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East Darfur State Water Corporation

and

CARE international Switzerland

Barrier Analysis Study to understand the socio-economic and technical factors affecting water yards' sustainability in Asalaya and Bahar Alarab localities, East Darfur State.



FINAL REPORT

By

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LIST OF ABBREVIATIONS AND ACRONYMS

CIS	CARE International Switzerland
DG	Director General
EPI	Expanded Programme on Immunization
FGD	Focus Group Discussion
GoS	Government of Sudan
HAC	Humanitarian Aid Commission
HH	Household
INGOs	International Non-Governmental Organizations
KI	Key Informants
MICS	Multiple Indicator Cluster Survey
O&M	Operation and Maintenance
OM&M	Operation, Maintenance and Management
SPSS	Statistical package for the social sciences
SWC	State Water Corporation
TOR	Terms of Reference
UNICEF	United Nations Children's Funds
UNOPS	United Nations Office for Project Services
WASH	Water Sanitation and Hygiene
WES	Water and Environmental Sanitation
WY	Water yard

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v. EXECUTIVE SUMMARY

Achieving sustainable operation, maintenance and management of water supply still poses major challenges in rural areas of East Darfur State, despite the progress achieved in terms of construction of new facilities and/or rehabilitation of non-functional ones. The main objective of the study is to identify the socio-economic and technical barriers to sustain the operation and maintenance of the water yards in Bahar Al Arab and Asalaya localities. The findings will be used to design the approaches to problems of water yards' operation and maintenance in ED. The study investigated the technical, socio-economical/cultural factors, water tariffs and policy factors influencing sustainability of water supply for rural communities in the pilot localities. Different tools and techniques were applied to collect quantitative and qualitative data from a sample size of 1400 HHs served by 28 boreholes, 5 focus group discussions with water management committees and users, 18 community meetings and 33 questionnaires targeting key informants. The collected data was analyzed using SPSS version 25.

The study findings show that there is a relationship between sustainable OM&M of water supply facilities and the technical, socio-economic, socio-cultural and water tariffs with the latter two (water tariffs and socio-economical/cultural) being the most significant factors. The study has proved that the frequent breakdown of water facilities is largely because of poor maintenance culture, inadequate funds for O&M due to the way water tariff was set, collected and utilized besides centralization of the responsibility for maintenance at state level. There was lack of involvement and participation of users in all process of water supply resulted into lack of ownership and no role for users to support OM&M. Despite users are not involved in setting water tariff the study shows high level of users' willing to pay for any service improvement. Technical factors were found to be limited to lack of repairing tools like crane and inadequate technical capacity of the SWC maintenance teams at the locality level to deal with various aspects of water supply.

The study recommends selection of hybrid technology (solar and diesel) to reduce costs of regular maintenance of generators, development of local regulations and legal framework for participation of water users in facility management, training of SWC team and water committees on technical and management issues of OM&M and advocacy for local private sector to become stockists of spare parts required for existing systems. Finally, based on the study findings, a strategy for sustaining OM&M of water supply in rural areas of ED should be developed.

1. BACKGROUND

The area identified by State Water Corporation (SWC) and CIS for the present study covers two localities of Asalaya and Bahr Al Arab in East Darfur state(ED). The State lies in the (Southern) western part of Sudan and it is bordered by latitudes N 9.5-13.5 and longitudes E 27.25--29.50. The State was carved out of the larger South Darfur in 2012 as part of the Doha Peace Agreement. It is bordered to the South by South Sudan, north by North Darfur and South Kordofan to the East.

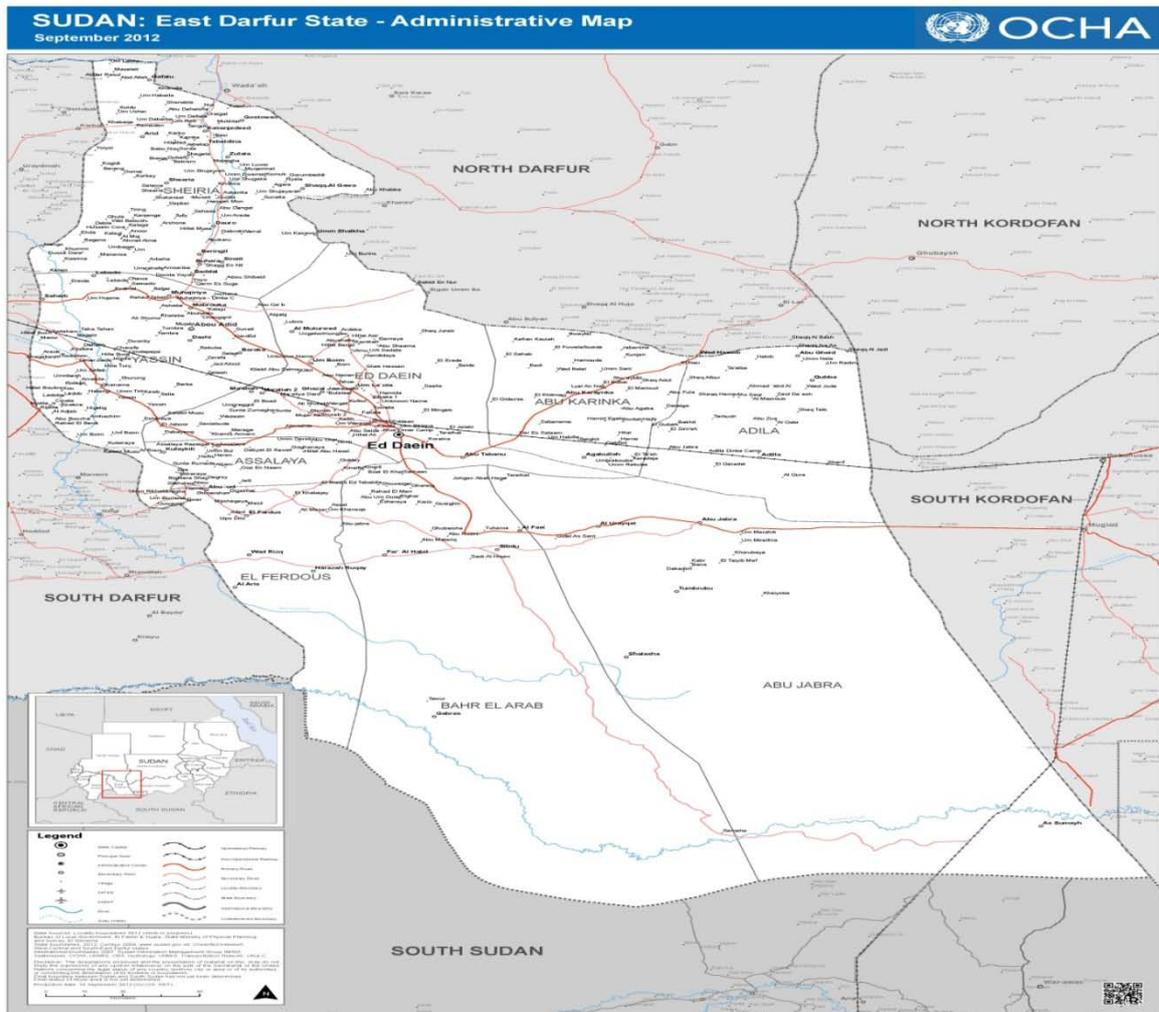


Fig (1) Location map of ED

Groundnuts, Millet, Sorghum, Gum Arabic, Sesame and Kerkadeh (Roselle) are East Darfur's main agricultural products. Along with livestock these have been its main exports, and also the base for much of ED Daein manufacturing industry. ED Daein is linked by rail to Khartoum and Nyala city (South Darfur state) and is a centre of local trade in Wheat, Peanuts, Barley and livestock.

According to SWC report (June 2019) there are 281 government owned boreholes (of which 34 were not functional i.e. 13%) in addition to all functional 72 private ones. However, based on MICS

2014, the WASH situation in East Darfur is characterized by very low indicators for access to water (45.1% of the state population have access to improved drinking water sources)¹

Despite the large investments and numerous initiatives made by government and sector partners to reduce the gap of water scarcity in water supply infrastructure, water yards continue to breakdown frequently resulting into intermittent water supply services. The problem is further aggravated by the low capacity of the local communities and government to foster effective operation and maintenance of water yards, notwithstanding NGOs endeavours in developing community-based OM systems. **Despite this effort (by NGOs), there is always question if there such systems in place to ensure sustainability of the investments already made', and what are the challenges underlining such water -related investments.**

As part of its ongoing WASH program focusing on rehabilitation of water yards in some localities including Bahar EL Arab and Asalaya, CIS realized the different factors which impede sustainability of water yards. Therefore, through funding from UNICEF, CIS hired a consultant (April to July 2019) to undertake this analytical study to understand the main socio-economic, technical barriers and constraints both in knowledge and behavior related to the sustainability of 'water yards' in Asalaya and Bahr Al Arab localities.

2. OBJECTIVE OF THE STUDY

Achieving sustainable operation, maintenance and management of water supply still pose major challenges in rural areas of ED, despite all the progress achieved in terms of construction of new facilities and/or rehabilitation of non-functional ones.

As per the study TOR, the main objective is to identify the socio-economic and technical barriers to sustain the operation and maintenance of the water yards in the pilot localities and design a solution. The findings will be used to design the approaches to problems of water yards' operation and maintenance.

3. METHODOLOGIES AND APPROACHES

The entire process of data collection and analysis was guided by two main approaches (secondary and primary data) using four mixed but complimentary methods namely questionnaire survey, interviews, focus group discussions and field observations.

¹ According to MICS 2014 The population using *improved sources* of drinking water are those using any of the following types of supply: piped water (into dwelling, compound, yard or plot, to neighbour, public tap/standpipe), tube well/borehole, protected well, protected spring and rainwater collection

Secondary data review comprising reviewing of SWC and CIS related documents, reports and materials to identify the existing water O&M practices, strategies, policies at national as well as at state and locality levels. Primary data collection combining quantitative and qualitative methods that included semi-structured interviews and meetings to gather inputs from a range of stakeholders including government, INGOs, and local NGOs with focus on WASH partners who support O&M and management of water supply in rural areas besides assessing types of collaboration and integration in terms of delivery approaches and management modalities. In details the following tools and methods were used in this study

- I. Three preparatory meetings with the CIS team were held to shape the way to execute the study. The first meeting in Khartoum (with Tesfaye Hussein), CIS Public Health and WASH Country Coordinator and (Michael Babu Onyango) CIS Program Manager to ensure having a common understanding and interpretation of the ToR.
- II. The others two meetings were held in ED Daein town with the CIS Senior Environmental Health Officer and Senior WASH Officer; where CIS availed all programme related documents including two recent assessment reports. The itinerary work plan was reviewed and amended based on the given situation then the meeting went into the needed support and facilitation that the office could provide to the consultant. The third meeting was with Abdulnasir Adam CIS Head of Office where lessons learnt from such studies were shared with some advices that has made the movement in the field easy.
- III. A semi-structured meeting was organized with SWC senior staff attended by the DG, the Coordinators for Abu Karina, Bahar El Arab and Central clusters, Planning Unit Director besides WES Project Manager and WES Senior Engineer. The meeting aimed at gathering information about the current operation, maintenance and management (OM&M) modality and the influencing social, financial and technical factors that limit the effectiveness and efficiency of the system in addition to their experience in overcoming such constraints. . The meeting also discussed the possible paths for a fundamental shift from centralized (State) ownership of water supply systems to local (Locality/community) ownership and control and how such unfamiliarity poses challenges because of issues like water treatment/chlorination. The discussion was mainly guided by questions and inquiries about institutional reform (if need be), adequate budget for O&M, tariff collection and utilization, support by Local government, human resources development and users' capacity to influence decision-making. All questionnaires and discussion points were reviewed together with SWC and CIS at the state level.

- IV. Similar meetings were held at locality level in the selected localities attended by the Executive Director(Acting Commissioner in case of Asalaya), Locality Water Corporation Directors and key staff responsible for water supply operations, HAC, Youth representatives and community-respected people. The discussion was oriented towards understanding the functions (governance and institutional) of the locality in providing basic services and how water is being handled during all process of identifying priorities, planning, budgeting and ways to involve the community in decision making. After elaborating all those factors, the discussion diverted to the socio-economical, cultural and religious aspects that might negatively or positively affect the level of the provided services
- V. Other three Focus group discussions of 6-8 people with different background and interest were conducted mainly to see how different partners have different interest and the expected roles of each and how those roles complement each other besides two women group discussion (one in each locality)
- VI. A number of institutions and organizations that directly or indirectly involved in the water sector were visited and discussions were held with decision-makers, managers and professional staff. Key people met were Director of Planning Unit of State Ministry of Finance (SMoF) to assess the funds allocation mechanism for different sectors and development priorities, Director of EL Zakat Chamber as the department mandated to support vulnerable communities and individuals, Director of Social Affairs to assess any existing policy or regulations concerning social equity/ inclusion, Director of Mass Media and Culture for available Mass Media (Radio/TV stations) and community raising awareness programme, Director of Religious Affairs to use their influence among the population to raise community awareness on water as a scare resource that all people should have equal access.
- UNOPS and UMCOR Offices were visited to learn from their experience in involving communities in managing water schemes. Moreover, these visits were aimed at assessing the level of their involvement/awareness about the programme, willingness to support/ collaborate and to further ensure the adequate enabling environment for addressing all the detected barriers in the future.
- VII. Twenty-eight enumerators with previous practical experience and relevant technical knowledge in socioeconomic or WASH surveys were recruited and trained to implement the HH questionnaire. It was made sure that all members of the team have had a thorough understanding of the aims of the work and the meaning of every question to be asked. A combination of classroom and demonstration of -the questionnaire in the field was provided to ensure the best understanding of survey.



Photo (1) Practical training on filling the questionnaire during the training of the enumerators

VIII. A total of 18 Community meetings were administrated by the consultants (jointly with WES staff in some occasions) to meet with the villagers, explain the survey work – its aims and approach – and ensure that all members of the community understand the expected outcomes of the survey work and before proceeding with the meeting, the team asked some questions to make sure that all members understood the exercise. For the purpose of the study, importance of having representation of women and youth in the meeting was made clear to villages Shaikhs who were the meeting organizers and they did understand that. The dialogue was directed towards the preferred management modality, barrier to sustain access to water a) technical barriers in terms of quantity, quality and continuity, b) social, economic, cultural and religious barriers in addition to community views to improve and sustain access

In the end, the community assisted to rank these barriers based on which is the most influential in the case of their community.

IX. Key informants' interview was conducted with 33 people who are deemed to have knowledge of the enabling aspects of sustaining water supply where other members of the community may not be able to provide such information. They mainly represent Government officials, WASH professional at state and locality level, WASH Coordinators/officers, Key community leaders/respected person who involve in decision making regarding water supply, fiancé allocation and influencing community priorities, Locality Executive Managers, Head of Service Committee of State/locality legislative councils, Youth and women Leaders/Activists.

The questionnaire was administered as follows: a half-day workshop was organized to refresh knowledge and share experiences on aspects of rural water supply and challenges facing sustainable operation maintenance and management of the facilities. Three presentations on a) experience of private sector in managing rural water schemes b) A case of EL Neem Community-based O&M as a successful story shared by EL Neem Water Committee and c) short orientation on why and how community could play effective role in sustaining O&M of their water supply system given by the consultant . Then the questionnaire was handed to the participants after a short orientation about its objectives, its main points (e.g., policy, institutional roles/responsibilities and management aspects). Following this, the participants were requested to start filling in the questionnaire. To ensure that the items are clear and easily understood, the consultant went thoroughly one by one informing the respondents to choose their responses on the basis of the alternatives provided. The opening session was addressed by DG of SWC and CIS Head of Office photo (2)



Photo (2) Sector partners workshop

- X. HH Questionnaire: this survey targeted 1400 HH to collect quantitative and qualitative data, through structured interviews with the head of the household using accidental sampling techniques that anyone who by chance met with the study team or attended the meeting that organized for the study purpose can be used as a sample if that person is deemed suitable as

a data source. The questionnaire was pre-tested using small group of people during the training of the enumerators to check the validity and applicability of the questions based on which some questions were refined. The questionnaire was administered to the respondents by the trained enumerators and it consists questions main with closed-ended items which followed by response options where, in some areas, very few open-ended items have been used to explore answers of the respondents. As the study emphasis was on the socio-economic and cultural aspects, the HH questionnaire was the main tools for getting those variables. The questionnaire structured in three parts. The first part asks for biographic and socioeconomic data about the respondents. The second part focuses on access to water and reliability throughout the year. The third part sought to test public attitudes and perceptions about water supply, religious and cultural aspects as well as perceptions towards institutional aspects of water supply services.

Before getting into the questionnaire, the enumerators explained to the HH member the objective of the study and highlighted how a huge investment has been made in the field of rural water supply by the national governments, donors and supporting agencies, but the outcomes seem to be disappointing mainly due to frequent breakdown of the facilities after installation. Prior to this exercise, a community meeting was organized to get the clearance to enter to the community up to the HH and conduct the survey.



Photo (3) Examples of HH filling the questionnaire

- XI. Field observations through visits to 28 boreholes was conducted to assess the mechanical condition, well yield, use of the facilities, overall environmental sanitation around the facilities and to cross-check some questions which were already been asked in the questionnaire
- XII. Four study results workshops were conducted, the first workshop aimed at peer review of the study prior to its wide sharing with sector partners. The meeting was attended by the key staff of SWC, WES Project Manager, CIS WASH Manager and CIS Senior Environmental Health Officer where SWC and WES had also provided their final comments. The other three workshops(1 per each locality and on at the State level) were conducted to present the study draft reports on which participants deliberated on results and recommendations. Feedback from these workshops was incorporated in the final reports.



Photo (4) Study result workshop (Asalaya)



Photo (5) Study result workshop Abu Matarig

4. SAMPLING AND DATA PROCESSING

The sample size was determined using a simple percentage approach. So, for selection of the targeted communities 50% of the total functioning boreholes in each of the study locality were used. Then assuming that each borehole serves about 5000 people as per WES standard and considering the average household size as five persons, total targeted HHs to be interviewed will be approximately around 1400 serviced by 28 boreholes. This resulted in targeting 500 HHs in Asalaya locality and 900 in Bahar EL Arab locality. Comparing this sample size with the population of the two localities (projected from 2008 census by an annual rate of 2.5%), it also gives a sampling size of 4% which is reasonable as the most common sizing is 3-5%. For the key informants interview and FGD a fixed number of respondents' approach (33 KII, 5 FGD and 18 community meetings) were selected

Table(1): Sampling villages and sample size

Locality	Village name	No. of Boreholes	Sample	Locality	Village name	No. of Boreholes	Sample
Bar Arab	Abu Matariq	5	250	Asalaya	Asalaya	2	100
	Keaik Barra	1	50		Nimir North	2	100
	Sibdo	2	100		Um Saada	1	50
	EL Shuraya	1	50		Kulkul	1	50
	Wad Um Zeiaif	1	50		Um Waragat	1	50
	Um Gerainat	1	50		Mashrou	1	50
	Narga	1	50		Maali	1	50
	Salwaji	1	50		Dabakir	1	50
	Um Kahir ban	1	50	Bahar Arab	Serhan	1	50
	Kerio	2	100	Manjour	1	50	

Upon completion of data collection, questionnaires were checked for errors and data was entered in Statistical Package for Social Scientists (IBM SPSS V.25) to calculate socio economic characteristics and Microsoft excel 2016 spreadsheet for organizing data and making necessary calculations. Data (after cleaning) was coded where responses were put in categories and numbers to allow for analysis. Then qualitative and quantitative techniques of data analysis was used and presented in percentages, means and frequencies. The software was used because of its flexibility and most commonly used.

5. STUDY RESULTS

5.1. Analysis of Current Operation, maintenance and management modality

In ED, according to SWC records/reports and the study findings, water yards (consist of one or more boreholes) are the main water sources for rural areas. There are 353 boreholes of which 281 are owned and operated by SWC in addition to 72 private owned (Table 2 shows distribution of water yards in the state). The operation, maintenance and management (OM&M) situation in this study was investigated with a focus on the type of technology, frequency of breakdowns, duration of repairs and maintenance, availability of spare parts and funds allocated for O&M.

Based on June 2019 SWC's records, about 85% of the government owned schemes are functional (Table 2) in addition to 68 abandoned boreholes while the private sector reported (at the sector workshop) functionality by 100% for their schemes. However, the referred SWC report was not based on field assessment and does not provide clear definition for functionality or how soon after construction the 68 boreholes were abandoned. So most likely the non functioning percentage reflect those not working at the moment of preparing the report regard less the other elements of functionality like (mechanical performance, yield, water quality and seasonality) which should be combined to determine system functionality and non-functionality. Otherwise, those facilities which are working today might not be working just next day.

For SWC the OM&M is centralized at locality level with support from the State. In each locality, there is a maintenance centre to carry out the maintenance while day-to-day operations are being done by SWC mechanics. Sale of the water and management of the water yards is mandated to the Water yard Clerk (Caretaker) as per SWC regulations.

The study revealed that the main technology for water extraction is diesel powered technologies (about 70% of the power system are Perkins generators) and all respondents reported they do not take part in the selection of the technologies used with an explanation that it is the SWC and development organizations which implement the projects who normally chose the technologies. In terms of accessibility, 84% answered that the water facilities/sources in the study area are accessible and reliable throughout the year and only 15% are not reliable during the rainy season mainly due to limited working days of the facilities as most users go for farming and do rely on surface waters. In terms of breakdown frequency, 26% of the respondents believe the facilities break down at least once every month, 48% every 3-6 months, 21% every year and 5% more than a year, while fixing the breakdown takes more than week, 2-3 days, and the same day as ascertained by 60%, 29% and by 12% of the respondents respectively (table 3). So despite the frequent and prolonged breakdown, the users see the source as reliable which might indicate limited alternative sources. However, the findings

from the discussions with community leaders and water committee members, revealed that repairs took longer and an example of 41 days was given in Sibdo village despite that (as reported by the community) spare parts are available but the bureaucracy in SWC procedures in terms of many steps to take response (from the date reporting the breakdown to procuring the spare part and sending the repair team) is the main reason. 80% of the respondents see the facility as users' friendly while 20% do not agree arguing on no separation between the human and animal consumption troughs, poor drainage and their areas are characterized by high animal population which is not considered in the design as the dimensions of the water yards is standard throughout the State.

Table (2) Rural water facilities in the State (June 2019)

Sector	Locality	No of Boreholes		
		Functional	Non-functional	Total
ED Daein	ED Dain (Town)	22	3	25
	ED Daein (Rural)	9	0	9
Central	EL Furdose	23	3	26
	Asalaya	22	2	24
Baha EL Arab	Abu Jabbra	55	15	70
	Abu Matarig	38	6	44
Eastern	Abu Karinka	27	3	30
	Adila	34	1	35
Western	Yasin	17	1	18
Total		247	34	281

Table (3) frequency of water facilities breakdowns

Frequency	No of respondents	%
Every month	686	49
Every 3-6 months	476	34
Every one year	154	11
More than a year	73	5
Do not remember	11	1
Total	1400	100

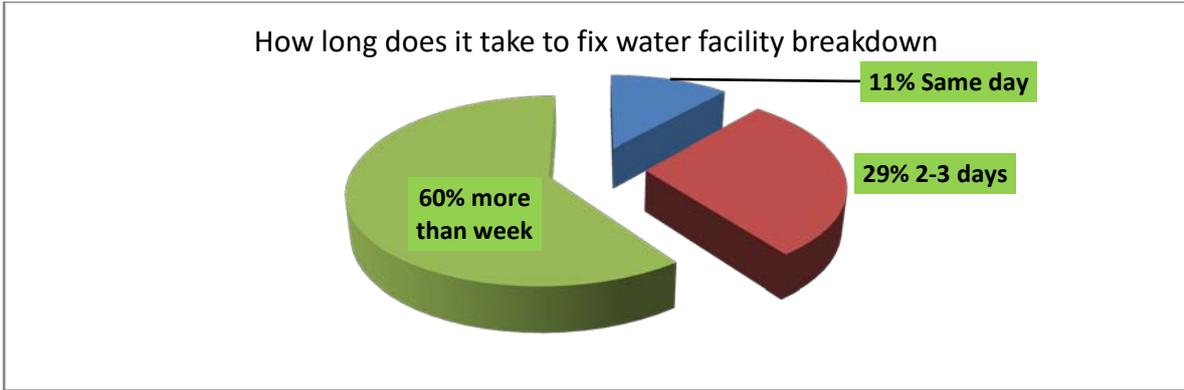


Fig (2) Time taken to fix water facility breakdown



Photo (6) example of poor drainage at water yards in Nerga village Bahar EL Arab Locality

Weak supply chain management, mainly the movement of the fuel and spare parts from the State to the sites through the locality was a concern that repeatedly flagged in all discussions. In general, most of the interviewed community leaders believe that the breakdowns are due to poor operations and maintenance especially on the generator powered systems which require regular oil change as well as preventive maintenance.

It was also important to note that there is (in most locations) a Water Committee from people residing in the same village. These committees are formed either through external intervention (project initiated) or are initiated by the people with main role to organize water users to raise additional funds to buy fuel whenever the fuel provided by SWC is inadequate in addition to other roles in case of donor supported projects(UMCOR and UNOPS). The agreement in such case where extra fuel have been

provided by the community, SWC should pay back the cost or in kind but as reported by all respondents from FGD, However SWC did not fulfil that obligation at all.

The committees are usually composed of a President, Treasurer and several representatives of the users, with one or two female members and in some cases the committee includes the operator and/or caretaker (Clerk). These committees do not have any power or proper legal status to represent the community in decision-making or control over the resources. However, it was only 41% of those interviewed who ascertained that their committees are fully operational and responsive, 44% of the respondents indicated that their committees are operational but not responsive, while 15% reported as non-operational. In general, this finding can be taken as an indicator for the ability of these committees to take active roles and responsibilities if well trained and capacitated.

It was observed that in all the visited locations, the drainage system was very poor and animals and human were sharing the same troughs despite that in four of the locations, separation between the two was piloted with support from NGOs but the impact of the project was only felt during its life-time and not continued for more than 6-10 months after the termination of the external support mainly due to bad quality of the taps, misuse by children and crowdedness when there is water shortage.

Majority of the visited boreholes are of yield ranging from 11 to 15 m³/h which is the average productivity of the boreholes in the study area. This (yield) defeat SWC's argument that low yielding due to aging of the water facilities is a factor contributing to inadequacy of the water revenue to cover O&M specially in this study case.

A very successful story of community-based O&M has been presented by EL Neem Water Committee at the sector workshop where there is a memorandum of understanding between WES and the Water Committee explaining role and responsibility of each partner, mainly on how tariff could be collected, deposited and utilized. However, the system has been operating well for almost four years but still under UNICEF/WES umbrella.

Another successful story was detected from UNOPS supported community-based managed water supply systems piloted in three localities including Bahar EL Arab with an overall objective to contribute to improved livelihoods and poverty alleviation of conflict-affected populations in ED. For running these facilities, a "co-management" system between the users' committee and SWC was adopted to share the revenue by 20% to cover O&M cost, 20% for SWC for administrative cost and 60% for the community to support livelihood activities benefiting from the borehole water. It was not clear on which basis those shares were determined but since the systems are still new, 20% for O&M might work for a while. Nevertheless, the system could work well throughout the project life (as far as it being operated under the umbrella of UNOPS) but by the handing it over to SWC, it was found not possible to continue with the co-management modality as SWC regulations do not allow community to

take a part in managing the water revenue. Learning from these two examples, it could be concluded that whatever successful CBOM system has been piloted, its replication will be constrained by lacking of supportive policies and regulations.



Photo (7) example of recent rehabilitated site with a separate human consumption taps



Photo (8) Example of site after less than 10 months from rehabilitation (animal and people are together), Salwaji village Bahar EL Arab locality

To assess the quantity of water that reaches the HH, a proportion of 68% found to have access to more than 8 Jerry cans /day, 18% receiving 4-6 Jerry cans per day , 8% for 4-5 Jerry cans and 5%

less than 4 Jerry cans. However, it was noted that households often have at least 4-5 animals living in the same HH structure. From the findings of the study, an average of 7 people can be taken as average HH size for purpose of calculations. However, within the reviewed SWC documents and materials there was no stated norms for human and livestock water supply except for the emergency that based on meeting minimum basic needs.

On measuring community perception about the best institutional arrangements and modalities for sustainable O&M of water supply, results have shown that 43% of the respondents suggest partnership between the communities and government as the best modality. Management by community alone was mentioned by 16% while 26% see management by government alone and 14% by private sector. Those who rely on the (two assessed) private boreholes prefer the private sector as the service provider, believing that they can benefit more through efficient operation and maintenance but they see it too early for any tendencies towards full privatization in the water sector.

However, majority of those who were interacted with referred the frequent breakdowns of water facilities to poor operations and maintenance, especially on the generators systems due to lack of preventive maintenance, poor supply chain and inadequate technical capacity of the operators (despite the continuous efforts by supporting agencies in training the water yards' mechanics) which all are of managerial nature rather than technical. Therefore, the technical influencing factors could be summarized as follow:

- i. Diesel powered, Perkins, generators and submersible pumps are the main technology as the case in many States in Sudan, and they are appropriate in terms of compatibility with the nature of area hydro-geology (deep water table), availability of spare parts and the required technical skills within and outside the community, potential for standardization, appropriate to local conditions as well as simple enough to allow community participation.
- ii. Recent years have seen the efficiency of solar-powered water pumping systems increase significantly, and their use has increased substantially within IDPs camp. So installation of hybrid solar/generator-powered system in the rural setting where fuel supply is erratic and inconsistent may improve the water supply continuity.
- iii. Despite some comments by the interviewees on poor drainage system and water yards' design to accommodate more animals, all the constraints are linked to the management aspects of O&M and very little has been found to be technical barriers.
- iv. The current effectiveness of O&M is determined, to a considerable extent, by non-technical factors.

5.2. Socio-economic factors influence on sustainability of water supply

Traditionally, water access is measured by the percentage of the population having minimum standard level of the service, a relation that provides a picture of the supply coverage situation but it is not enough to characterize the sustainability of the situation unless the socio-economical dimension of the service users is taken into consideration and analysis

To assess the interrelationships between socioeconomic factors, water source features, and household water management, the following socio-economic characteristics were examined; that include, sex of the household head, education level, marital status, family size, residence of the respondents, security and economic activities, land ownership and utilization, livestock ownership, economic activities and household annual expenditure.

In total, 1400 households in 22 villages/towns (9 in Asalaya and 13 in Abu Bahar AL Arab)served by 28 boreholes were examined. The main socio-demographic characteristics of the respondents based on the frequency analysis, are shown in Table (4)

Table (4) main socio economic characteristics

Socio economic characteristics	Range	%	Socio economic characteristics	Range	%	
Gender	male	57	Education	Illiterate	41	
	female	43		Khalwa	26	
Age	<25	26		Primary	19	
	26-55	65		Joiner	6	
	>55	9		Secondary	7	
Family size	2-5	27		Graduate	1	
	6-9	48		Post Graduate	0	
	10-14	20		Marital status	Single	13
	>14	6			Married	82
HH Headed by	Father	79			Divorced	2
	Mother	15	Widowed		4	
	Brother	5	Residence	Town	36	
	Other	1		Village	55	
Occupation	Farmer	75		Fareeg	7	
	Agro pastoralist	15		IDP Camp	1	
	Merchant	4		Damra	1	
	Labour	2		Owning land	YES	81
	Others	3	NO		19	
Practice agriculture	YES	93	Owning livestock	YES	65	
	NO	7		NO	35	

Table (4) shows that 57% of the respondents are male where the selection of the respondents per household was based on who was present during the interview. However, for the objective of the study that built on women as special group in water issues, 15% HH headed by women were reached which are expected to be at a disadvantage in all the dimensions of vulnerability in comparison to households headed by men. In this regards, the community leaders explained that in most cases the male member of the HH owns the productive resources (notably land livestock). On the other hand 82% of the respondents were married, 74% -% of the HH size was found to be more than 5 person which reflect the nature of Sudanese extended families that includes other members like uncles and cousins which might negatively effects the wealth of the family. So for this study the gender of the household's head and the household size can be considered as the two major determinants of household's vulnerability. It is worth mentioning that the community has the ability to subsidize the cost of the water to cover such poor members as indicated below.

75% of the respondents are farmers and 15% are agro-pastoralists, thus the economy of the study area is fundamentally based on crop farming significantly mixed with animal rising. This makes agro-pastoralism the dominant livelihood and socioeconomic system as 93% practicing agriculture (Fig 4), 81% has their own land and 65% own livestock. Regarding security situation to undertake these activities, 86% described the situation as good.

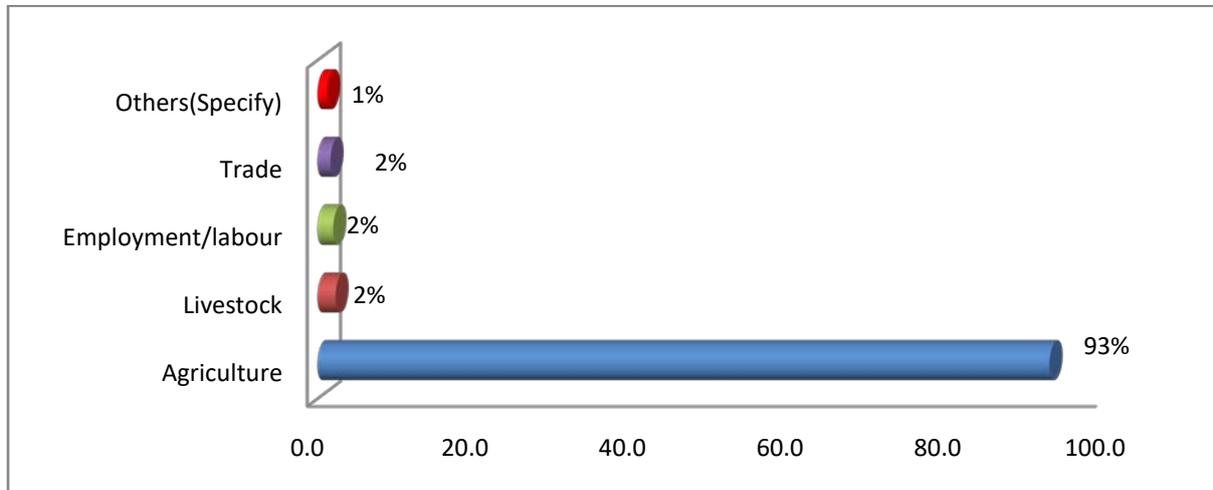


Fig (3) Household main sources of livelihood

On the age groups, age ranges from 25-50 years constituting about 65 % and this could be interpreted that the middle aged people are dominant and expected to get the required participation in running and sustaining the project in the future. Regarding the education level, the majority of the respondents were illiterate accounting for 41% ,with additional 27% having Khalwa education (informal Islamic teaching), 19% had primary education, 6% secondary and 7% high secondary educations (Table4). This low level of education can be attributed to the nomadic nature of the residents in search

of pasture for their livestock as 55% live in villages compared to 36% live in towns and might also reflect the low level of social capital in the study area. However, it was not possible to directly explore associations between income and access to water due to the absence of the variables of the household income. Thus, land and livestock ownership, and the percentage of the income expenditure were used as a socio-economic status. In this regard 69 % of the HH estimated the annual expenditure to be more than 90% of total HH annual income.

To conclude, the water need of the community for human and other household uses is a function of its socio-economic conditions. These socio-economic factors will influence water requirements (mainly the occupational profile of the family, whether employed or engaged in farming, land and live stock owner, saving level, education level e.t.c. Given the water requirements, the price of water also influences the demand for water or the amount of water for which the communities are willing to pay which in turn influence the supply sustainability, so all these factors are interlinked and influence the level of the services including water supply. Furthermore, the future sustainability of the facilities could be affected by growth in community, which might change in these socioeconomic factors. In general, the findings show that these factors were never considered in the planning of rural water supply schemes in ED.

5.3 Socio-cultural factors influence on sustainability of water supply

"Due to its fundamental role in society's life, water has a strong cultural dimension. Without understanding and considering the cultural aspects of our water problems, no sustainable solution can be found (UNESCO 2003).

Internationally 22nd of March every year is designated as World Water Day (WWD) aimed at focussing attention to the critical issues of fresh water. The theme of 2006 WWD was Water and Culture. Thus as water supply services affect people's lives, people reciprocally affect the level and status of those services and their development and such interlink should be considered in each water project.

In the study area, 82% of the respondents do think that the cultural context of the users, to a high extent acts as an enabling factor or as a counteracting force for good water management but 73% of them reported that those beliefs, traditions and practices are not being decisive factors in planning and operating of water facilities.

In that regards, one important way of directing and positively influencing public attitude is by engaging them in the definition of the problems throughout the stages of the project to increase the chances for a solution to be reached and aims to be set. To measure this, the interviewees were asked three questions to find out if there are any channels for sharing and knowing from them how could run service provision. The results show that 80% of the respondents believe communities were not consulted when water tariff was set and they just see SWC staff from a distance when they come accompanied with Police staff to collect the tariff or a team doing maintenance without having any opportunity or means of dialogue with the people served or to reflect their concerns. In addition to that, many individuals including community leaders argued that they do not know that it is their right to be consulted in this respect . Another means of influencing decision making is access to make complains where 49% (male 57% and female 37%) of the respondents had complained about service level and 51% did not complain. The reasons for not complaining were found to be by (42%) nothing to complain, 32% do not know where to complain and 26% expected no action will be taken. For those who did complain, the result as expressed by figure 4 below, 24 % (male 26 % and female 18%) of the respondents reported that prompt action was taken, while 53% stated delayed action was taken and 23% % expressed that no action was taken(fig .4).

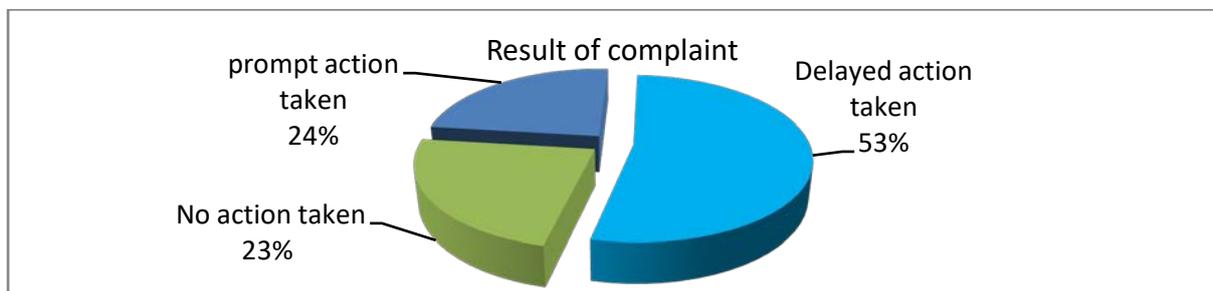


Fig (4) Result of complaint

In the study area 90% of the respondents believe that water fetching is considered a job for women and children and it easy to imagine how this place a huge burden on them particularly when water infrastructure in inadequate Photo (6). This finding supports the common belief that water issues are gendered and its use is socially and culturally categorized. Moreover, it is easy to assume that water use is controlled by the person who fetches it which, in this case, is the female of the household and sometimes accompanied by her children who are usually girls. In a situation where water must be bought, the man of the household gives the money to buy water while the management remains the work of the woman. This was captured in most of the focus group discussions.



Photo (9) Children trying to put water jerry cans on back of a donkey

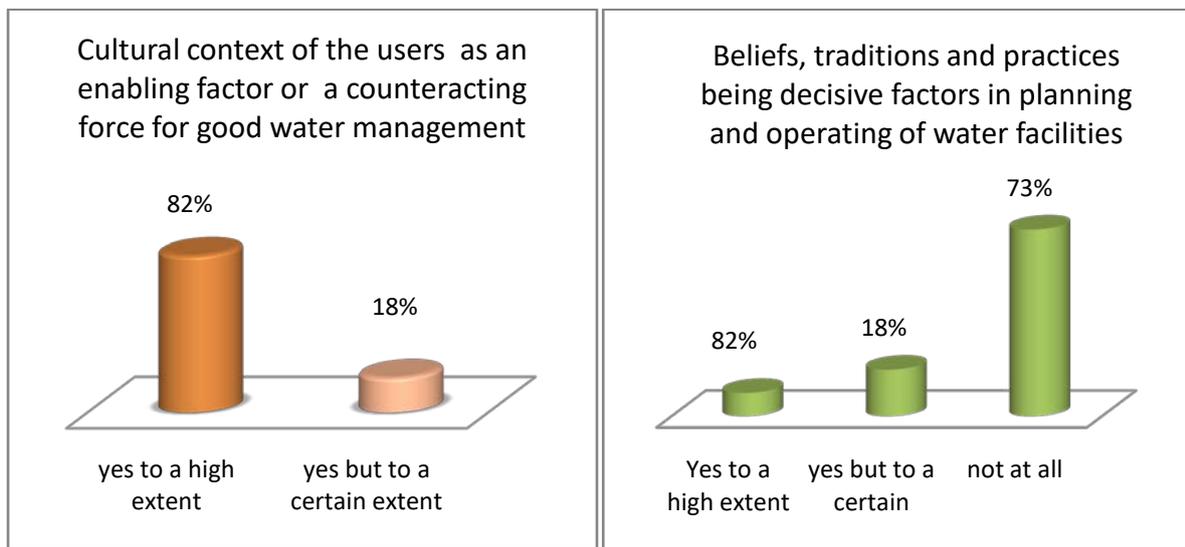
So, because of their dependence on water resources, women in particular have accumulated considerable knowledge about water issues including location, quality and storage methods. However as indicated from the results of the KI questionnaire, the role of the women in the sector is very limited and not in compliance with the principle of Integrated Water Resources management (IWRM).

On whether the users should pay for water or not, 77 % (male 77% and female 78%) of the HH responded they have to pay while 23% believe they should not. During the community meetings a similar attitude encountered about free access to basic education and primary health services giving examples that till Mid 1970s, Basic and Junior Secondary educations and primary health care services were free provided. So that old culture may still in the minds of those demanding free water. Moreover, in the government owned water yards, all respondents do not have the sense of ownership and no mechanism is in place to build that sense. It was notable that some community members have the feeling that O&M does not concern them believing that when the system is out of order government should come and put it right. In addition, the community do not have any power to control or influence the utilization of what they pay for. That may be the reason that 87% of the respondents do not trust the tariff collection and usage mechanism and 93% do not know how the collected tariff is used. Currently all respondents do pay for water though in one location a list of about 29 vulnerable HH was presented as a case should be exempted but the government regulations do not allow.

Ninety percent of the respondents believe there are religious values and norms in dealing with water. In general, high public attitudes were obtained towards the role of Islamic teaching in improving personnel hygiene, wise management of water and right of all living creature to access water. Also

positive attitude was observed throughout the community meeting towards willingness to pay to subsidize the water cost for the poor.

According to the Acting Director of the Religious Department of State Ministry of Health and Social welfare (SMoHSWF), the religious leaders have several platforms through whom negative behaviours of using water can be changed adding that religious leaders are by far the most important opinion leaders in communities that can help to shift social norms in a positive way.



Fig(5) Cultural as enabling/counteracting factor. Fig(6) Considering cultural context in planning.

The media plays a pivotal role not only to raise awareness and support for the water sector, but could also facilitate public dialogue and draw public attention to the magnitude of water problems. In this regards Acting DG of the State TV and Radio indicated that the broadcast is covering all the localities in the State except Adilla and Sheriya being covered from Nyala. On the possible collaboration with them (State TV and Radio), they share previous partnership with EPI programme and WES Projects during the WWDs and similarly they could broadcast content that is relevant to any specific audience. For local communities, radio was identified as the preferred means for communicating message to them.

5.4 Water tariffs influence on sustainability of water supply

Financial sustainability is the core element in sustaining O&M of water facilities. It was also widely recognized that the most reliable modality is community –financed mechanism as local cost should be met by local people/users through water tariff or any other funds raising options. The study found that over 80 percent of the respondents do not take part in tariff setting which is also supported by 85% of the KI who stated that communities were not consulted when the tariff was set despite reporting in the FGD that it's the responsibility of the community together with the water management committee to set the tariffs. Moreover, 61% of the key informants reported not aware how much tariff is collected per

month per facility, 70% do not know how much of it is used for O&M but more than the half (58%) believe that the water tariff was determined through O&M cost analysis, 15% determined randomly and 27% not aware how it was determined. However majority of the KI and community leaders indicated that community income as well as the ability to pay are the major factor to consider in tariff setting followed by repairs and maintenance cost.

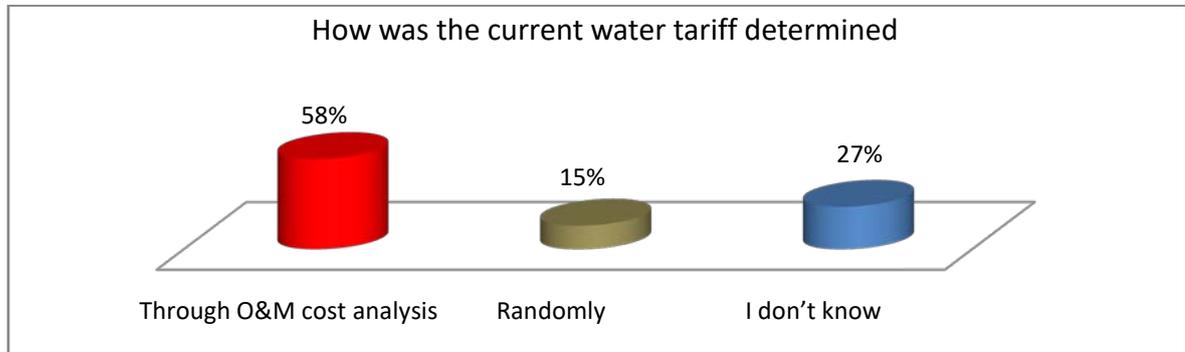


Fig (7) Determination of the current water tariff

The findings show that on average HH pays 0.5 to 1.0 SDG per 20 litres size jerry can for an average of 10 Jerry cans per day which equals in cost to about SDG 300 per month spent by the HH for water. Sixty-four percent of the KI respondents indicated that water tariff is not adequate to meet operation, maintenance cost while 51% of the HH respondents believe that the current tariff is high, 4% low and 45% is normal. However, having people not represented during water tariff setting might be among factors lead to prices being too high for the poor. In terms of gender there is no much difference in the view as can be seen in the below figure (high 50% by male and 52% by female, normal male 45%, female;46%). Further gender segregated analysis conducted to see possible different interest for future improvement and result has shown a willingness to pay for further improvement by 90% male and 91% for female while for participation in decision making, women interest found to be higher by 64% against 36% for male. This can be interrelated as women are the most affected in decision making and they would like to be part of the process.

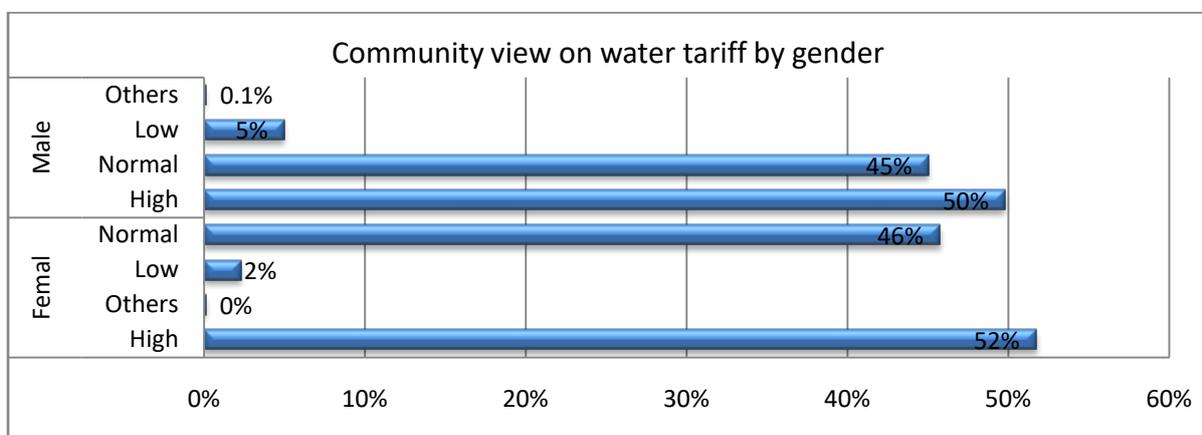


Fig (8) Community view on water tariff by gender

SWC is solely responsible for collection of the water tariff where 93% of the HH respondents do not know how the collected tariff is used and 87% do not trust the tariff collection and usage mechanism.

Nevertheless, 90 % of the HH respondents were found to be willing to pay more if there is a plan to improve the water supply services so as to meet that improvement against 10% indicated not willingness to pay more even if there is any improvements. However, since the major source of revenue generation is water users, the respondents who are willing to pay were asked about where the water authority should invest the extra revenue. It was found that 68% of the respondents are interested in improving water supply continuity, 18% in participation in decision making and 14% in tariff collection and utilization.

Water affordability is a central element to sustain the O&M. When water costs make water unaffordable, the users might continue to pay but it might be on cost of other basic needs leading to welfare losses and may discourage household from using safe sources. In general, and for the purpose of this study, affordability was looked into as the amount of monthly income that the household is willing to give up to obtain improved water services, while remaining as well-off as before. However, it was not possible to get estimation for the household annual income but for the expenditure 69-% of the respondents estimated annual expenditure to more than 90 % explaining that the purchase of water constitutes a major economic burden on the household economy. Majority of the community and native leaders estimated that more than 30% of household financial resources go for purchase of water. However, none of the SWC reviewed document has considered a definition for water affordability but many literatures point to range of 2.5 to 4.5% of the medium household income as affordability criteria. <http://mannyteodoro.com/wp-content/uploads/2014/03/Teodoro-JAWWA-2018-affordability-methology.pdf>.

In water service, satisfaction may be the sum of different elements and the source of dissatisfaction may differ from one area to another and from one household to another. In this study the result did show some factors that seem to contribute to dissatisfaction like neither being involved in setting water tariff nor having power to control what they are paying. Moreover, the community leaders explained that they have been paying more than the official tariff for some crisis maintenance or when there is fuel shortage without seeing any improvement and reversely the reliability of the service is decreasing or even worsening. In general, the findings suggest that 80% of the users appeared to be satisfied with quantity, 83% with quality but in contrast 90% were not satisfied with the reliability of the facilities in terms of service continuity.

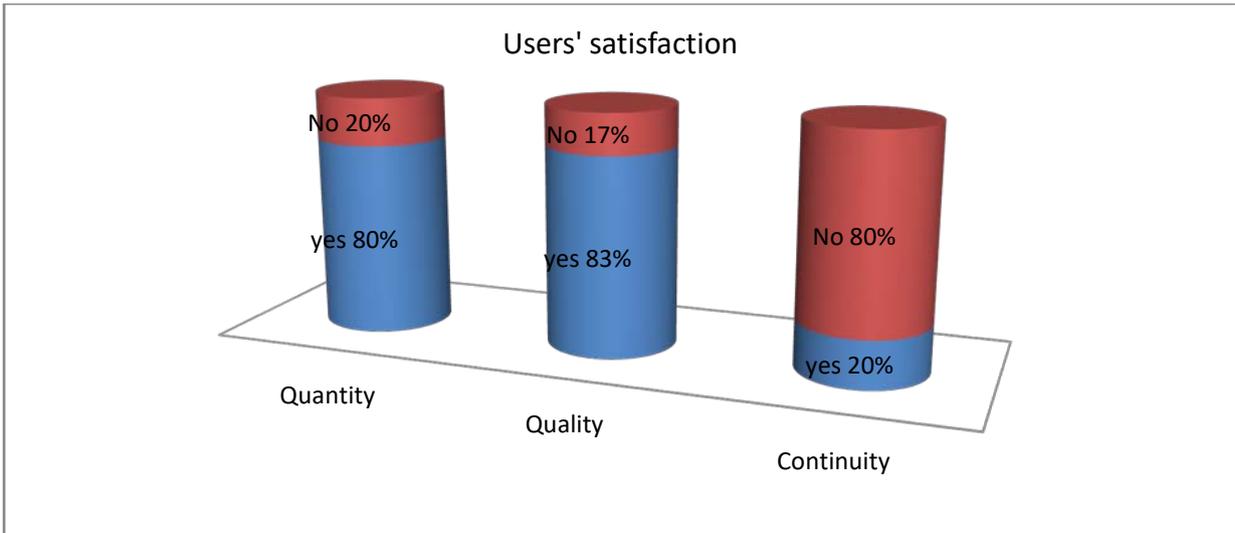


Fig (9)Users' satisfaction

The study result show that most of the respondents are farmers or agro-pastoralist of which (93%) relay on seasonal agriculture, 19% do not own land (using others' land) and 35% do not own livestock. Having all these socioeconomic characteristics, a large proportion of consumers may not afford water if priced at full cost recovery levels. However, the current tariff 'as explained by SWC' calculated to only cover OM&M cost and does not include service expansion and capital recovery.

On main sources for financing water infrastructure, most of the interviewed stakeholder reported NGO and supporting international agencies followed by federal government. However, DG of SMOF reported that this year (2019) they supported establishment of new water facilities with amount of SDG 70,000,000 besides the on-going Zero-Thirst Programme. Nevertheless, considerable findings of this study have shown that such "easy" solutions to increase water supply will "easily" elapse if users socio economic and cultural factors that might constraint the sustainability not considered as a genuine component of water supply. This necessitate more resources and political will to track public spending flows to understand where they are going, who is benefitting and why some populations are not reached and to ensure that public spending on water is efficiently directed and targeted toward sustainable water services before going for new facilities.

In conclusion, the study revealed that the current tariff is insufficient to cover operation and basic maintenance cost due to many factors related to the way it being set, collected, managed and utilized. The justification from SWC that setting tariff is based on the operation and maintenance analysis but after submitting it to the State Legislative Council for approval, the proposed tariff usually largely reduced due to political interest. However, SWC believe the solution on involving all those who will be affected in a policy protected environment to collectively workout who to pay what and what to cover what. However, tariff setting requires additional information because it requires meeting a set of

social, economic, and financial goals such as good governance, financial sustainability and economic efficiency. So all those social considerations should be used in setting tariffs putting in mind that water demand and use keep growing with socio-economic development.

The below table (table 5) which is abstracted from the SWC 2019 Mid-year report could help in getting a rapid financial analysis for an expenditure of SDG 49,830,944.0 where many items were aggregated together (in consultation with WES) to come up with the four main categories. It is clear that the staff who are involved in the day to day work (Guards and operators) are 23% of the total staff, engineers and technicians 20% while the supporting staff (administrative) are 57%. On the expenditure side, staff payment represents 43% and O&M cost 49% assuming that 90% of the supplies, transportation, vehicle renting and maintenance were to support O&M

Table (5) Detailed SWC Human Resources and Financial expenditures as per June 2019

Human resources			Annual Expenditure		
Staff category	No.	%	Budget line	Total in SDG	%
Administrative staff	425	57	Staff	21,294,738.3	43
Guards	75	10	O&M	24,273,166.5	49
Water yards' Operators	101	13	Admin cost	4,247,096.2	9
Technical staff	151	20	Training	15,943.0	0.03
Total	752	100	Total expenditure	49,830,944.0	100

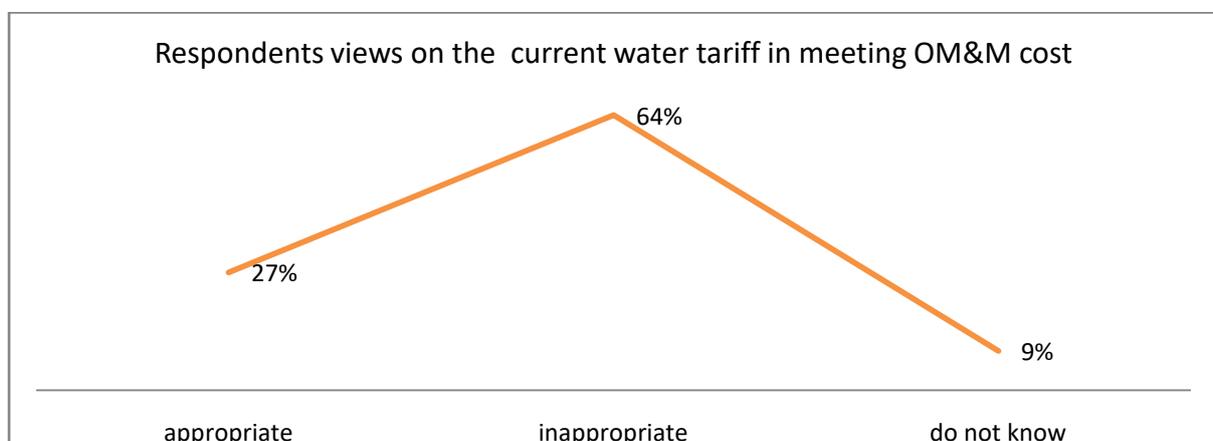


Fig (10) Respondents views on the current water tariff in meeting OM&M cost

5.5 Enabling Environment

5.5.1 Policy

Water policy is one of the means to know whether the State has comprehensive strategic objectives for its water facilities management or not. So, existence of water policy or an institutional framework that outlines the different water management institutions, functions, and the extent to which those regulations allow community participation, enhance social inclusion and provide overall enabling environment were explored through interviewing 33 KI from State and locality levels. Participants were drawn from government, NGO and private sector of which 85% are males and 15% females. However, gender inclusiveness and gender sensitivity has always been a core value in each water programme but this obtained ration of gender is not quite strong, but it could be interpreted that water management is male dominated.

Though there are there draft Water Policies in Sudan 1992,2000,2007 and one Water and Sanitation Policy(2010). The survey responses point to a few number of key stockholders (21%) believing that there is a comprehensive water policy in Sudan, 9% to some extent, 6% don't know and 64% no policy. (Fig 11)

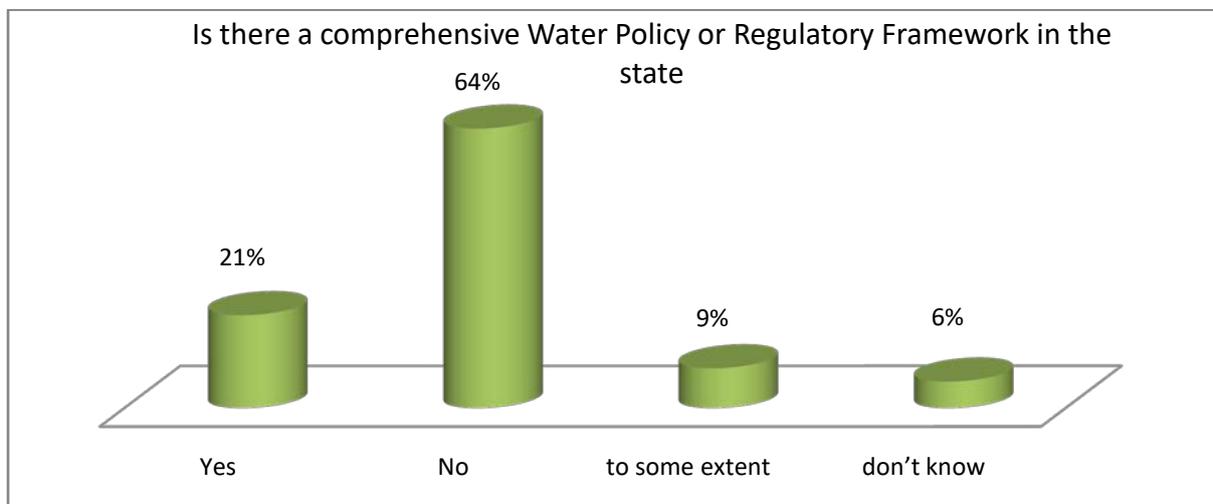


Fig (11) Respondents views on Water Policy or Regulatory Framework in the state

Moreover, the findings have proved that the existing policies and strategies do not allow any type of community participation and do not promote social inclusion to ensure access to water for all, including poor/low income people and people with disabilities as expressed by 45% of the respondents, do encourage some type of participation by 12% and 43%to limited extent. Thus it seems that decision making around water issue is characterized by a pragmatic, problem-solving approach rather than being directed by policies. However, Drinking Water and Sanitation Unit (DWSU) has completed review

of WASH policy which encompasses issues of community participation, gender, climate change and IWRM which may eliminate the gap in this area

Though UNICEF supported establishment of 13 WASH Technical Manuals and Standards, only 43% of the respondents reported aware about them but they are not available with them. On the other hand, respondents were asked to rank the below factors as main indicators for water shortage by rating from 1-5: as 5 is most influential factor and below percentages were obtained:

Table (6) Rating main indicators for water shortage

Indicator	Rating (5 is the most influencing factor)				
	1	2	3	4	5
Rapid population and urbanization	0	9%	15%	30%	45%
Inadequate community involvement	18%	9%	21%	6%	42%
Lack of clear policy direction	6%	12%	9%	24%	48%
Overbearing bureaucratic control by various supervising authorities	6%	6%	30%	27%	30%
Poor technical institutional structure	3%	12%	18%	30%	36%
Poor or unclear tariff collection/ management	15%	6%	12%	18%	42%
Inadequate funds for O&M	0	6%	21%	36%	37%
Aging of water infrastructure	6%	34%	18%	24%	18%
Poor maintenance culture	3%	0%	6%	9%	82%
lack of data for planning	3	3	24	37	33
Ownership of water facilities	6%	15%	3%	30%	45%
Lack of focus in terms of goals and objectives	8%	9%	21%	20%	42%

In summary, above 75% of the respondents scored most of the indicators between 4 and 5 while the highest scores were on poor maintenance culture (91%) followed by lack of ownership (75%), rapid urbanization (75%) and inadequate funds for O&M (73%). So rapid population growth and urbanization are expected to set a heavy demand on water making it more and more difficult for SWC (alone) to provide adequate water services, particularly to the poorer communities.

Globally it has been recognized that CBOM is one of the best approach to sustain O&M. So respondent's views on whether the government is or will be committed at the highest level to implement CBOM principles was examined and found that 58% reported as not at all, 33% yes but to a certain extent and only 9% do think that government will be committed to a high level. Furthermore, the obstacles that face the implementation CBOM was investigated and the results show that, 48% believe that lack/ low capacity of SWC personnel as the main constraint, 86% SWC personnel are not well trained to deal with various issues of water management, 73% do not see legal framework for participation of community in water facilities despite the initiatives to pilot CBOM project as indicated by 82% of the respondents. On the other hand, most of the SWC senior staff reported that no comprehensive water sector training strategy that translated into concrete action plans whether at national or state level and whatever training conducted, the focus was only on the technical aspects and the soft-ware issues like community, gender, environment etc are left to the NGO. However, capacity building of local communities (mainly by NGOs) is in general making progress but mainly on the technical part as well.

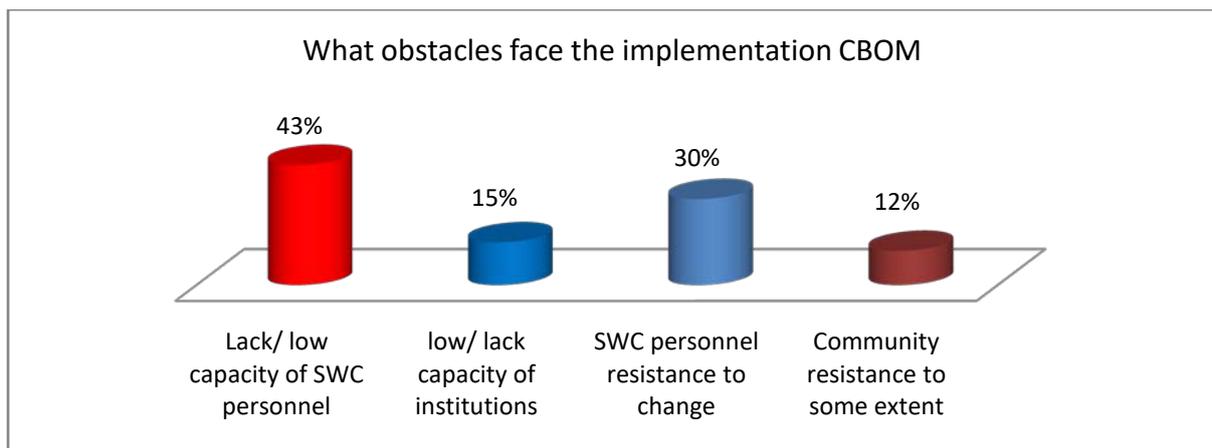
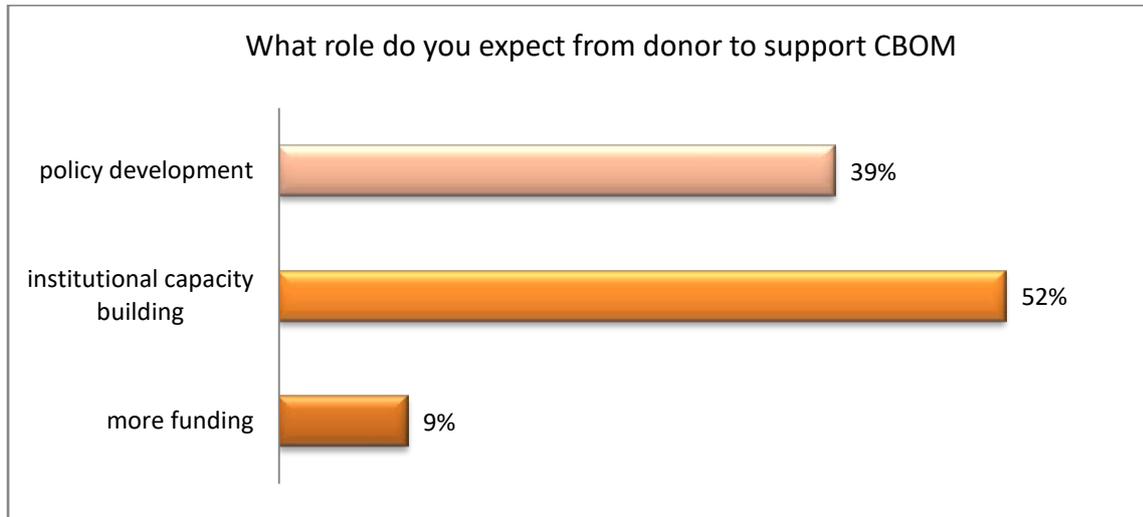


Fig (12) Obstacles facing the implementation CBOM

Despite the global move towards CBOM, it could be concluded that the level of political will is low , implementing staff capacity inadequate, principle of CBOM not well disseminated by most sector partners. All these factors resulted that water facilities operation, maintenance and management in ED is still business as usual. However, management of water resources can be a sensitive political issue. Because of this, CBOM concept needs to have a strong 'voice' in political forums and it is only with political will, the rules, regulations and institutions that manage water are more likely to function

Currently, several international financial institutions and bilateral donors have been providing technical and financial support to the water sector in ED, including (but not limited to) CIS, UNICEF,

UNOPS, UNEP, Oxfam, ARC, UNCOR, UNDP. So, on the area that the support should be focused, 52% of the respondents wanted the support to be on institutional capacity building, 39% on policy development and 9% on more funds. Thus more than 90% do see the gap is institutional rather than lack of funds. (fig13). However 58% reported that different partners have different approach in introducing CBOM modality.



Fig(13) Expected from donor to support CBOM

5.5.2 Institutional Roles and Responsibilities

Institutional management and participation of all stakeholders is essential to achieve the successful management of the water facilities. Thus, existence of an institutional framework that outlines the different water management institutions as well as the specific functions of each entity was explored through a question on the main agencies that are responsible for water related issues and whether they are aware about roles and responsibility of each institution.

SWC, Private Sector and community-based organizations (mainly water committee with NGO support) are recognized as the key institutions responsible for water supply operations. On the involvement of the users in the management, 73% of the respondents reported no legal framework for participation of community in water facilities, 21% to some extent, 6% absolutely while 61% believed there is no clear responsibilities for community within the management systems, 15% do not know and 24% believe that there is role for community. Moreover 87% of the KI do see the level of knowledge and awareness on the politicians and decision makers as low (45%) very (42%). In general, participation of stakeholders can take many forms. At its basic level, it can occur as water users' organizations with a primary mandate to facilitate the coordination of decisions relating to water facility management at users' level. As indicated above there almost a water committee in each of government

managed water yards but their role is not institutionalized. In view of this, it could be interpreted that there is no legal document(at least with the State and locality authority) that details the roles and responsibility of each stakeholder though the 2010 Water and Sanitation Policy states that government shall act as the promoter rather than the sole provider and implementer and be primarily responsible for setting policies, strategies and developing sector plans as well as monitoring and regulating service providers.

The training of SWC personnel to deal with non-technical issues of water management is found to be less than adequate by 76%, adequate by 12% and more than adequate by 12% of the interviewees.

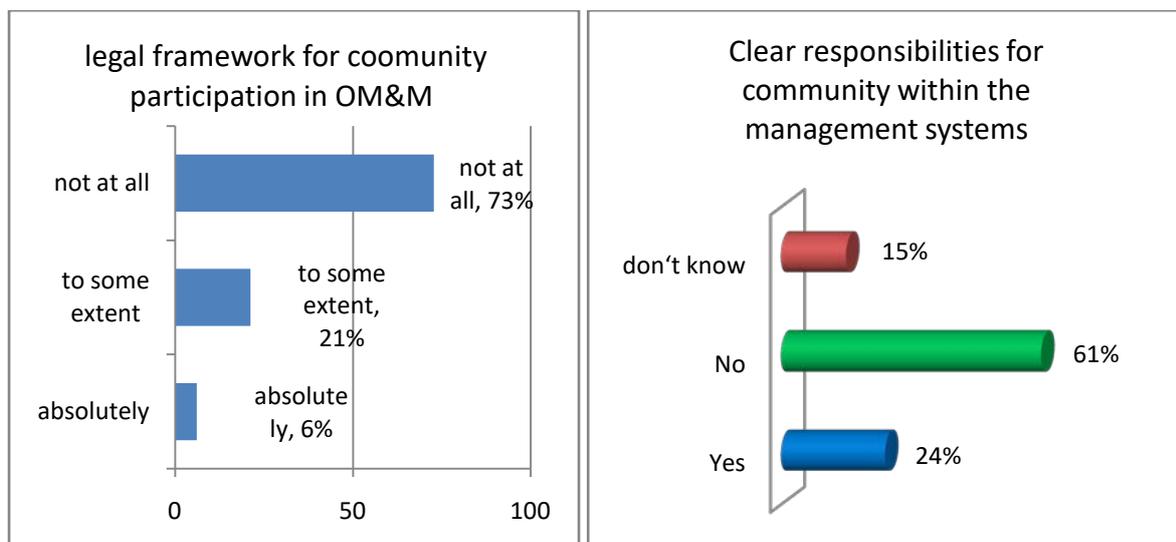


Fig (14) Legal framework for Community participation. Fig (15) Clear responsibility for community

Therefore, a holistic approach for water supply management which relies heavily on input by all users at every stage from the public, tribes, stakeholder groups, and public agencies representing a variety of interests seems to be a big institutional gap.

In general, there is a trend the world over to make governments more accountable and responsive to local people through decentralisation to encourage participation of people in the decision-making process at the grassroots level. In Sudan service delivery is at the heart of locality's mandate as direct service provider or in partnership but the findings have revealed that water sector is decentralized up to the State level. So this talk of the institutional linkage between the communities, locality and SWC is found to be a main barrier in establish a sustainable OM&M of water facilities that requires institutionalized and legal framework for community participation within clear roles and responsibilities of all stakeholders

6. COCLUSION

OM&M activities encompass not only technical issues, but also managerial, social, financial and institutional issues which must all be directed towards the elimination or reduction of the major constraints which prevent sustainable water supply. From the study findings it is evident that there are many factors that negatively impact on the current OM&M system in the two assessed localities which could be summaries as follow.

6.1 Technical factors and managerial aspects

The study results have shown that technical aspects in terms of technology type, its appropriateness to local condition, simplicity to allow community participation, availability of spare parts and affordability to community are of minor impact. Interestingly, some concerns about variety of engines that imposed by some projects but in all, it is within the familiar technologies to SWC and communities. However standardization of technology as far as possible gives access to order spare parts in stock and sharing them between communities and also the training can be standardized accordingly.

Design of the water yards to suit the local condition based on the density of users (human and animal) was another comment which is valid in few locations. However, the poor quality of the spare parts specifically the taps and fittings were the most technical issues detected by this study.

Management of the O&M was another factor investigated and the findings show that this component is the bottleneck of the facility management. The findings indicate that SWC regularly collects the revenue to meet the O&M cost, spare parts are available in the market and there is technical team in each locality to carry out major repairs and the minors repairs to be done by the water yards' mechanics. In spite all of that, about 60% of the respondents reported it takes more than a week to fix the breakdowns. This also indicated by 26% of the respondent sby reporting that the facilities break down at least once every month, 48% every 3-6 months while fixing the breakdown takes more than week by 60% explaining that most of the breakdown were on the generator which requires regular oil change and preventive maintenance explaining that this task could simply be done if there is a system in place. However, private sector has appeared in the analysis as an option that proved to be more efficient in service delivery. As most of the system breakdowns associated with the generators, installation of hybrid solar/generator-powered system in the rural setting where fuel supply is erratic and inconsistent may improve the water supply continuity. However, solar panel theft is a harsh reality learnt

from its using in the IDPs camps so security measures should be considered in both the technical design and hours guarding system to protect against theft and vandalism.

6.2 Socio-economic and cultural aspects

The results of the study provided some link between the socio-economic characteristics of the targeted population and the current level of O&M practices. 70% % of the respondents are farmers and in total 93% are practicing seasonal agriculture, 35% live in towns and 55% in village and remaining are of nomads.

The results has shown that 74% of the HH size was above the standard (5 person) that used for planning and calculating the coverage, 15% of the HH headed by whom expected to be at a disadvantage in all the dimensions of vulnerability in comparison to households headed by men. Regarding the education level, the majority of the respondents were illiterate accounting for 41% with additional 27% had Khalwa education and 69 % of the HH estimated the annual expenditure to be more than 90% of the HH annual income.

In general, a low level of social capital could be interpreted from these socio-economical characteristic but none has been considered during the planning to ensure equity or social inclusion which are the core value in improving access to safe water. Instead, the same level of the service with same price is being provided to different users with different interest and ability. Findings also indicate that users do not have trust on the SWC as they feel that what they pay should be used to provide and maintain a better level of water supply rather than what they are currently getting.

The study results have also concluded that cultural context of the users, to the high extent, act as an enabling factor or as a counteracting force for good water management as confirmed by 88% of the respondents but 73% of them reported that those beliefs, traditions and practices are not being decisive factors in planning and operating of water facilities.

However, one important way to do that is by directing and positively influencing public attitude through engaging them to get their interests, suggestion and fears heard but the study results indicate there is no any means of communication or dialogue with SWC to the extent that community members do not know they have to be consulted even when water tariff was set(which is the most decisive factor). Another channel to hear users' views is through complaint mechanism where findings revealed 51% do not know where to report and 51% of those did report, the result was found to be delayed action or no action taken.

One of the significant links between culture and water management practices is that fetching water is considered a job for women and children by 90% which means women have accumulated considerable knowledge about water issues, but their role in the sector is very limited compared with the principle IWRM. Despite efforts been paid to get women represented the sector found to be male dominated.

The results have also show a negative cultural attitude towards paying for water as 33% of the respondents urge for getting free water but it seems this percentage reflects some cultural history as currently willingness to pay is high as indicated below. Moreover, they feel that the facility is owned by the government, they do not have any say on it, O&M does not concern them and when the system is out of order government should come and put it right. This attitude could be changed through social mobilization and advocacy.

Interestingly the results show 90% of the respondents do believe there are religious values and norms in dealing with water and that religious leaders have several platforms through which negative behaviours of using water can be changed. Within SWC staff, the result showed a negative attitude of poor maintenance culture as indicated by 91% of the respondents.

Most importantly, the results have proved that effective use, operation and maintenance of water systems at community level depend on users, individually and collectively to ensure that things are done in a way that people desire and afford.

In summary, the study has concluded that on the top of the socio-economic and cultural barriers are poor maintenance culture as reported by (91%) followed by lack of ownership (75%), rapid urbanization (75%) and inadequate funds for O&M (73%)

6.3 Financial aspects

The findings show that all users pay for water regardless of their ability to pay. Moreover, 90% are willing to pay more if there is a plan to improve prioritizing improving water supply continuity.

Whenever, SWC is not in position to provide fuel, Water Committees fill the gap on loan basis. Yet so far no loan paying back was experienced. Even though, it seemed communities willingly will continue filling the gap under any circumstance. In spite of the high degree of users willingness and commitment to support O&M, findings indicate that communities were not consulted in any matter at all.

It was evident that purchase of water constitutes a major economic burden on the household economy but, in setting water tariff, only the financial and political criteria were considered. Basically,

water tariff determined by SWC through O&M analysis based on the cost recovery but when it submitted to the State Legislative Council for approval, political interests erupted out. So the principles of equity and social inclusion as core value were overlooked despite that community has the ability to subsidize the cost of the water to cover poor members.

. Findings also revealed that communities are used to paying more than the official tariff for some crisis maintenance (then the tariff back to the normal) without seeing any improvement with that additional paying, and reversely, the reliability of the service is decreasing or even worsening leading to 90% of the users not satisfied with the reliability of the facilities in terms of service continuity. Despite all efforts to fulfil the financial requirement, study findings indicate no allocation of adequate funds for O&M.

looking at all above-mentioned conclusions, it is quite clear that the current tariff is insufficient to cover operation and basic maintenance cost due to many factors related to the way it is being set, collected, managed and utilized . At the same time, findings indicated that it is easy to mobilize funds from the communities, if the provided services are addressing their true needs.

6.4 Institutional aspects

It is very clear from the findings that the present water administration structure ignores the role of users in the long term sustainability of the system and the institutional framework that outlines the different water management institutions as well as the specific functions. Therefore, based on the findings of the study, any modality of OM&M of rural ware supply cannot succeed in the absence of genuine and effective legal participation of water stakeholders in general and users in particular.

The results has shown that the institutional and human capacity of SWC to bring the user on board and share roles and responsibility is inadequate and tied by absence of legal framework to delegate some power to the community particularly in controlling the revenue.

The results of the study also reveal that lack of clear policy and regulations is among the leading barriers to sustainable management of water facilities. More importantly the findings concluded that the bulk of OM&M problems are of institutional nature rather than technical. Thus, the type of assistance that is most required in order to fill these gaps is of institutional nature as indicated by 90% of the respondents

7. RECOMMENDATIONS

- 1) As development of water policy might takes long time, it is recommended to support local regulations and legal framework for participation of water users in facility management, especially the duty bearers, women in this context.
- 2) Socio-economic and cultural attitude of the target population to be among the decisive factors for development of a joint management system between communities and SWC.
- 3) As the frequent breakdowns of rural water supply system was referred to poor operations and maintenance especially on the generators, it is recommended to introduced pumping system which would be powered by a hybrid Solar/diesel generator system with battery storage coupled with a solid system of routine and preventative repairs.
- 4) Establishment of a robust monitoring feedback mechanism for O&M related issues
- 5) Capacity building of SWC personnel and users to deal with the various aspects of the water supply management and ensure including planning, budgeting for operation and maintenance and monitoring skills within the training curriculum.
- 6) Based on the findings, Development of OM&M strategy that built on actual O&M cost , future capital investment analysis, clear set up of transparent and participatory tariff system that supported with a clear tariff collection, utilization, management and feedback system. **The strategy to be piloted in two communities.**
- 7) Mapping and assessing the private sector to see how it could be capacitated to play more efficient role as service provider (mainly provision of spare parts).
- 8) Due to rapid urbanization type and level of water supply is challenging. It is recommended to find a third modality to settlements that are no longer rural nor yet urban (small town)

8. References

1. SWC Wells inventory report June 2018
2. SMOF 2018 Annual report
3. Rural Development: Putting the Last First ,Robert Chambers
4. CIS Water yard Assessment report January 2019
5. CIS Water yard Assessment report March 2019
6. 2014 Multiple Indicator Cluster Survey (MICS)
7. S. Arabi (205) Community-based Rural Water Supply Management System M.Sc
8. Water Sector Reforms and Institutional Capacity Development Program, Programme Appraisal Report 2015
9. 2010 Water Supply and Environmental Sanitation Policy

9. Annexes

9.1 People me

1. Eldouma Adam Osman, DG SWC East Darfur.
2. Adam Ali Mohamed, Former State Legislative Council member and private well owner.
3. Hassan Adam Mahmoud, Deputy SWC for Central Sector.
4. Kouther A/Rahman Mohamed, WES Project Manager.
5. Hatim Abdalla Hassn, WES Project, Senior WASH Officer.
6. Ali EL Toum EL Rawi, Deputy SWC for AbuKarinka and East Sector.
7. Hassan Adam Mahmoud, Deputy SWC for Bahar EL Arab Sector.
8. Abdalla Abdelkareem Abdalla, Planning Unit Director SWC.
9. A/Rahman Ahmed Mahmoud, State Ministry of Health and Social Affairs (Religious Affairs Department).
10. Michael Babu Onyango, (CIS)Program Manager – WASH
11. Tesfaye Hussein, (CIS) Public Health and WASH Country Coordinator
12. KhamisaRajab, WASH Officer UNICEF ED
13. AbbakerAhmedBakhiet, Planning Unit Director State Ministry of Finance
14. Adam Omer, State Ministry of Health and Social Affairs, Zakat Chamber, Projects Unit.
15. Faisal A/Aziz Adam, State Ministry of Health and Social Affairs Director. Social Affairs Sector.
16. Aisa Mohamed Idris, (OIC) State TV and Radio

17. Osman Salih Senior Environmental Health Officer CIS ED Daein
18. MalazIbrahim, Senior WASH Officer CIS ED Deain
19. Abdel Nasir Adam Head of Office CIS ED Daein
20. Mohamed EL Rizeigi Ahmed, Executive Director SWCBaher El Arabi Locality
21. Salah Siddig Abu Aagla, Acting Assalaya Commissioner
22. Hassan Adam Musabbal, HAC Assalaya
23. Musaab Adam Ahmed, UNOPS
24. FitainKhatir, Sheikh Sibdo Village
25. Mohamed Ibrahim Omer, ShiekhMunjar Village
26. Yahya Ismail Bershum, Water Committee member Um Greinat village
27. Mohamed Khamis Ahmed, Shiekh Um Khair Ban Village
28. Mohamed Ahmed Haroun, Water Committee member UmKhaur Ban Village
29. EL Sharif ShayibMohmed, Sheikh EL Nimer Village

9.2 Study TOR

9.3 Household Questionnaire

9.4 Key Informants Questionnaire