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Unravelling systems of inequality and debating pro-poor policy results in drought prone areas of South West Ethiopia

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A desk review, survey, interview and on-site observation were used to collect data. The impact of external systems on smallholder water scarcity management institutions in the context drought stress was analyzed in this study. The findings show that the external intervention eliminated resilient people's institutions such as water scarcity (in droughts). Interventions introduce new water management systems that fuel tension, conflict and water poverty. The local water management systems are sustainable and enhance social cohesion and trust while the new program-based institutional arrangements/systems are nepotic and corrupt in terms of ensuring equality and addressing needs of diverse beneficiaries. A local peoples' institutional approach is recommended to respond to climate change-induced stresses and such approach is capable of managing social, political, economic and environmental dimensions. Policy interventions need to consider a bottom-up approach to accommodate local specific context as well as built on existing local systems that ensure social cohesion among members of community. Interventions that meet pro-poor, inclusive and sustainable objectives need to adopt a human-rights based transformative approaches and such an approach inclusive and sustainable.

Key words: Institutional conflict, drought stress, pro-poor policy.

INTRODUCTION

Ethiopia has been facing droughts for millennia having diverse drought-prone, arid and drylands (Gezahegn, 2017; WVE, 2020). In the context of rain-fed farming system, the country considered irrigation farming as a strategy and expansion of small-scale irrigation schemes as pro-poor farm support (Oliveira et al., 2009; Poole et al., 2013). Irrigation farming contributes to 40% of the food and fiber production in the world (Asayehegn et al., 2011; van der Ploeg, 2014). Irrigated farming has shown huge expansion (500% hectares in irrigated land). About 40 to 270 million hectares of farm land are irrigated both to increase food production as well as reduce vulnerability to droughts and crop failures by enhancing resilience and adaptations to shocks in arid farm lands. Irrigation farming is a change in subsistence farming to produce enough food for growing population and

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industrial needs of our time (Oliveira et al., 2009; Cherre, 2010). In Ethiopia, rural households in drought shock-prone areas suffer from food shortage and receive food aid on an annual basis for many decades (OCHA, 2015; Chinigò, 2015; Gezahegn, 2020a, b). About five to ten million people on average receive food aid each year and the number of aid-recipients are increasing (Gezahegn, 2021b; Assefa et al., 2016).

The recent droughts, civil wars, political instabilities and resource-based rural conflicts increased food aid dependents by 45% since (FSCB, 2004; WVE, 2020)? In normal weather and market conditions, not less than five million receive food aid in Ethiopia over the past fifteen years. An average of 700,000 metric tons of food aid per annum has been imported to meet food needs of Ethiopia (MoARD, 2021; Gezahegn, 2020a). In the framework of PRSP, PASDEP and GTP I & II, range of donors collaborated and are collaborating with the Ethiopian government in both short-term (emergency) and long-term (individual and community asset building interventions) (MoFED, 2020; MoARD, 2011; Dorosh and Mellor, 2013; Alemu and Dufera, 2017; Gezahegn, 2021b). The small-scale irrigation schemes are part of these collaborative interventions to support smallholder farmers in drought-prone locations, including land restoration works, moisture retaining technologies and institutional systems and small-scale irrigations were considered as government food security initiatives (MoAD, 2021; Cherre, 2010; Assefa et al., 2016).

The small-scale irrigation schemes consider farm land potential in Ethiopia; which is between 3.7 and 4.3 million hectares (Awulachew, 2010; Gezahegn, 2021b; Assefa et al., 2016). The actual irrigated land is 7-10%, out of which 55% comprise traditional irrigation, 20% small-scale irrigation and 25% medium-to-large-scale irrigations (Asayehegn et al., 2011). Besides the low level of irrigation farming in Ethiopia, most modern irrigation schemes are not functional due to shortage of water or damaged structures or poor water institutional and management mechanisms (Tadesse, 2009; Oni et al., 2011; Assefa et al., 2016). Though irrigated farming creates jobs, expands farm surplus and incomes (Kedir, 2011; Asayehegn et al., 2011), and exapnds investment and local busineses (Oni et al., 2011), they could perhaps increase conflict, inequality and unsustainability in drought-prone areas. In such context, user-friendly local systems and social cohesion may better mediate water scarcities (Yaro et al., 2015) while external interventions consider these schemes as traditional demanding change (Regassa et al., 2019).

The study location is vulnerable to droughts; depends on rain-fed farming, is subject to land degradation and about 40% of the households receive food aid via productive, pay-for-work and relief aid schemes (Assefa et al., 2016; GZoARD, 2020; GoPDA, 2021). To resolve the food shortage and drought-impact, the government introduced small-scale irrigation in 1991; however the food aid dependence increased to 45% and new conflicts observed in these locations. Despite the empirical evidence showing that access to small-scale irrigation shemes inceases yields per hectare, income, consumption, local investment and business growth (Asayehegn et al., 2011; Wiggins et al., 2014), the food aid dependence in the locations, conflicts and tension, and land degradation increased. Despite empirical evidence also shows that access to small-scale irrigation can increase technology adoption (improved tecnology, farm practice and marketing) (Hagos et al., 2009; Oni et al., 2011), the evidence in this location has not been the case. Rather, about 89% of farmers rely on rainfall; suffer from droughts and lose 25 to 100% of crop yield (Assefa et al., 2016; Regassa et al., 2019; WVE, 2020). Despite the farm land and workforce potential, poverty (food insecurity) and water-based conflicts increased in the locations. The farm yield reduced and modern farm practices were not adopted by smallholder farmers in the location. Based on this background information, the study questioned the system of water management introduced by the irrigation scheme and its impact on local institutions, water-yield sustainability and inequality (Neef, 2009).

Local water management institutions and new irrigation interventions

Increased supplies of irrigation water increase food and fiber production to feeding growing populations by enhancing food security, improving incomes and living standards of farm households (Awulachew, 2010; Hussain et al., 2004; Oni et al., 2011; Gezahegn, 2021b). Irrigation helps farmers in water-scarce environments to overcome rainfall and water constraints, improves sustainable water supply for cultivation, and livestock and human nutrition (Aseyehegn et al., 2011). Depending on the irrigation size, cost and location, small-scale irrigation systems are often considered as pro-poor, equity and social protection interventions and effective and efficient to be managed at local levels (Yaro et al., 2015; Barrientos, 2016; Devereux et. al., 2011). Small scale schemes are thus provided primarily for subsistence framers and in drought-prone areas (Awulachew, 2010; Cherre, 2010; Assefa et al., 2016).

Empirical evidence shows that small-scale irrigation in drought-prone areas could damage the agroecosystem, reduce water yield, increase the management costs in the context of drought cycles and enhance environmental degradation (Abera, 2004; Oni et al., 2011). Small-scale irrigation schemes may increase water loss through seepage, irregularities in water use by upstream and downstream users, inaccessibility for farms away from the irrigation canals, produce marketing and transportation, land tenure security, managing irrigation systems, triggering competition among rain-fed and irrigated agriculture (Abera, 2004; Assefa et al., 2016) and finally loosening of community cohesion, levels of farmer participation and contradictions to local institutional systems (Belayneh, 2009; Hagos et al., 2009; Rahim et al., 2011; Tadesse, 2009; Yaro et al., 2015).

A study by Hagos et al. (2009) found that the expansion of small-scale irrigation schemes increased production, income and diet diversification in drought-prone areas of Oromia and Southern Nations Nationalities and peoples' regions of Ethiopia. The same study identified increase in farm investment, consumption, incomes and cash crop production. Hussain et al. (2004) identified that farmers with reliable access to irrigation water were able to adopt new technologies and intensified cultivation which led them to increase productivity and greater returns to investments on land. According to Hagos et. al. (2009) small-scale irrigation opens up new employment opportunities leading to improved farm and off-farm incomes and the quality of life in rural areas (MoARD, 2010).

Awulachew (2010) and Tadesse (2009) found that access to irrigation water improved household assets by more than threefold for irrigation water users as compared to non-users whose assets declined in the cycles of droughts. The association was significant at the 1% level and the difference-in-difference estimate suggested a 1.9-ton increase per households who have access to Irrigation water. Oni et al. (2011) revealed that irrigated farming improves household assets by improving household incomes and returns of farm investments. The study conducted by Abonesh (2006) using Heckman two-step procedure, the variables that are found to determine participation in irrigation are: nearness to the water source, household size, size of cultivated land, livestock holding, farmer's perception of soil fertility status and access to credit service (Assefa et al., 2016).

In Ethiopia in general and in the study area in particular, previous studies focused on the positive benefits of introducing small-scale irrigation scheme to beneficiaries in drought-prone locations and the negative impacts of such interventions are not given attention in scholarly investigations. On the basis of the benefits noted earlier, looking for sustainable access to the irrigation water and changes in jobs, income and choice is proposed in this study as motivation for more water and more outputs by upstream and downstream users and establishing the argument that interventions that do not consider local specificity, smallholder farmer-friendly institutional systems and considerations of doing "no harm" could lead to conflicts and tensions at one hand and enhance inequality, unsustainable use of water and increased land degradation. This means the pro-poor and equity-motivated objectives of the interventions could become enhancing inequality, elimination of local friendly institutions of water management (resource management) (Neef, 2009) and increase droughts, food-aid dependence and farm poverty among communities. Therefore, proper study of such gaps, documentation, and a search for recommendations on alternative intervention mechanisms were the motivations for this study.

RESEARCH METHODOLOGY

Data collection and sampling

The study employed a mixed methods approach with cross-sectional design which is recommended for grassroots and multiple interest-based information and data collection by scholars such as Creswell (2010, 2011, 2014), Kothari (2004) and McCall (2005). Qualitative and quantitative data (from primary and secondary sources) were collected on socio-demographic, socio-economic, policy and institutional variables to explain the impacts of the scheme on smallholder farmers' sustainable water, catchment land management as well as social cohesion and local peace in drought-prone locations observed.

Primary data were collected from irrigation water users and non-users using household survey (by employing a questionnaire), interviews (by employing interview guides) and on-site observations (by employing checklists). The questionnaire was administered for irrigation users and non-users while the guides and checklists were administered for experts, farmers, and local institutional leaders from the field. Secondary data were collected from unpublished documents including policy documents of concerned local and broader government offices. Irrigation user and an adjacent non-user household list was developed from local agricultural and irrigation office; a finite population sample size determination formula was employed to decide the number of respondents. Thus, 300 respondents were randomly selected from both user and non-user groups of households.

Data analysis and interpretation

Data collected were analyzed using descriptive and inferential statistics; appropriate tests were conducted to substantiate the impacts of the irrigation intervention on beneficiary households, the systems of water and catchment management as well as the local social cohesion and peace. The data were collected from appropriate respondents. The instruments of data collection were pre-tested and revised for consistency. Triangulation of evidence, data sources and methods were made to ensure cross-checking of data results and simultaneous validation of the information obtained. A step-by-step data collection and analysis was conducted. Therefore, assured reliability of the data sets and instruments was ensured while also the findings are believed to be valid and dependable to answer the questions and achieve the research objectives. The overall data collection, analysis and interpretation process ensured substantiveness of the evidence.

Descriptive statistics were used to analyze the socioeconomic, demographic and service equity aspects of the irrigation users and non-users as well as variations in impact of the intervention. The age, sex of household head, education level, dependency ratio, and family size in adult equivalent, were observed from demographic variables. The landholding in size, livestock holding in TLU and distance from market center were observed from socio-economic factors. The access to irrigation water, extension and credit services, land tenure and access to mass were observed from institutional variables. The water use (protection from crop failure and livestock loss in droughts), diversity in sources of incomes, livestock holdings, financial savings and farm investments were also observed in terms building assets and improving consumption in the context of continuous drought shocks. The analysis focused on the observed household's capacity to ensure consumption, offset drought effects on assets and recovery from drought effects. The descriptive statistics employed mainly include bivariate analysis, percentage and T and Pearson χ2-square significance tests. The qualitative data focused on the impact of the intervention on local social capital (cohesion and peace), local institution (elimination of farmer-friendly systems of water and catchment management) and conflicts among/between users and non-users of the irrigation water. Such an approach was employed and proved effective in substantiating evidence (Hunter et al., 2014).

Specification of variable associations

Using the irrigation water was defined as participation in the program. It is dependent variable that explains the positive improvements (as intended by the small-scale irrigation intervention). The independent variables include land size, livestock holding, new investments (Abonesh, 2006; Belayneh, 2009) leading to reduced drought effects on crops, increased crp/livestock productivity, incomes, consumption and savings. The socio-economic, demographic, institutional and environmental independent variables positively or negatively influence the impact of the use of irrigation waters; in terms of labour and capital investment, control of crop failures and livestock loss, and ensure the stability of the household assets in persisting droughts (Abonesh, 2006; Tadesse, 2009; Kedir, 2011). These associations manifest the pro-poor, equity and social protection support objectives of the intervention; but do not often include variables that explain the negative impacts.

The loss of local systems due to introduction of external intevention systems, the 'doing of harm" by interventions on local systems, socio-economic inequality, unsustainable resource use and damage to local social capital (in terms of local social cohession, conflict resolution and resource management) are not given attenion.

RESULTS AND DISCUSSION

Here presents and discusses evidence on the impact of small-scale irrigation on household asset building in drought-prone locations by comparing users and non-users of irrigation water constructed by the government. Demographic, socioeconomic, policy support service and access small scale irrigation water were analyzed against asset building (measured by owning corrugated iron sheets and livestock units, income and new investments). The analysis used descriptive statistics such as mean, percentages and standard deviations. T and pseudo $^{R}2$ were used to test reliability and validity of the evidence substantiated. The inferential statistic of a bivariate Chi-square, and a T test was used for generalization. The impact of irrigation water on household asset building was linked to descriptive and inferential data sets to conclude and answer research questions.

Households characteristics and changes in households assets

In rural agrarian literature, policy impact depends on age implying skill, experience, labor productivity and cost (liability) in drought shocks in the form of dependency ratio. Also, it can imply inefficient use of assets in and constraint to recovery drought shocks (Assefa et al., 2016). Table 1 shows that the mean age of the all-respondent category is 41.5 with the standard deviation of 11.9. Regarding households that use irrigation water and those that do not, the mean age was found to be 46.4 with standard deviation of 1.7 and 39.8 years with standard deviation of 1.1, respectively. The mean age difference is significant at less than 1% significance level (with t-value of -3.1 and p-value of 0.001). This indicates that since irrigation farming requires intensive labor, the famers in both groups are in the economically active age group; therefore, the farms of irrigation water are productive and these groups produce more than twice a year. This confirms the empirical findings that access to irrigation water can potentially increase farm productive and frequency of harvests (Cherre, 2010; Gezahegn, 2021a).

Regarding dependency ratio, in Table 1, the overall mean is 1.17 with standard deviation of 0.98 units. The mean for irrigation water users is 1.08 with standard deviation of 0.88; while for the non-users, the mean is 1.19 with the standard deviation of 1.02. Though the statistical difference for the users and non-users of irrigation water is insignificant at 1% level (with t-value of 0.40), the proportion of equivalence ratio is 1.2:0.98 (for each productive labor, there is 0.98 dependent to feed for irrigation users) while for the non-users the ratio is 1.2: 1.02 (almost 1 productive labor feeds one extra person); which in both cases confirm to the existing literature that with access to irrigation water and intensive farming, idle-labor reduces (Cherre, 2010)..

Babington (1999) argues that sex (gender) constrains individual woman's capability to overcome constraints of dignity, self-esteem and sustenance; these together eliminate women's ability to use available opportunities, transform constraints to benefits and expand possibilities (Sen, 1990). For a female household, in interface of intersectionality of external and local institutional systemic barriers, sex difference easily translates to disparity, inequality, discrimination and exclusion (Babington, 1999; Kabeer and Deshpande, 2019). On the other hand, institutions that mediate the use of productive time, access to new information and policy support start to work against women and give edges of benefit to men (Kabeer and Deshpande, 2019). However, literature also indicates that women's transformative change agency starts to flourish in constraints and women contribute to innovations, productivity and growth (Boserup, 1970; Cherre, 2010); however, in mainstream measures, these women's efforts (Assefa et al., 2016). The reason for the invisibility has been associated to gender-based systems of exclusion from targeting, participation, which further expands disparities in access to and control over resources, and prestige (Babington, 1999; Kabeer, 2016).

Table 1. Socio-demographic characteristics of respondents.

Continuous measures	Users (150)		Non-users (150)		Total (300)		t –value
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	
Age of HHH	46.4	1.7	39.8	1.1	41.5	11.9	-3.05***
Dep. Ratio	1.1	0.9	1.2	1.0	1.2	0.9	0.40

Discrete measures	Users (150)	Non users (150)	Total (300)	Ch^2
	N (%	N (%)	N (%)	t –value
Sex of HHH				
Female	4 (2.7)	146 (97.3)	150 (100)	0.02
Male	145 (96.7)	5 (3.3)	150 (100)	
Education level				
Could read and write	100 (66. 7)	98 (65.3)	198 (66.0)	0.01
Don’t read and write	50 (33.3)	52 (34.7)	102 (34.0)	
Family size				16.4812**
1-3	88 (58.7)	102 (68.0)	190 (63.3)	
4-6	57 (38.0)	44 (29.3)	101 (33.7)	
≥7	5 (3.3)	4 (2.7)	9 (3.0)	

***Significant level at 1%,**significant level at 5%.
Source: Own Computation of Field Survey Data (January, 2021)

When interventions remain gender insensitive, a policy that intends to benefit women may give males better opportunities to get targeted and involved with “relatively full information” (Crenshaw, 1989; Sen, 1990). In Table 1, the sex composition of irrigation water users shows clear gender disparity in access to “new” scheme; about 96.7% irrigation users are males as compared to 2.7% for females. In the non-user group, about 97.3% are females while only 3.3% are males. This further indicates that female heads of households do not have farm plots along the irrigation facility; however, the statistical result is not significant (Chi^2=0. 02, p=0. 874). As it is long argued by gender scholars such as McCall (2005) aggregate and categorical quantitative measures often hide women’s lived-experiences of exclusion in the development process and benefits. While Hancock (2007), Chant (2008) and Chant and Sweetman (2012) argue in the framework of feminizing exclusion, poverty and inequality rather than working with and expanding individual women’s agency.

In the literature, it has been clear that education enhances technology adoption, productivity of farm labor and returns to unit land (Cherre, 2010; Assefa et al., 2016). In this study, out of the total sampled households, slightly more than three in five (66%) could read and write while the rest could not. Comparing education level of users and non-users of irrigation schemes, slightly less than seven in ten (66.67 and 65.77 %) in both cases of households could read and write, respectively, while the remaining 33.33 and 34.23% could not, respectively. The statistical relation between access to irrigation scheme and education is statistically insignificant (Chi^2 = 0.0104, p = 0.919); because (1) there has been experience of traditional irrigation scheme and from experience farmers in the location practice irrigation and (2) the farmers whose farm plots are across the irrigation canals and facility have already access to the scheme.

Active labor is associated with farm productivity and land management leading to more incomes from a unit land (Gezahegn, 2020a). The family size for the whole respondent category shows that households with 1 - 3 persons are 63.3%, 4 - 6 are 33.7% and 7 and above are 3%. Regarding the irrigation users, households with 1 - 3 active labor were 58.7%, 4 - 6 were 38% and above 7 were 3.3%. For the non-users, 1 - 4 active labor is 68%, 4 - 6 is 29.3%, 7 and above were 2.7%. The average family size in adult equivalent was 4.82. This is slightly less than the national average (5) and regional average (6). The qualitative interview and on-site observation data show that active labor from non-user households allocate idle labor via seasonal migration to cities and places where wage work is available. The finding confirms with what Bryceson (2002) explains it as allocation strategy of labor allocation efficiency by smallholder farmers in poverty and crisis context; a strategy to reduce vulnerability to shocks.

The majority of farmers in rural Ethiopia derive their livelihoods from crop and livestock farming; and in drought contexts, these farmers face risk sets that increase their vulnerability to shocks and manifest in

Table 2. Socio-economic characteristics of sampled households.

Variable (Discrete)	**Users (150)**	**Non-users (150)**	**Total (300)**
Occupation of HHH	**N (%)**	**N (%)**	**N (%)**
Farming activities	138 (92.0)	126 (84.0)	264 (88)
Farming & related activities	12 (8.0)	24 (16%)	36 (12.0)

Variable (Continuous)	**Users (150)**		**Non-users (150)**		**Total (300)**		**T –value**
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	
Land size	1.1	0.1	0.7	0.05	0.8	0.61	-3.56***
Livestock	4.7	2.5	3.6	2.6	3.9	2.61	-2.24**
Market town	5.2	0.5	6.2	0.27	5.9	2.94	1.98**

Variable (discrete)	**Users (150)**	**Non-users (150)**	**Total (300)**	**Ch^2 value**
oil fertility	**N (%)**	**N (%)**	**N (%)**	
Infertile	73 (48.7)	100 (66.7)	173 (57.7)	3.95**
Fertile	77 (51.3)	50 (33.3)	127 (42.3)	

*** and ** indicate significant at 1 and 5%, respectively.
Source: Own computation of field survey data (January, 2021).

asset loss (Gezahegn, 2021b; Assefa, et. al., 2016). Data results in Table 2 below that from the overall respondent category, 88% of the observed households were engaged in farming and the remaining 14% were engaged in farming and related economic activities. However, the share of irrigation users that were mainly engaging in agriculture was found to be 92%. The remaining 8% of households were engaged in farming and related economic activities. Regarding the non-users of irrigation, 84% of the households were engaged in farming which the rest 9% engaged in farming related activities. The data sets in Table 2 below, regarding economic activity, irrigation users engage mainly agriculture than for the non-users, which indicates that the irrigation scheme associates with irrigation farming; and this confirms with the findings of World Vision (2021) in East Ethiopia (east Hararghe, Oromia).

Since land is key factor of production for crop growing and harvest (Dorosh and Mellor, 2013; Cochrane and Nigussie, 2018; Assefa et al., 2016), land size, proximity to irrigation canals, the application of inputs and new farm practices determine level of harvests, incomes and assets holding as buffer to offset drought shocks. The average cultivated land size holding of the total sampled household was found to be 0.77 ha with the standard deviation was 0.61 units. The average cultivated land size for irrigation users and non-users was found 1.05 with standard deviation of 0.11 and 0.67 ha with standard deviation of 0.05, respectively. In addition, the standard deviation for both groups was 0.1 and 0.05, respectively. The mean land size difference between the users and non-users is statistically significant at 1% level (t=-3.56, p= 0. 005). This finding confirms with the findings of Gezahegn (2020a), Assefa et al. (2016) and Cherre (2010).

Livestock in farm settings is instrumental for agricultural activity (as draught power) and the livestock products are both sources of income and balanced diet for rural farm households (Atena et al., 2020a). Livestock is also associated with endowments and savings for bad crop yield years and is a critical household asset (Chinigò, 2015; Devereux, 2006). Drought shocks in such setting affect rural farm households in diminishing their draught power, source of income, balanced diet, savings and capability for transfer of shocks (from crops to livestock-holding), making the livestock holding as buffer to and at the same time vulnerable to drought shocks when the dry spells prolong and affect livestock weights (Assefa et al., 2016). In Table 2 also, the average livestock measured in tropical livestock units was 3.86 with standard deviation of 2.61 units. The average holding was 4.65 with standard deviation of 2.48 and 3.58 with standard deviation of 1.61 units, respectively for irrigation water users and non-users. The statistical test is significant at 5% (t=-2.2431, p=0.03).

Proximity to nearest town center improves access to information on inputs, price, farm technology, administrative and policy supports (Poole et al., 2013; Wiggins et al., 2014; Assefa et al., 2016). The mean distance is 5.94 km with a standard deviation of 2.94 for the whole respondent groups. The mean average distance to the nearest town for users and non-users of the irrigation water is 5.15 with the standard deviation of 0.5 and 6.22 with the standard deviation of 0.27 units, respectively. The mean difference for irrigation water users and non-users is statistically significant at 5% level

Table 3. Access to services related to SSI by sampled households.

Variable (Discrete)	Users (150)	Non-users (150)	Total (300)	Ch^2
Credit access	**N (%)**	**N (%)**	**N (%)**	
No	27 (18.0)	68 (45.3)	95 (31.7)	
Yes	123 (82.0)	82 (54.7)	205 (68.3)	8.99*
Extension access				
No	31 (20.7)	28 (18.7)	59 (19.7)	
Yes	119 (79.3)	122 (81.3)	241 (80.3)	
Access to radio				
No	115 (76.7)	126 (64.0)	241 (80.3)	
Yes	35 (23.3)	24 (16.0)	59 (19.7)	

*** indicate significant at 1% probability level respectively.
Source: Own Computation of Field Survey Data (January, 2021).

but actual it is pseudo-association.

In literature, soil fertility affects crop productivity and increases invest injected on the farm plot (in financial and labor) based on experience whether the soil is easily ploughed, holds water and yield in the past (Gezahegn, 2020a, 2021b; Assefa et al., 2016). From Table 2, the data shows that out of the farm plots, for the overall respondent group, 57.7% believed their land is not fertile while 42.3% believed their soil is not fertile. From the irrigation water user group, 48.7 respondents do not have fertile land while 66.67% of the non-users do not have fertile soil. From the user group, 51.3% have fertile land while 33.3% from the non-user group has fertile soil. The Chi square test is statistically significant at 5% level (Ch^2=3. 95, p=0. 047) for the association between use of irrigation water and soil fertility.

Regarding access to services, farm credit solves financial constraints of farmers to invest as well as apply new techniques and purchase inputs (Cherre, 2010; Yaro et al., 2015). With access to credit, farmers purchase farm inputs, boost yields, diversify income sources and improve consumption (including food security) (Atena et al., 2020a; Chinigò, 2015). Farm households have limited credit sources and do not afford collateral criteria set by formal finance institutions (Clay et al., 1999; Gezahegn, 2020a, b). Therefore, rural cooperatives (finance, service and producers) unions and agricultural extension support offices offset the financial constraints of smallholder farmers (Yaro et al., 2015; Wiggins et al., 2014). These institutions provide credits on kind such as improved seeds, fertilizers and farm extension services and loan finance (Neef, 2009; Wiggins et al., 2014; Regassa et al., 2019). As indicated in Table 3, from the survey result, from the overall category, about 68.3% accessed credit and 31.8% did not access credit during the observation season. Access to credit for the users and non-users of irrigation water in the observation season was 82 and 54.7%, respectively. In the same order for users and non-users of the irrigation water, about 18 and 45.3% have not accessed credit, respectively. The Chi-square test result is significant at 1% significance level (Ch^2=8. 99, p=0. 003). The reason for those who did not access credit, from interviews and observations that lack of collateral, preference not to take risk and the high costs of credit loan, in rank order, expressed by the respondents. Also, from interview and on-site observations, households whose farm plot face interruption in access to irrigation water and those whose farm plots are far from irrigation canals did not opt for credit. But the households that do not have access to irrigation water (non-users) accessed credit in order to invest farm-product related services such as selling food and drink in market days.

Access to agricultural extension plays a great role in technology adoption and improvement in production (Regassa et al., 2019; Assefa et al.., 2016; Wigginset al., 2014). In Table 3, what can be observed is that out of the total sampled households, 80.3% accessed extension service and the remaining 19.7% did not get extension service support. Here agricultural extension service refers to advice, training and demonstration of agricultural techniques and displaying its productivity as compared to local farming techniques that the households were using for years.

In the same Table 3, 79.3 and 81.3% of the irrigation water users and non-users, respectively, had access to extension service during the observation season. The remaining 20.7 and 19.7% of users and non-users did not get access to extension service, respectively. In the literature, access to agricultural extension expands exposure to information on farm technologies, market prices and quality of farm products (Poole et al., 2013). Access to extension service almost the same to the two groups since extension service is a universal government support and services to smallholder farm households in all farming systems in Ethiopia (MoARD, 2021; Assefa et al., 2016). However, as observed in the site, from the interviews, the frequency of visits of extension agents to sampled households was associated to farming techniques adopted by the farmers. From the qualitative interviews, the experience is that extension agents frequently visit users of irrigation water; and these groups of farmers harvest increased crop yields per hectare and cultivate more than two times in the year.

Access to mass media is supposed to benefit farmers in access to useful information about available and working agricultural technologies and market information (Poole et al., 2013; Assefa et al., 2016). The mass media considered here were access radio program on agriculture and marketing which is widely accessible in all rural areas of the country. Radio has been important media for rural households in the area. The data on this, in Table 3, show that out of the total sampled households, 46.3% had no access to radio and the remaining 53.7% had access to radio program focusing on agricultural technologies and marketing. For those who owned radio, the frequency of attending messages for the users of irrigation was relatively higher than that of the non-users. About 76.7% from the uses and 16% from the non-users of irrigation water own radios and listen to farm information every day. While 23.3% from the users and 64% from the non-users of the irrigation water do not own and do not follow information. However, regarding information relevance, none positively replied to this.

From the interviews and onsite observations, the respondents informed that messages on relevant farm techniques and information are required on daily basis while on market price are relatively useful on weekly basis since rural market center work on weekly basis in the area. The service is specifically frequent and relevant based on farm (on input, seedling and pest handling) and in the harvest seasons the practice was aimed at reducing harvest grain losse). Even if users of irrigation water have a better access to media than non-users, the association is statistically insignificant (Ch^2=0. 92, p=0. 34).

In general, the data results in Tables 1 to 3 clearly imply planned discrimination in service provision to irrigation users and non-users; leading to increased inequality and differentiation among farm households in drought-prone locations. It further implies that interventions can have positive outcomes (such as improvements in productivity, etc.) but also “do harm” to non-beneficiaries of the intervention (Wiggins et al., 2014). If gender and other exclusion analysis is not conducted, new facilities, targeting and provision arrangement exclude the non-beneficiaries; and when new institutions and systems are introduced, without attention to the local context, new forms of tension arise leading to conflicts (Assefa et al., 2016). Therefore, the study found that small-scale irrigation intervention that was considered pro-poor, pro-equity and pro-social protection scheme in drought contexts; however, the initiative increased inequalities among beneficiaries and non-beneficiaries (Wiggins et al., 2014). Thus, this specific intervention has done “harm” to local people.

The modern irrigation water and facility management systems

Management of small-scale irrigation is considered essential for sustainable water utilization and increasing allocative efficiency of water in empirical and policy practice literature (Atena et al., 2020a; Assefa et al., 2016).

From the response of the irrigation users and non-users on the management of irrigation water, irrigation water adequacy, reasons for the inadequacy of irrigation water and the modern irrigation canal management as compared to the traditional ones were assessed. The response rate on the adequacy of irrigation water for crop cultivation was that out of the total irrigation users and non-users, as indicated in Table 4, 67.3% of users have responded that the irrigation water was not enough. The remaining 32.7% responded that the water was enough; but the respondents in this group were households that are residing in the upper streams and next to the irrigable water reservoir. Both the water users and non-users were asked to rank in order of criticality of the main causes for the inadequacy of the water yield. The aggregate rank order of the two groups showed that the reduction in the volume of the river water in the dry season was the first cause; hence, the water yield is not enough.

The reasons for the reduction of the river water are related to the weak yield of the springs across the mountains; but as forests and grasses vanished; and the mountain range changed to farm plots and the gullies. The weak enforcement of water users’ rules, schedules and exclusion of households that previously use irrigation water by the traditional canals was the second cause of inadequacy in downstream and plots away from the new irrigation canals. The third cause was water wastage in the irrigation canals that were not maintained in time; this was confirmed by 69.3% of users and 89.3% of the non-users. Also, considerable respondents, 31.7% from the users and 10.7% from the non-users claimed the canals were maintained timely. From the total category, 20.7% claim that the canals were maintained timely while the rest 79.3% were skeptical of timely maintenance of the canals. Also, water seepage is high and illegal water users increased; even by damaging the canals and diverting the water to traditional canals for plots far away from the new facilities. From the interview and on-site observation sessions, problems raised were that greedy upstream users are not willing to allow the irrigation water to cross their farms and, thus, those next to the dam and canals are growingly engaging in water-intensive crops such as growing banana trees. Thus, neither the upstream nor downstream users consistently use the

Table 4. Access to services related to SSI by sampled households.

Variable (Discrete)	Users (150)	Non-users (150)	Total (300)
Water yield declined after the scheme	N (%)	N (%)	N (%)
Yes	101 (67.3)	-	101 (67.3)
No	49 (32.7)	-	49 (32.7)
Canal not maintained timely as before			
Yes	104 (69.3)	134 (89.3)	238 (79.3)
No	46 (31.7)	16 (10.7)	62 (20.7)
New scheme excluded past users			
Yes	115 (76.7)	134 (89.3)	249 (83.0)
No	35 (23.3)	16 (10.7)	51 (17.0)
Traditional canals not functioning			
Yes	121 (80.7)	131 (87.3)	252 (84.0)
No	29 (19.3)	19 (12.7)	27 (16.0)
Water scarcity increased conflict			
Yes	135 (90.0)	139 (92.7)	274 (91.3)
No	15 (10.0)	11 (7.3)	26 (8.7)
No catchment work as before			
Yes	144 (96.0)	141 (94.0)	285 (95.0)
No	6 (4.0)	9 (6.0)	15 (5.0)

Source: Own Computation of Field Survey Data (January, 2021)

irrigation water because of the decline in yields. From the field observation, the issues were observed and found that in the irrigation scheme, the diversion weir was filled by sand during the heavy rain and over flooding. The sand accumulation was not cleaned and the damaged facilities were not maintained.

The interview participants said that the accumulated stone and sand was difficult to clear manually unless government assists the community with machines. In the field also observation was made on the situation of canals. It was found that the primary and secondary water delivery canals were covered by grass which indicates that water is not flowing to farms and the major problem is the lack of maintenance in time. The respondents prioritized this issue into four areas: first, the participation of users was less; second, there is weak rule enforcement for water use; third, there is weak water coordination at upstream and downstream; and finally, the new system of the water management eliminated the traditional systems respected by the local residents. Besides the lack of farmers' respect and trust in the new system, as interview respondents reiterated, the new system introduced corruption and nepotism among local government authorities and greedy-individuals. Thus, the technical and management aspect of irrigation water needs to be strengthened and the aforementioned four areas are of policy concern; specially giving due attention to previous farmer-friendly enforcement systems.

The irrigation water users and non-users were asked whether the new facility introduced excluded previous users, whether traditional; irrigation canals still function, whether land restoration works in the river catchment is still undergoing and finally whether the new irrigation system enhanced social cohesion, reciprocity in the use of resources and whether there is any conflict after the introduction of the irrigation facility in the location. In general, respondents from both groups that engaged in the interview and observation sessions agree that the scheme improved farm productivity, grain surplus, intensification of cash crops such as banana and improvements in consumption, incomes and food security of the irrigation scheme beneficiary households. However, in respect to answers to the aforementioned questions, survey questionnaire respondents from both groups indicate that 76.7 and 89.3% of irrigation water-users and non-users, respectively said that the new facilities excluded households that traditionally practice irrigation farming and 80.7 and 87.7% of irrigation water-users and non-users, respectively said that because of the new facilities, the traditional irrigation canals stopped functioning. After the introduction of the new facilities, 90 and 92.7% of respondents believed that conflict over water use increased, reciprocal social cohesion of people declined and is increasingly replaced by individualistic and myopic relations; and thus, the new scheme increased problems which is not the case before in the location; even in the time of critical drought shocks. Finally, the age-old practice of river catchment development work tradition (system); which were useful for managing the community forests were gradually replaced by myopia. Finally, from users, 96% believed that catchment rehabilitation practices of the past were not observed and 94% of the non-users agree on these same issues.

From the data aforementioned results, though the scheme has been useful for beneficiary households, in its beginning, now, the benefits are not as before; since the water yield is declining, the systems of corruption and nepotism replaced reciprocal social relations and thus growing water-based conflicts in the locations. The finding here further implies that the positive intentions of the scheme have gradually created harm to local reciprocal and farmer-friendly as well as respectful and trustworthy local systems of water and land management to myopic and unsustainable; yet nepotic and corrupt systems. Thus, the new intervention gradually eliminated local working systems, enhanced inequality, exclusion and unsustainable use of land and water resources in the context of persisting droughts in the location.

CONCLUSION AND RECOMMENDATION

This study analyzed the causes of tensions and conflict among/between irrigation water users and non-users in the study location and inquired why the tensions exist despite the institutional mechanisms in place from the outset of the project. After primary and secondary descriptive, inferential and qualitative data analysis, the study found that the scheme improved farming practices, incomes and consumption of beneficiary households; especially for upstream beneficiaries. It also improved assets, assets of the irrigation beneficiaries. However, the introduction of the scheme also introduced myopic, corrupt and nepotic new systems replacing local reciprocal, inclusive and farmer-friendly systems of water and relationship management in the context of droughts. This caused water wastage, undermined water security and become a cause for conflicts at local levels over the scarce waters. As opposite to what was expected as outcomes of the schemes, which was improvements in food security, equity in access to farm inputs, the intervention increased inequality, conflicts and decline in social cohesion and reciprocity among households in the location.

The introduction of new systems with the intervention eliminated the age-old local institutions while introducing “greed”, corruption and nepotism to the local culture; which were not existing in the previous reciprocal institutional systems of the people. Therefore, interventions at local levels need to integrate the local institutional values and systems; otherwise, interventions that are intended to generate positive outcomes turn to “doing harm” to local people, increase differentiation (leading to more inequality and exclusion) and waste efforts of actors and scarce resources.

Furthering empirical research and policy information is required to synthesize and document available best practices in irrigation water use and conflict transformation in drought-prone locations. Specifically, best ways of integrating local institutional systems and implementing conflict-sensitive development need assessment, planning, implementation, evaluation and dissemination of lessons is of academic, policy practice, advocacy and media concern in revisiting pro-poor and equity policy actions. Finally, participatory action-research, tailored awareness, locally customized intervention and holistic participation of stakeholders should be given attention including similar intervention domains.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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