (Adjusted R Squared = .733)

As shown in the table above the mean income of the irrigation areas from different land size (small, medium, and large) were different. Since the p-value is 0.000, we reject the null hypothesis and conclude that the mean income of the irrigation areas from different land sizes are not the same at 5% significant level and also R Squared = .771 and Adjusted R Squared = .733. Therefore, the smaller land size is having the lower the income and the larger land size they're having a large amount of income from irrigation practices.

Table.3 major factors that affect small scale irrigation practice

Pearson Chi-Square	critical value	Df	Sig.
1273.000	7.81	3	.000

As shown in table 4.4 there is a significant association between water using during irrigation practice and the causes of conflict X2(3, N=123) = 123.00, P< 0.05) since, x2 value 123 is greater than the critical value 7.81faced any conflict in irrigation water use were depending on the causes of conflict that's way one to other outcome were associated significant each other at df=3, p<0.05. In line with this, Hussain (2004) confirmed that access to reliable irrigation water can enable farmers to practice new technologies and intensify cultivation, leading to increased productivity, overall higher production, and greater returns from farming. This can open new employment opportunities and improve incomes in rural areas.

Table 4.4 Results of multiple regression

No.	Irrigation per hectors						
		R	R Square	Df1	Df2	F –value	P – value
1	Fertilizer per Kg	.875	.766	1	3	26.207	.001
2	Types of crops	.863	.745	1	3	23.345	.001
3	Trained manpower	.680	.463	1	3	6.894	.030
4	Land sizes	.959	.920	1	3	34.526	.010

The table above indicated that the selected variables that influence irrigation per hectors of farmers of the study area. In the stepwise multiple regression, fertilizer per kg was entered first and irrigation per hectors 76.60% of the variance in fertilizer per kg was influenced for irrigation per ha. Report from the table above, it was found there was a significant effect of the independent variable on the dependent variable on irrigation per ha df (1, 3) = .875, F= 26.207, and P< 0.05. Types of crops were entered second and irrigation per hectors 74.50 % of the variance in types of crops was influenced for irrigation per ha. Report from the table above, it was found there was a significant effect of the independent variable on the dependent variable on irrigation per ha df (1, 3) = .863, F= 23.345, and P< 0.05. Trained manpower was entered third and irrigation per hectors 46.30 % of the variance in trained manpower was influenced for irrigation per ha. Report from the table above, it was found there was a significant effect of the independent variable on the dependent variable on irrigation per ha df (1, 3) = .680, F= 6.894, and P< 0.05. Land sizes were entered last and irrigation per hectors 92.00 % of the variance in Land, sizes were influenced for irrigation per ha. Report from the table above, it was found there was a significant effect of the independent variable on the dependent variable on irrigation per ha df (1, 3) = .959, F= 34.526and P< 0.05.

CONCLUSIONS

Irrigation can enable farmers to adopt new technology, and intensive cultivation, leading to increase production, productivity, and greater return from the farm. Therefore, as it can be in the finding of the present study and in other literature elsewhere, the mean income of a farmer who

uses irrigation is significantly higher than rain-fed farmers. This study also revealed that households that used irrigation have got significantly larger mean annual income than their income practicing irrigation. In the study area, small-scale irrigation user households mean annual income increase which was a statistically significant and significant effect of the independent variable on the dependent variable on irrigation per ha. The users were practicing irrigation through those types such as a modern micro dam, motor pump, traditional river diversion, and treadle pump. And the type of input was employed the user's inorganic fertilizers, improved seeds, Manure, and Pesticide for the improvements of their production capacities with the help of Irrigation agriculture.

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