Impact Evaluation of FDW Project in Ethiopia providing Sustainable Water Services in Harari Region (SWSH)

SECTION TWO: Report on Baseline and Follow up Surveys OF Urban and Peri-Urban Households (2015 and 2017)

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1. Introduction

This part of the evaluation exercise is based on a longitudinal household survey conducted in urban and peri-urban areas of Harari People National Regional State (HPNRS). The first round of data was collected before the implementation of the Sustainable Water and Sanitation for Harar Region (SWSH) Project (hereafter 'the Project) in 2015 and it serves to understand the baseline socioeconomic characteristics and main sources of water in the study area. After the intervention was launched, the follow up survey was carried out in 2017. The study participants include treatment households that were expected to directly benefit from the SWSH project. A 'pipe-line sample' of control households was identified that were not initially targeted by the project and would be used to compare differences in outcomes with the intervention sample.

The SWSH urban water supply Project intervention targeted 25,000 people with five different types of activities:

i) Rehabilitation of water tankers to deliver water to a number of points where piped water is in short supply. This is linked to the rehabilitation of ROTO storage/distribution facilities.
ii) Shared yard metered provision aimed at small group collective provision where two to five households lived in close physical proximity.
iii) Water point metered provision available to wider local populations in 'peri-urban' areas judged to have deficient piped water supplies at present.
iv) 'In-house' metered provision. These households are located between households with existing 'in-house' piped water provision and therefore not suitable for 'shared yard' provision.
v) Institutional improved water provision to three institutions.

Based on these different forms of provision, households are categorised into different categories. In what follows are presented the sampling frame, strategies and the data collection in practice for interventions where beneficiary households could be clearly identified.

2. Sampling frame and sampling strategy for urban shared yard-points

Sampling frame: The Harar water authority (HWSSA) categorises urban and peri urban population into different groups based on types of intervention and areas where beneficiaries are found. The urban households for 'shared-yard point' interventions were identified by local government authorities on the general criteria of lack of direct access to piped water and local perceptions of socio-economic deprivation (too poor to pay for in-house connection). The selected households for interventions were grouped into two phases for implementation purposes which allowed a 'pipeline' sampling frame for our evaluation household survey.

Sample households were selected using a proportionate simple random sample (proportionate to number of households targeted for 'shared-yard points'). A sample percentage of 10% was considered sufficient to give sufficient representativeness and power in assessing impact given the probable homogeneity in key variables of the

beneficiary households in the two time-separated cohorts. The claim of homogeneity was tested ex post in the data analysis

Sampling and data collection in practice: The target population was initially identified from a mixture of HWSSA records of 'shared yard point' target households in the early and later intervention woredas, mainly using 'soft' copies in English (augmented by 'hard' copies in Amharic). A random sample of households proportionate to number of target households in each cohort was drawn (see Table 1). The sample was geographically divided and teams of 2 to 3 interviewers (who had been trained for one and a half days) were given manageable numbers of potential interviewees for each day's work and fully debriefed at the end of each working day. In order to ensure gender sensitivity all interviewers were women and women were the priority interviewees.

Where cases in the sample were not found (urban households' numbering is somewhat imprecise and names can be ambiguous), then substitutes were found through a new random selection, again broadly proportional to number of cases missing in each kebele.

Sampling frame and sampling strategy for urban individual connection

Sampling frame: In this category were found urban households who were not suitable for shared yard-points for reasons of location or risk of social discrimination. Households were identified as the poorest of the poor and/or with diagnosed HIV/AIDS. Lists of these households for HWSSA were collected from kebele officials. The sampling approach used for households receiving individual connections was the same with 10% from the total listed households selected using simple random sampling (see Table 1).

3. Sampling frame and general sampling considerations for peri-urban households

Sampling frame: HWSSA divides the peri urban population into different groups based on areas where beneficiaries are found and by two implementation phases. Some categories do not have access at all to safe water and some have limited access. The four selected 'peri-urban' categories proved different in ethnic and socio-economic characteristics. The selected locations included 'villages' with livelihoods based on agricultural activity and 'suburban dormitories', where virtually the whole working age population went to Harar town for economic activity. We identified the proposed water points (with help of HWSSA) for each category. Starting from the site of each selected 'waterpoint', interviewees were identified through a random 'paces' method (10 to 200 paces) moving away from the 'waterpoint' site in four orthogonal directions with an arbitrary starting direction.

The sample distribution of panel data by category and survey year is reported in Table 1. Total number of households in the baseline period (2015) was 339 while the follow up survey (2017) found 317 households of the 339. Thus 22 (6.5%) households were not found in the follow up survey. The baseline study contained 121 households from the urban area and 142 households the from peri urban area. In both urban and peri urban areas, second phase control households were fewer than first phase treated households, with the difference more evident in peri urban areas. In the first phase

baseline and second phase 'impact' surveys, the sample sizes of individual household connections were 37 households and 39 households, respectively.

Table 1: Sampling distribution by category and survey year

No	Category	Baseline survey (2015)			Follow up survey (2017)			Sample attrition in the follow up survey	
		Treatment	Control	Total	Treatment	Control	Total	Treatment	Control
1	Urban yard-point	64	57	121	57	53	110	7	4
2	Peri urban[1]	81	61	142	79	52	131	2	9
3	Household connection (poorest of poor)			37			37	0	
4	Household connection (HIV/AIDS)			39			39	0	
Total				339			317	22	

Source: HH survey, 2015 and 2017

4. Empirical approach to impact evaluation

In order to examine the impact of the intervention, comparing the average outcomes between treatment and control groups; the study used micro econometric techniques. The impact of the SWSH project in improving the livelihood of communities was assessed using the difference in difference approach. These analyses were conducted using before after and treatment comparison study design. Beneficiaries of water supply project were considered as treatment group (*T*) and those who were not supposed to be directly benefited from the intervention categorized under control group (*C*).

The available panel data which include the baseline information support the impact identification strategy by measuring change in the outcomes before and after the intervention. Therefore, the difference in difference estimates are done considering the following specification:

$$DID = (Y_{TA} - Y_{TB}) - (Y_{CA} - Y_{CB}) \quad \ldots\ldots\ldots\ldots\ldots (1)$$

Where *DID* refers to difference in difference estimates that would be obtained by subtracting the overtime change in outcomes for control group (ΔY_c) from the overtime change in the outcomes for treatment group (ΔY_T). *Y* indicates different outcomes that

[1] Treatment status of one sample household from peri urban category is not known and excluded from the above Table. Including this household, total sample collected during the baseline survey was 340 and in the follow up was 318. Due to lack of clear implementation plan in categories 3 and 5, it was not possible to identify control and treatment households. Source: HH surveys, conducted in 2015 and 2017.

are expected to be affected with the intervention. The analysis considers different outcomes such as quantity of drinking water consumed, travel time to fetch water, episode of diarrhea, water treatment cost and medical expenditure. The evaluation also examined the effect of the intervention on absenteeism from work and school due to diarrhea as well as on availability and use of improved toilet facilities. In the above equation, *B* indicates outcomes for the baseline period (2015) and *A* stands for the values after the intervention in the follow up study period (2017).

For practical matters and in order to consistently predict *DID* estimators using regression technique, the study run the following model.

$$Y_{ht} = \alpha + \beta_1 Treat_{ht} + \beta_2 Year + \beta_3 (Treat_{ht} * Year_{ht}) + \varepsilon_{ht} \ldots\ldots\ldots (2)$$

This model regress outcome (Y_{ht}) for household *h* and in time period *t* on treatment status (*Treat*) and survey period (*Year*) as well as the interaction between the two explanatory factors. In equation (2), α and β_i's are coefficients to be estimated and the final term is the error term. Among the coefficients to be estimated, β_3 shows the difference-in-difference estimator (that is *DID* in equation 1) which shows the effect of being exposed to the intervention on the dependent variable under consideration. If the intervention strongly predicts change in the outcome, β_3 will be statistically significant.

It should be noted that in order to ensure validity of *DID* estimator parallel trend assumption should hold. This requires that in the absence of the intervention, the outcomes for treatment and control groups should move in the same direction or follow the same path (Ravallion et al., 2005; Lechner, 2011). In order to check parallel trend assumption, it requires trended baseline data collected for more than one time which is not available for this study. The effect of omitted variables is the other concern of the specified model. Equation (2) by design cancel out the effect of time invariant factors. However, there could be still time variant confounders that could explain the outcome and correlates with the treatment status. In order to account for the effect of such factors and as a sensitivity analysis, the study also conducted multi variable regression analysis after controlling for different covariates as shown below:

$$Y_{ht} = \alpha + \beta_1 Treat_{ht} + \beta_2 Year + \beta_3 (Treat_{ht} * Year_{ht}) + x_{ht} + \varepsilon_{ht} \ldots\ldots\ldots (3)$$

In equation (3), x_{ht} includes a set of household and community level characteristics that were requested during the data collection process. In this regard, demographic composition by age group and household size were controlled. The socio-economic status of the households was indicated by monthly household cash income category. Experience of diarrhea episodes among household members was also included in equation (3). Number of difficult days in obtaining water used as a measure of access to water. The other covariates include availability of sanitation facilities and hygiene education. Finally, location dummy for household living in peri urban area is also included to account for difference in the outcomes between urban area and peri urban area.

5. Characteristics of Households

This section provides background information about the characteristics of households included in the study. Accordingly, it first describes demographic characteristics of the sample individuals by gender and age groups. Then, it presents sources of cash income to the households and amount of cash earned in one-month recall period. Finally, sources and quality of water used by the households are compared. In order to provide detail understanding on demographic and economic conditions of the sample households, different variables of interest are reported based on household location/intervention types (five categorical groups) and treatment status (treatment vs control).

5.1 General demography

The baseline survey in urban and peri urban areas of Harari region included 340 households with 1619 total household members of which 52.5 percent were female. Among the total individuals about 58.7% (both females and males) are categorized in a 'productive' age group (16-59 years). The proportion of household members in an elderly group was 6.3%, while children aged 15 and below accounted for 35% (see Table 2).

Table 2: Sample individuals by category and age group in the baseline survey

Group	Female				Male				Total
	Age 0-5	Age 6-15	Age 16-59	Age 60+	Age 0-5	Age 6-15	Age 16-59	Age 60+	
Urban	20	44	158	37	16	43	160	14	492
Peri urban	69	119	206	9	72	112	192	21	800
Urban poorest of poor	4	20	60	3	4	12	41	3	147
Urban householdHIV affected	5	18	67	11	2	7	66	4	180
Total	98	201	491	60	94	174	459	42	1,619

Source: HH survey 2015

As shown in Table 3, the number of baseline sample individuals found in the follow up survey fell by 10% (155 individuals) as compared to the baseline survey. In the different age groups, the largest reduction is observed in productive age group (Age 16-59) which is 99 females and 110 males, probably due to emigration.

Table 3: Sample individuals by survey year and age groups in the panel

Survey year	Female				Male				Total
	Age 0-5	Age 6-15	Age 16-59	Age 60+	Age 0-5	Age 6-15	Age 16-59	Age 60+	
2015	98	201	491	60	94	174	459	42	1,619
2017	69	244	392	59	71	249	349	31	1,464

Difference (2017-2015)	-29	43	-99	-1	-23	75	-110	-11	-155

Source: HH surveys, conducted in 2015 and 2017

Across all categories, there are relatively more females as compared to males. The proportion of elderly in the peri urban sample is lower than urban partially explained by the proportion of children under 16 years in the peri urban sample is more than twice the urban. The household size in the urban sample categories (4.16) is significantly lower than in the peri-urban area (6.76).

Table 4: Summary statistics for age groups and HH size

	All urban	Peri urban	Total
Less than 16 years	23.8	46.5	35.0
16-59 years	67.4	49.7	58.7
60 and over years	8.8	3.8	6.3
Female proportion	54.6	50.4	52.5
Mean HH size	4.16	5.60	4.76

Source: Computed from Tables 2 and 3.

When we see sampling distribution across study areas, 492 household members were surveyed in the yard-point urban groups with 220 household members categorized under treated and 272 household members are grouped under control group (see Table 5). On the other hand, 796 household members were surveyed in the peri urban of which 345 members are treated and 451 individuals are control.

Table 5: Sample individuals by age group and treatment status in the baseline survey[2]

	Female				Male				
Urban	Age0-5	Age6-15	Age16-59	Age60+	Age0-5	Age6-15	Age16-59	Age60+	Total
Treatment	9	26	71	25	9	17	56	7	220
Control	11	18	87	12	7	26	104	7	272
Total	20	44	158	37	16	43	160	14	492
Peri urban									
Treatment	25	48	91	4	36	51	82	8	345
Control	42	71	114	5	36	61	109	13	451
Total	67	119	205	9	72	112	191	21	796

Source: HH survey 2015

[2] Total sample individuals from per urban area are 800 but the treatment status of one household containing four members is not reported and these household members are excluded from the Table.

In terms of gender, among the total surveyed urban population 52.6% are females (see Table 6). In relative terms, the share of females in control households is higher than treated households. The proportion of individuals in productive age group (16-59 years) in treatment group is greater than control group while the dependent age group is lower in treatment households. The average household size for all urban groups is 4.07. As compared to control group, average household size is higher in treatment households.

Table 6: Summary average figures by treatment status in the baseline survey

		Treatment	Control	Total
Urban	0-16	22.8	27.7	25.0
	16-59	70.2	57.7	64.6
	60+	7.0	14.6	10.4
	Female proportion	47.1	59.5	52.6
	Mean HH size	4.25	3.86	4.07
Peri urban	0-16	46.6	46.4	46.5
	16-59	49.4	50.1	49.7
	60+	4.0	3.5	3.8
	Female proportion	51.4	48.7	50.4
	Mean HH size	5.57	5.66	5.60

Source: Computed based on Table 5.

When we come to peri-urban survey, gender distribution between females and males is nearly the same as 50.4% is female. In terms of age group, the proportion of individuals in different age groups is similar between control and treatment households. The average household size for all peri urban groups is 5.6. considering treatment status, the average household size of treatment group (5.77) is slightly more than the control group (5.66) (see Table 6).

Reviewing the comparative demographic baseline statistics, there is a clear difference between urban and peri urban household characteristics that suggest it would be inappropriate to combine the two sets of households into a single sample. Within the urban and peri urban samples, there are differences between treatment and control sub-samples (greater in the urban). But it is difficult to identify systematic biases that might significantly influence responses to the Project interventions, but the differences do suggest caution is needed in making strong claims about the impact of the interventions.

Source and level of cash income

Most households rely on agriculture/livestock as their main source of income. This accounted for 30% from the total respondents. It is reported that the other main source of income is daily labour. Whereas the least frequent source of income is craft worker (see Table 7).

Table 7: Main sources of cash income in the last three months for urban and peri urban households

Main source of cash income	1st rank	2nd rank	3rd rank

Agriculture/livestock	104	7	1
Trader (food/non-food items)	53	23	2
Craft worker	13	9	1
Daily labourer	72	20	2
Remittances	20	12	0
Other/no clear response	85	7	1
Total	347	78	7

Source: HH survey 2015.

The most important source of cash income for all urban households are trade and daily labour (see Table 8). It is noted that 61 out of 205 total households depend on daily labour as a primary source of cash income. Very few respondents reported that their main source of income is Agriculture with Livestock and Craft worker. In the 2nd rank no one reported Agriculture/Livestock as source of income. Whereas nobody identified Trade and Remittances in the 3rd rank.

Table 8: Main sources of cash income in the last three months in urban areas including category 3 and 5 (number of total respondents)

Main source of cash income	1st rank	2nd rank	3rd rank
Agriculture/livestock	9	0	1
Trader (food/non-food items)	40	9	0
Craft worker	9	8	1
Daily labour	61	11	1
Remittances	19	9	0
Other/no clear response	67	5	1
Total	205	42	4

Source: HH survey 2015.

Disaggregating income sources by treatment/control status reveals a slightly different story (see Table 9). The first specified source of cash income is Daily Labour for treatment and control. But Trade for the treated group and Remittances for the control group are reported as significant sources of cash income. As might be expected, the least important source of cash income for urban households is the same for treated and control which is Agriculture with Livestock.

Table 9: Main sources of cash income in the last three months in urban area by treatment status (number of respondents)

Main source of cash income	1st rank	2nd rank	3rd rank

	Treatment	Control	Total		Control	Total		Control	Total
Agriculture/livestock	2	1	3	1	0	1	0	0	0
Trader (food/non-food items)	15	6	21	3	3	6	0	0	0
Craft worker	3	4	7	5	1	6	0	0	0
Daily labour	17	20	37	4	2	6	0	0	0
Remittances	5	11	16	2	2	4	0	0	0
Other	23	16	39	2	1	3	1	0	1
Total	65	58	123	17	9	26	1	0	1

Source: HH survey 2015.

But in the peri urban sample, Agriculture/livestock is by far the most important source of cash income (66.9%). The least mentioned primary source of cash income is Remittances. In the 2nd rank Trade is the most important cash income source (see Table 10).

Table 10: Main sources of cash income in the last three months in peri urban sample (number of total respondents)

Main source of cash income	1st rank	2nd rank	3rd rank
Agriculture/livestock	95	7	0
Trader (food/non-food items)	13	14	2
Craft worker	4	1	0
Daily labour	11	9	1
Remittances	1	3	0
Other	18	2	0
Total	142	36	3

Source: HH survey 2015.

Main source of cash income in peri urban area by treatment is elaborated in Table 11. Majority of treatment and control households in peri urban group responded that their most important source of cash income is Agriculture/livestock. The least mentioned source of cash income is Remittances (1 out 80 households for treated and null for control group).

Table 11: Main sources of cash income in the last three months in peri urban by treatment status (number of total respondents)

Main source of cash income	1st rank			2nd rank			3rd rank		
	Treatment	Control	Total		Control	Total		Control	Total
Agriculture/live stock	53	41	94	5	2	7	0	0	0

Trader (food/non-food items)	6	7	13	6	8	14	1	1	2
Craft worker	2	2	4	0	1	1	0	0	0
Daily labour	5	6	11	4	5	9	0	1	1
Remittances	1	0	1	2	1	3	0	0	0
Other	13	5	18	0	2	2	0	0	0
Total	80	61	141	17	19	36	1	2	3

Source: HH survey 2015.

Disaggregating total monthly household cash incomes between urban and peri urban is presented in Table 12 and 13. Among the urban households, 43% are in the range between Birr 0-499. The second largest number of households falls in the category of Birr 500-999 with 74 out of 196 households. In the peri urban sample, the largest number of households' reported monthly cash incomes fall between Birr 500-999. As compared to urban households, peri urban households appear to be better off on average in terms of cash income.

Table 12: Monthly households cash income by category (Freq.)

Last month cash income	Total urban	Peri urban	Total
Birr 0-499	84	41	125
Birr 500-999	74	65	139
Birr 1000-4999	35	33	68
Birr 5000 or more	3	3	6
Total	196	142	338

Source: HH survey 2015

Table 13: Last month cash income (in %)

	Total urban	Peri urban	Total
Birr 0-499	42.9	28.9	37.0
Birr 500-999	37.8	45.8	41.1
Birr 1000-4999	17.9	23.2	20.1
Birr 5000 or more	1.5	2.1	1.8

Source: Table 12.

For the urban treated category, majority of households earned less than Birr 500 per month (67%) while a higher proportion of control households had monthly cash income falling in the category Birr 500-999 (44%). This indicated that treatment households were relatively poorer. The opposite is true for households in the peri urban where 33% of control households' income fall below 500 while this is only 23% for the treatment households (see Table 14).

Table 14: Monthly households cash income by treatment status (Freq.)

	Last month cash income	Treatment	Control	Total
Urban	Birr 0-499	38	25	63
	Birr 500-999	15	28	43
	Birr 1000-4999	3	10	13
	Birr 5000 or more	1	1	2
	Total	57	64	121
Peri urban	Birr 0-499	14	27	41
	Birr 500-999	34	30	64
	Birr 1000-4999	12	21	33
	Birr 5000 or more	1	2	3
	Total	61	80	141

Source: HH survey 2015

The frequency distributions of income sources and cash incomes indicate that peri urban households have mean cash incomes higher than urban households (though it must be noted that peri urban households have more members than urban households which off-sets this difference in terms of per capita cash incomes). But the case for not combining the samples is reinforced. Comparing treatment and control groups, the differences in mean cash incomes need to be borne in mind when analyzing impacts of the interventions.

Water supply and quality – baseline and follow-up results

Households have different considerations such as time, distance, cost and cleanliness in obtaining drinking water. This is tabulated in Table 15. As may be observed, more than 73% of sample households considered cleanliness most important in obtaining drinking water. The second main consideration was distance to the water sources. It is found that in the 2nd rank, the largest number of respondents prioritised distance among the list of considerations.

Table 15: Rank for main consideration during obtaining water (number of respondents)

Main consideration	1st rank	2nd rank	3rd rank	4th rank
Cleanliness	253	40	20	12
Time	9	93	90	43
Distance	55	127	59	42
Cost	26	54	49	102
Total	343	314	218	199

Source: HH survey 2015.

Disaggregating this by different category (urban and peri urban) revealed similar patterns. The majority of urban households considered cleanliness for obtaining drinking water (72%, see Table 16). In terms of ranking (giving priority for cleanliness) both treatment and control households are similar.

Table 16: Ranking of main considerations in obtaining water among urban yard-point respondents

Main consideration	1st rank			2nd rank			3rd rank			4th rank			Total		
	Treatment	Control	Total	Treatment	Control	Total	Treatment	Control	Total	Treatment	Control	Total	Treatment	Control	G Total
Cleanliness	53	35	88	6	11	17	2	6	8	1	2	3	62	54	116
Time	1	4	5	19	11	30	24	12	36	5	8	13	49	35	84
Distance	8	6	14	28	16	44	11	11	22	8	11	19	55	44	99
Cost	2	13	15	11	9	20	7	5	12	28	12	40	48	39	87
Total	64	58	122	64	47	111	44	34	78	42	33	75	214	172	386

Source: HH survey 2015.

Main considerations during obtaining water for households in the poorest of poor and HIV affected categories are shown separately in Table 17. Similar to the other urban households, the highest number of people in these categories reported cleanliness as their most important consideration.

Table 17: Rank for main consideration during obtaining water in poorest of the poor and HIV affected categories (number of respondents)

Main consideration	Urban poorest of the poor					Urban HIV affected				
	1st rank	2nd rank	3rd rank	4th rank	Total	1st rank	2nd rank	3rd rank	4th rank	Total
Cleanliness	29	7	1	0	37	36	2	1	0	39
Time	0	14	11	10	35	0	14	11	9	34
Distance	6	11	11	8	36	2	13	17	4	36
Cost	2	3	14	17	36	1	10	6	16	33
Total	37	35	37	35	144	39	39	35	29	142

Source: HH survey 2015.

As with urban areas, control and treatment households in peri urban also reported cleanliness as their major consideration in accessing drinking water (see Table 18), though, predictably, distance has greater significance, as obtaining water from neighbours with in-house piped connections is less of an option in peri urban locations.

Table 18: Rank for main consideration during obtaining water in peri urban area (number of respondents)

Main consideration	1st rank			2nd rank			3rd rank			4th rank			Total		
	Treatment	Control	Total	Treatment	Control	Total	Treatment	Control	Total	Treatment	Control	Total	Treatment	Control	G Total
Cleanliness	54	46	100	8	6	14	7	3	10	6	3	9	75	58	133
Time	4	0	4	19	15	34	14	18	32	7	4	11	44	37	81

Distance	22	10	32	34	25	59	5	4	9	5	6	11	66	45	111
Cost	5	3	8	13	8	21	10	7	17	12	17	29	40	35	75
Total	85	59	144	74	54	128	36	32	68	30	30	60	225	175	400

Source: HH survey 2015.

Most households in urban areas have access to protected sources. Over 87% of respondents obtained water from their neighbour's in-house piped drinking water supply, which is improved water, whilst very few consumers used unprotected water (i.e river/pond/lake). Out of 123 total respondents only 1 household used a privately owned, commercial water point. As we can see from Table 19 the result for treatment and control group is nearly the same. These results have significant implications for the likely small impact of the Project intervention.

Table 19: Sources of drinking water in urban area (number of yard-point respondents)

Main consideration	1st rank			2nd rank			3rd rank			4th rank			Total		
	Treatment	control	Total	Treatment	Control	Total	Treatment	Control	Total	Treatment	Control	Total	Treatment	Control	G Total
Own piped water tap	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Own hand pump/borehole	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1
Unprotected well	0	0	0	2	0	2	0	0	0	0	0	0	2	0	2
Protected well	0	3	3	9	2	11	1	0	1	0	0	0	10	5	15
Collective hand pump/borehole	0	2	2	8	6	14	0	1	1	0	0	0	8	9	17
River/pond/lake	3	3	6	13	3	16	1	1	1	0	0	0	17	7	24
Rainwater storage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Neighbour's private drinking water supply	57	51	108	7	3	10	0	0	0	0	0	0	64	54	118
Privately run water point	1	0	1	0	3	3	0	0	0	0	0	0	1	3	4
Bottled	0	0	0	2	1	3	1	0	1	0	0	0	3	1	4
Tanker	3	0	3	14	8	22	3	0	3	0	0	0	20	8	28
Total	64	59	123	55	26	81	7	2	7	0	0	0	126	87	213

Source: HH survey 2015.

Unlike urban households, many people in peri-urban areas consumed unprotected water (river, pond, lake), about 42% (see Table 20). The second source of water is a neighbour's private water supply (29% of HHs). Those who used unimproved water from river, pond, and lake in treatment group is 57 out of 59 members while it is only 2 people in control group. This indicates people in treatment group are much more exposed to water borne health problem as compared to control group which will affect comparison of treatment/control differences.

Table 20: Sources of drinking water in peri urban area (number of respondents)

Main consideration	1st rank			2nd rank			3rd rank			4th rank			Total		
	Treatment	control	Total	Treatment	Control	Total	Treatment	Control	Total	Treatment	Control	Total	Treatment	Control	G Total
Own piped water tap	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Own hand pump/borehole	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unprotected well	1	0	1	1	0	1	0	0	0	0	0	0	2	0	2
Protected well	6	2	8	3	0	3	0	0	0	0	0	0	9	2	11
Collective hand pump/borehole	10	16	26	11	4	15	0	0	0	0	0	0	21	20	41
River/pond/lake	57	2	59	15	19	34	0	2	2	0	0	0	72	23	95
Rainwater storage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Neighbour's private drinking water supply	5	36	41	23	2	25	1	0	1	0	0	0	29	38	67
Privately run water point	2	1	3	0	2	2	0	0	0	0	0	0	2	3	5
Bottled	0	0	0	1	1	2	0	0	0	0	0	0	1	1	2
Tanker	0	2	2	2	7	9	1	0	1	0	0	0	3	9	12
Total	81	59	140	56	35	91	2	2	4	0	0	0	139	96	235

Source: HH survey 2015.

Sources of drinking water for urban households in poorest of the poor and HIV affected categories are similar to yard-point urban households. In both categories the highest number of people fetch water from neighbour's private water supplies (see Table 21), though Tankers are a significant source for the poorest of the poor.

Table 21: Sources of drinking water in poorest of the poor and HIV affected categories (numbers of respondents)

Variable	1st rank	2nd rank	3rd rank	4th rank	Total
Poorest of the poor category					
Own piped water tap	1	0	0	0	1
Protected well	0	0	1	0	1
Collective hand pump/borehole	2	1	0	0	3

River/pond/lake	1	2	0	0	3
Neighbours private drinking water supply	31	1	0	0	32
Bottled	0	1	0	0	1
Tanker	2	20	0	0	22
Total	37	25	1	0	63
HIV affected category					
Own piped water tap	6	0	0	0	6
Protected well	0	3	0	0	3
River/pond/lake	1	7	1	0	9
Rainwater storage	1	0	0	0	1
Neighbours private drinking water supply	24	2	1	0	27
Privately run water point	0	0	1	0	1
Bottled	1	0	0	1	2
Total	33	12	3	1	49

Source: HH survey 2015.

Table 22 shows share of households using water from protected sources. Between the baseline and follow up study periods, overall access to improved water increased from 79% to 89%. This progress is mainly due to the Project intervention. In urban areas, the share of households that used improved water increased by 4.7 percentage points for treatment group and 1.5 percentage points for control group. For peri urban area, the share of treatment households that used drinking water from protected sources increased from 28% in 2015 to 97% in 2017. This indicates that the Project intervention significantly benefitted treatment households in peri urban area.

Table 22: Access to improved water from main sources (%)[3]

	2015			2017		
	Treatment	Control	Total	Treatment	Control	Total
Urban yard-point	95.3	94.7	95.0	100.0	96.2	98.2
Peri urban	28.4	96.6	57.1	64.6	92.2	75.4
Total			79.3			88.9

Note: Source: HH surveys, conducted in 2015 and 2017.

Seasonal impact on the availability of water is improved following the intervention. In the baseline survey study, it was about 84% of the households facing changes in the availability of water based on seasons. This has reduced in the follow up survey to 77.6% see Table 23).

[3] Use of water from own borehole is also excluded from analysis since it is difficult to know whether water obtained from own borehole is protected or not.

Table 23: Change in the availability of water (total sample)

Is there change in availability of water with the seasons?	2015		2017	
	Freq.	Percent	Freq.	Percent
No seasonal differences	52	16.0	68	22.4
Availability depends on seasons	273	84.0	235	77.6
Total	325	100	303	100

Source: HH surveys, conducted in 2015 and 2017

Further evidence for the above claim being due to the Project intervention is obtained from the survey data by looking at the treated and control households. The dependency of water availability on season has reduced more for treatment households than control households (see Table 24). The same story can be read for the peri urban. Indeed, the dependency of availability of water on seasons has increased in the follow up survey for the control households where there was no intervention at all during the study period (see Table 25).

Table 24: Change in the availability of water for urban (in %)

Is there change in availability of water with the seasons?	2015			2017		
	Treatment	Control	Total	Treatment	Control	Total
No seasonal differences	11.1	14.3	12.6	32.1	21.2	26.9
Availability depends on seasons	88.9	85.7	87.4	67.9	78.8	73.1

Source: HH surveys, conducted in 2015 and 2017

Table 25: Change in the availability of water for peri urban (in %)

Is there change in availability of water with the seasons?	2015			2017		
	treatment	control	Total	treatment	control	Total
No seasonal differences	9.1	25.5	15.9	27.4	18.0	23.6
Availability depends on seasons	90.9	74.6	84.1	72.6	82.0	76.4

Source: HH surveys, conducted in 2015 and 2017

6. Effects of the intervention in urban and peri urban area

The differential effects of the Project on different welfare measures are discussed in this section. It specifically presents the impact of being a member of treatment group on access to water, health status, work and education outcomes. The results are produced based on panel data collected from urban and peri urban areas and the data include control and treatment groups.

Effects on access to water

The Project intervention has brought significant reduction in number of trips and travel time to fetch water and significant reduction in waiting time to get water at the water source. Over a two-month period of time, treatment groups made 7.1 trips less to fetch drinking water in the follow up survey as compared to the baseline period whereas control households travelled 2.4 trips more (see Table 26). The result

indicates that the Project may have reduced trips to collect water by 9.6 trips which is statistically significant at 1% level of significance. Similarly, the water supply intervention helped to reduce water collection waiting time by 29.1 minutes (p=0.000).

Table 26: Trends in access to water supply in urban area

	Treatment		Control		*DID*	
	2015	2017	2015	2017	Estim.	p-value
Average number of trips to collect drinking water in the last two months[4]	12.8	5.7	9.8	12.2	-9.6	0.000
Average travel time to fetch drinking water from the primary source (in minutes)	12.5	3.0	14.3	13.2	-8.5	0.028
Average in line waiting time for getting drinking water from the primary source (in minutes)	41.3	4.8	20.6	13.2	-29.1	0.000

Source: HH surveys, conducted in 2015 and 2017

Similar to urban areas, there was also reduction in daily water consumption in peri urban areas. Average number of journeys in order to fetch water reduced by 3 trips in the intervention group while it increased by 2 trips in control group (see Table 27). The water supply Project significantly reduced number of trips made to access drinking water in peri urban areas. When we come to average travel time to collect water and waiting time for fetching water, it took less minutes in the follow up survey for both groups.

Table 27: Trends in access to water supply in peri urban area

	Treatment		Control		*DID*	
	2015	2017	2015	2017	Estim.	p-value
Average number of trips to collect drinking water in the last two months[5]	18.4	15.6	13.4	15.2	-4.7	0.046
Average travel time to fetch drinking water from the primary source (in minutes)	39.6	37.6	24	21.7	0.3	0.951
Average in line waiting time for getting drinking water from the primary source (in minutes)	64.4	37.4	46.6	31.7	-12.1	0.249

Source: HH surveys, conducted in 2015 and 2017

[4] Outlier values of reporting more than 50 times of collecting drinking water in the last two weeks were excluded.

[5] Outlier values of reporting more than 50 times of collecting drinking water in the last two weeks were excluded.

Though we expressed caution about combining the urban and peri urban results, the consistency of the Double Difference results do deserve consideration. Table 28 shows water collection duration in the intervention area (both urban and peri urban). In two-week recall period, people in the intervention group made 16 trips to fetch water from the main sources in 2015 while it was 11.6 trips by 2017. On the contrary, number of trips for control group rose from 11.6 to 13.8 trips. The Project significantly reduced number of water collection trips. At the same time, average in line waiting time declined from 54.1 minutes to 25.1 for those households categorized in the intervention treatment group. The intervention saved in line waiting time to get drinking water by about 18 minutes for beneficiaries (p=0.012).

Table 28: Trends in access to water supply in intervention area

	Treatment		Control		*DID*	
	2015	2017	2015	2017	Estim.	p-value
Average number of trips to collect drinking water in the last two months[6]	16	11.6	11.6	13.8	-6.6	0
Average travel time to fetch drinking water from the primary source (in minutes)	27.6	24.2	19.3	17.7	-1.8	0.679
Average in line waiting time for getting drinking water from the primary source (in minutes)	54.1	25.1	34.3	22.8	-17.5	0.012

Source: HH surveys, conducted in 2015 and 2017.

Effect on health indicators

The study also assessed the effect of the water supply intervention on different health outcomes. During the study period, prevalence of diarrhea caused by contaminated water reduced for both treatment and control households. The Project reduces the incidence of diarrhea illness by 14 percentage points (see Table 29). Average medical expenditure for diarrhea treatment reduced for treatment group by Birr 66.5 while it increased by Birr 161 for control group. Thus, overall, the improved water supply Project reduces medical costs for treatment of water borne diseases by Birr 228.

Table 29: Trends in experience of diarrhea episodes and treatment cost in urban area

	Treatment	Control	*DID*

[6] Outlier values of reporting more than 50 times of collecting drinking water in the last two weeks were excluded. The result is based on both urban and peri urban surveys.

	2015	2017	2015	2017	Estim.	p-value
At least one household member suffered from diarrhea in the last two weeks (%)	28.1	3.5	14	3.8	-0.14	0.08
Average water treatment cost in the last month (in Birr)	11.7	1.2	12.5	2.6	-0.5	0.948
Average amount spent on medical treatment for diarrhea in the last two weeks (in Birr)	97.6	30.5	185.6	346.7	-228.2	0.05

Source: HH surveys, conducted in 2015 and 2017

In peri urban locations, the effect of the Project in controlling incidence of diarrhea is not found to be statistically significant. In 2017, incidence of diarrhea among treated households in peri urban area (11%) is found to be larger than treated group in urban area (3.5%) (see Table 30). Water treatment and medical costs are found to be higher for treatment group as compared to control households.

Table 30: Trends in experience of diarrhea episode and treatment cost in peri urban area

	Treatment		Control		*DID*	
	2015	2017	2015	2017	Estim.	p-value
At least one household member was suffered from diarrhea in the last two weeks (%)	16	11.4	19.7	5.8	0.09	0.259
Average water treatment cost in the last month (in Birr)	12.3	16	9.2	2.2	10.6	0.45
Average amount spent on medical treatment for diarrhea in the last two weeks (in Birr)	166.6	97	156.9	55	32.4	0.569

Source: HH surveys, conducted in 2015 and 2017

Overall, the effect of the Project on health outcomes appears more positive in urban areas and more negative in peri urban areas. The subjective self-nominated health indicators are clearly open to question, and arguably we should treat these results as open to question. General health statistics for the Harari Region are weak and therefore it is difficult to triangulate our results and we will draw no firm conclusions on the impact of the Project.

Effect on education and work

Efforts to improve access to safe water supply are expected to reduce incidence of sickness caused by water borne diseases. Better health status on the other hand is expected to enhance labour productivity through reducing absenteeism from school and workplaces. Therefore, this study attempts to evaluate the effect of the Project on education and labour outcomes.

In the 2015, 5% of the baseline sample households in the urban area reported incidence of absence from school and 6% reported work absenteeism. In the 2017 follow-up survey, no household member from the control group experienced school and work absenteeism caused by diarrhea illness. Given the low overall incidence of absenteeism in the control group, we did not expect to identify a statistically significant double difference effect of the Project intervention on school attendance and labour supply. However, the incidence and duration of absence from work and school significantly falls over time for treated households. For instance, the share of households with diarrhea affected school attendance of children reduced from 9.3% in 2015 to 1.7% in 2017 (see Table 31). This difference in school absenteeism between the baseline and follow up surveys for the treatment group is statistically significant. The average duration of absenteeism from school also reduced considerably for the treatment group between 2015 and 2017.

It is also found that about 10% of the treated households in urban area experienced absence from work due to diarrhea while no cases were reported in 2017. This indicates that the negative effect of diarrhea on education and labour outcomes was reduced among treated households covered by the Project.

Table 31: Trends in school and work absenteeism in urban area

	Treatment			Control		*DID*	
	2015	2017	*Mean diff p-value*	2015	2017	Estim.	p-value
Percentage of the households that diarrhea prevent members of the family from attending education	9.3	1.7	0.0742	5.3	0	-0.02	0.641
If diarrhea affected attending school, how many days of education were lost in total in the two weeks?	0.23	0.01	0.07	0.33	0	0.11	0.585
Percentage of the households that diarrhea prevent members of the family working for cash in the last two weeks	10	0	0.0098	3.5	0	-0.07	0.111
If diarrhea prevent members of the family working for cash, how many days of work were on average lost in total in the two weeks?	0.55	0	0.0155	0.18	0	-0.37	0.137

Source: HH surveys, conducted in 2015 and 2017

The results for the peri urban sample show some drop in the incidence of absence from school and work due to the intervention in peri urban areas. The share of

households with children missing education falls from 4.9% to 1.3% between 2015 and 2017 (see Table 32). In the same period of time, experience of absenteeism from workplaces also reduced by 1.2 percentage points for treatment households. However, the differences in the outcomes between the baseline and follow-up surveys are not found to be statistically different from zero.

Table 32: Trends in school and work absenteeism in peri urban area

	Treatment			Control		*DID*	
	2015	2017	*Mean diff p-value*	2015	2017	Estim.	p-value
Percentage of the households that diarrhea prevent members of the family from attending education	4.9	1.3	0.1842	4.9	0	0 .01	0.75
If diarrhea affected attending school, how many days of education were lost in total in the two weeks?	0.46	0.13	0.1895	0.98	0	-0.2	0.37
Percentage of the households that diarrhea prevent members of the family working for cash in the last two weeks	3.7	2.5	0.6725	0	0	-0.01	0.672
If diarrhea prevent members of the family working for cash, how many days of work were on average lost in total in the two weeks?	0.4	0.18	0.3965	0	0	-0.22	0.393

Source: HH surveys, conducted in 2015 and 2017

Aggregating urban and peri urban data, the study shows statistically significant improvements in labour and education outcome following the improved water supply intervention. The single difference analysis shows that absenteeism from attending school and working for cash reduced significantly between 2015 and 2017 (see Table 33). Durations of school and work absent days are also reduced significantly overtime. As shown from the previous results, the project may have reduced absenteeism from workplaces and schools more in urban area as compared to the case of peri urban area.

Table 33: Trends in school and work absenteeism in intervention area[7]

	Treatment	Control	*DID*

[7] Intervention area includes both urban and peri urban surveys.

	2015	2017	*Mean diff p-value*	2015	2017	Estim.	p-value
Percentage of the households that diarrhea prevent members of the family from attending education	6.9	1.5	0.0246	5.1	0	-0.003	0.913
If diarrhea affected attending school, how many days of education were lost in total in the two weeks?	0.36	0.08	0.0678	0.21	0	-0.06	0.708
Percentage of the households that diarrhea prevent members of the family working for cash in the last two weeks	6.9	1.5	0.0246	1.2	0	-0.04	0.158
If diarrhea prevent members of the family working for cash, how many days of work were on average lost in total in the two weeks?	0.46	0.1	0.0402	0,08	0	-0.27	0.133

Source: HH surveys, conducted in 2015 and 2017

Interpreting these results in terms of impact evaluation is problematic. The treatment group starts from higher levels of absenteeism in the baseline, possibly due to some pro-poor bias in phasing the Project implementation. As the variables cannot fall below zero, the double difference calculations are 'squeezed'. The small, but significant, single difference falls in absenteeism in the treatment group are welcome, but may be largely explained by relatively small, wider contextual changes in schooling, workplaces, and non-water related health conditions. But, on the other hand, there is no reason not to attribute some of the improvement to the Project intervention.

Effect on expenditure in obtaining drinking water

The Project aims to improve livelihoods of the target population in Harari region by creating cheaper access to safe drinking water. The intervention could lead to changes in direct and indirect expenditure in obtaining drinking water. This evaluation exercise examines if there is reduction in direct spending for drinking water for those households exposed to the intervention. The baseline survey revealed that treated households (Birr 70.1) on average spent more amount of money to access water as compared to control households (Birr 55.2) in urban area. In 2017, households in the treatment group paid less (Birr 36) than households in the comparison group (Birr 46). The difference in difference estimates suggests that improved water provision due to the Project significantly reduced monthly spending on drinking water in the urban area (see Table 34).

For the peri urban sample, the analysis reveals that the intervention does not change spending for drinking water significantly in double difference terms. This is because many households in peri urban areas did not pay cash for drinking water in 2015 or 2017. However, looking at single difference changes between 2015 and 2017, mean

monthly expenditure reduced by 16.2 Birr for treatment group and by 41.2 Birr for control group between the baseline and follow-up surveys. But the frequency distributions of payments indicate that this difference in means is probably due to specific local circumstances rather than the Project intervention.

Table 34: Trends in monthly household expenditure for drinking water (Average spending in Birr)[8]

Category	Treatment		Control		*DID*	
	2015	2017	2015	2017	Estim.	p-value
Urban area	70.1	36.0	55.2	46.0	-24.9	0.024
Peri-urban area	71.8	55.6	78.3	37.1	25.1	0.106

Source: HH surveys, conducted in 2015 and 2017.

7. Conclusion

Water scarcity has a negative effect on the livelihood of the households in Harari People Regional State. It is estimated that less than 50% of the population in the region have access to safe water while many people in rural areas are using unimproved, probably unhealthy sources. The Harar Water Supply and Sewerage Authority (HWSSA) did not have financial and technical capacity to ensure sufficient quantity and good quality of drinking water before 2015. There was frequent interruption of water supply and it is difficult to guarantee good quality of water supply to households on a continuing basis. There was certainly a strong case for drinking water interventions in the Harar Region of Ethiopia prior to the Project.

This study evaluates the effect of one activity of a multi-dimensional Project in terms of improving water access for some households in urban and peri urban areas of Harari Region. In order to do so, it used household level panel, pipeline samples collected before and after the first phase of a targeted household intervention distinguishing first phase treatment and control households, where the control households were due to receive similar interventions in a later phase. The baseline study was conducted in 2015 and the follow up survey was undertaken in 2017. The study covered 340 sample households with 1,619 individuals.

During the baseline period, the study shows neighbour 'safe' sources in urban area and river/pond/lake sources in peri urban area were the major sources of drinking water. Excluding neighbour sources, access to drinking water from protected sources, overwhelmingly in peri urban households, increased from 48% in 2015 to 85% in 2017. There was larger improvement in access to water from protected sources among treatment households as compared to control households. The econometric analysis revealed that access to safe water significantly increased among the treatment group.

Travelling long distances to fetch water leads to wastage of energy and time especially for women and girls. In 2015, in order to collect water, treatment households made 16 trips and control households made 12 trips. After two years, travel to access water fell by 12 trips for treatment households, while it increased to 24 trips for control households. Overall, the intervention reduced trips to collect water by 6 trips. Similarly,

[8] Note: Expenditure for drinking water includes monthly payment for different bodies including HWSSA, neighbour, private commercial provider, water committee and others.

the average in line waiting time to get drinking water from primary sources dropped by about 18 minutes per trip attributable to the Project. This result indicates that the Project saved time that could be used for educational and/or productive purpose.

Provision of improved water, among other things, is also expected to reduce incidence and side effects of water borne diseases. During the study period, the water supply intervention appeared to significantly reduce urban incidence of diarrhea by 14 percentage points. However, in the peri urban sample, the overtime change in illness between treatment and control group is not statistically different from zero. The average water treatment and medical spending for diarrhea declined for both intervention and control households.

The study also investigates if access to safe water supply brings improvement in the livelihoods of treatment groups through reducing absenteeism from school and workplace. Experience of absence from school happened in about 9% of treated households in the urban sample in 2015 and this was significantly reduced and became less than 2% in 2017. Similarly, incidence of absence from workplace was reduced for treatment group. But these changes were not significant in double difference terms and must be seen in wider contextual terms and cannot be totally attributed to the Project intervention.

Overall, the surveys of urban and peri urban households do suggest some positive impacts of the Project interventions to directly improve drinking water supply for targeted households in terms of direction of qualitative change in indicators of well-being. But as most urban and some peri urban households were already receiving 'improved' water supply from neighbours with in-house piped connections, while still being subjected to discontinuities in supply from the piped water system, the quantitative impact on households' well-being is limited. Thus, with little gain in quality of drinking water consumed by targeted households in urban areas, claim to positive impact depended primarily on decreased costs of purchasing drinking water. Urban households were able to reduce expenditure on drinking water which provided some financial gains amounting to about Birrs 25 a month (about ten percent of household cash income).

The heterogeneity of revenue arrangements in the peri urban water supply context meant that there were no clear Project attributable financial gains for peri urban households. But there is evidence of gains in time spent collecting water in peri urban locations, though it is very difficult to convert those time savings into financial values.

It is difficult to justify the direct household provision aspect of the Project in terms of sustained positive value added attributable to the Netherlands' government subsidy to the Project. The overall poor water supply context and the behavioural reality that treated households were already generally accessing good quality piped water set limits to potential gains from improved connections to the very restricted water supply meant livelihood gains were inevitably highly constrained.

BIBLIOGRAPHY

Abdelmawla M.A. (2017) Water Poverty and its Impact on Income Poverty and Health Status in Sudan: The Case of Gezira State (1993-2013), International Journal of African Development. 4(2): 99-109

Adane M, Mengistie B, Medhin G, Kloos H, Mulat W (2017) Piped water supply interruptions and acute diarrhea among under-five children in Addis Ababa slums, Ethiopia: A matched case-control study. PLoS ONE 12(7): e0181516

Adane, M.(2014). Water Quality and phytoplankton community structure in the Southern Gulf of Lake Tana, Ethiopia, Addis Ababa, Ethiopia.

Bisung, E, and Elliott, J. (2017). psychosocial impacts of the lack of access to water and sanitation in low- and middle-income countries: a scoping review: J Water Health. 15(1):17-30. doi: 10.2166/wh.2016.158

Cheng, J. J., Schuster-Wallace, C. J., Watt, S., Newbold, B. K., & Mente, A. (2012). An ecological quantification of the relationships between water, sanitation and infant, child, and maternal mortality. Environmental Health, 11(1). doi:10.1186/1476-069x-11-4

Demie, G., Bekele, M., and Seyoum, B. (2016). Water accessibility impact on girl and women's participation in education and other development activities: The case of Wuchale and Jidda Woreda, Ethiopia. Environmental Systems Research, 5(1). doi:10.1186/s40068-016-0061-6

Jacqueline, N. and Gregor, W. (2012). The Economic and Social Benefits and the Barriers of Providing People with Disabilities Accessible Clean Water and Sanitation: 4, 3023-3041; doi:10.3390/su4113023

Jain, R. (2012). Providing safe drinking water: A challenge for humanity. Clean Technologies and Environmental Policy, 14(1), 1-4. doi:10.1007/s10098-011-0446-1

Josephine T. (2019) Drinking Water Treatment and Challenges in Developing Countries: The Relevance of Hygiene to Health in Developing Countries

Keredin T. and Prasada R.(2016). Review on water resources and sources for safe drinking and improved sanitation in Ethiopia, Just International Journal of Applied Research 2016; 2(3): 78-82.

McQuaid, J., Thuringer, C. B., Jackson, D., Hanson, L., and DuBois King, M. (2018) The Role of Water Stress in Instability and Conflict, American Geophysical Union. Accessed on July 26. Accessed from < https://www.cna.org/CNA_files/pdf/CRM-2017-U-016532-Final.pdf>

Meier, B., Kayser, G. L., Amjad, U., & Bartram, J. (2013). Implementing an evolving human right through water and sanitation policy. Water Policy, 15 (3):116–133.

Nathaniel M. and Beatrice M.(2017). How to reduce inequalities in access to WASH; Overseas Development Institute 203 Blackfriars Road London SE1 8NJ

Noel S, Phuong, H., Soussan, J, Lovett, J. (2010) The impact of domestic water on household enterprises: Evidence from Vietnam. Water Policy. 12(2):237–247.

NPC (2016) Growth and Transformation Plan II (2015/15-2019/2020), National Planning Commission, Addis Ababa.

OWNP (2018) FDRE: One WASH National Program Document Phase II Updating. A Multi-Sectoral SWAp, National Wash Coordination Office. Addis Ababa.

Prüss-Üstün A., R. Bos, Gore F., and Bartram J. (2008). Safer water, better health: costs, benefits and sustainability ofinterventions to protect and promote health. World Health Organization, Geneva.

Ralph, P., Barbara, V., and Emily, V.(2014). The Human Right to Water: The Importance of Domestic *and* Productive Water Rights, Sci Eng Ethics. 2014; 20(4): 849–868.

Ravallion, M., Galasso, E., Lazo, T., and Philipp, E. (2005) What Can Ex-Participants Reveal about a Program's Impact, *Journal of Human Ressources*, 40: 208-230.

Roger, C., Eva, L. and Josephine, T.(2013). Achieving Water Security Lessons from research in water supply, sanitation and hygiene in Ethiopia, Practical Action Publishing Ltd, The Schumacher Centre Bourton on Dunsmore, Rugby, Warwickshire CV23 9QZ, UK

Serrat, O. (2017) The sustainable livelihoods approach. In Knowledge Solutions; Springer: Berlin, Germany.

Siraj KT, and Rao PP. (2016) Review on water resources and sources for safe drinking and improved sanitation in Ethiopia. International Journal of Applied Research. 2:78–82.

Sorenson, S. B.; Morssink, C. and Abril Campos, P. 2011. Safe Access to safe water in low income countries: water fetching in current times. Social Science & Medicine 72(9): 1522-1526. https://doi.org/10.1016/j.socscimed.2011.03.010 (accessed on July, 17 2017)

UN Water (2009) Water in a Changing World, The UN World Water Development Report 3, Accessed on July 24, 2019. Accessed from < https://unesdoc.unesco.org/ark:/48223/pf0000181993>

UN Water (2015) Waste Water Management, A United Nation Water Analytical Brief No 43, Accessed on July 20, 2019. Accessed from < file:///Users/anagaw/Downloads/UN-Water_Analytical_Brief_Wastewater_Management%20(1).pdf >

UN-HABITAT (2008). Dire Dawa Urban Profile, United Nations Human Settlements Programme, UNON Publishing Services Section, Nairobi, ISO.

WHO (2018). Water, Sanitation and Hygiene strategy 2018-2025. World Health Organization Geneva:.

WHO (2019) Water and health - Fact Sheet, Geneva, United Nations Children's Fund and World Health Organization. Accessed on July 28, 2019. Accessed from < https://www.who.int/news-room/fact-sheets/detail/drinking-water >

WHO/UNICEF (2000). Progress on Drinking-water and Sanitation, special focus on sanitation. New York/ Geneva, United Nations Children's Fund and World Health Organization

World Bank Group. (2016) Social Impact Analysis of Water Supply and Sanitation Services in Central Asia : The Case of Uzbekistan. World Bank, Washington, DC.