36th WEDC International Conference, Nakuru, Kenya, 2013

DELIVERING WATER, SANITATION AND HYGIENE SERVICES
IN AN UNCERTAIN ENVIRONMENT

The sustainability of handpumps in Konso District, Ethiopia from a household water security perspective

M. Arlt, Germany

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The objective of this research was to assess sustainability of hand pump fitted boreholes in Konso district, Ethiopia, from a household water security perspective. A mixed methods approach was used applying purposive sampling for the selection of 10 Afridev hand pump sites constructed in 2002 and 2003. The overall sustainability score of six hand pumps was between 2 and 2.3 on a scale ranging from a score of three (3) as most favourable to a score of one (1) as the least favourable. The four non-functioning hand pumps received scores between 1.3 and 1.9. The research showed that use of alternative water sources, the number of people served by the hand pump, access to slow-wearing spare parts, insufficient support of water committees were criteria likely to determine sustainability. It is recommended to carry out further research due to the indicative nature of the findings.

Introduction

In 2007 there were 30,046 hand pumps in Ethiopia of which about 35% were not working (Harvey, 2009). Sustainability of water supply schemes is a challenge in Sub-Saharan Africa and Ethiopia is no exception. The official non-functionality rate of water schemes in Ethiopia was 33% in 2007 (Chaka, et. al., 2011). Non-functionality of water supply schemes affects the household water security of those depending on the improved water source. Availability and access to water resources is essential for life and livelihood of many rural people.

This research had two research purposes:

1. Finding key factors that limit the sustainability of hand pump fitted boreholes.
2. Understanding the role of hand pump fitted boreholes in a household water security perspective.

The scope of this research was limited to the district of Konso, Southern Nations Nationalities Peoples Region (SNNPR), Ethiopia. The time boundary of this research was boreholes fitted with Afridev hand pumps in the years 2002 and 2003. The research took place in 2012.

Theoretical framework

The concept of sustainability applied to community-based management of water supply schemes has developed since its introduction in the early 1990s. One definition of sustainability of rural water supply is from Davis & Brikke (1995). They defined that a water supply is sustainable if:

- Water supply facilities are being maintained in a condition that ensures a reliable and adequate safe water supply,
- The water source is not overexploited,
- Benefits of water supply are continued to be realized over a prolonged period.

According to them, water supply projects are not to be considered as an end in themselves but as indicators of a range of benefits which will be realized over a prolonged period if factors influencing sustainability and an effective O&M system are in place. An effective O&M system is considered to depend on a range of factors such as support services, financial matters and providing an appropriate service level. Major constraints to effective O&M for sustainable services have been identified, such as an unsuitable political environment, focus on capital construction costs and lack of community involvement. Another

aspect in this definition is environmental sustainability, meaning that the use of a water source should be in balance with its natural recharge.

People's access to water delivered by a hand pump needs to be seen in the larger context and in relation to the reality of those using the hand pump. Some models to help people to see the bigger picture of factors involved in sustainability have been developed. One model is the household centred approach (Coad, 2000). Another model is the DFID sustainable livelihood framework (Ashley & Carney 1999). This framework was operationalised in relation to water by the organization ADRAR that developed the tool Securing Water to Enhance Local Livelihood (SWELL) (Maluleke et al. 2005). SWELL is a local name of a Multiple Use Services (MUS) approach.

The concept of water security emerged in the 1990s and has evolved since then. It was first used linked to military security and food security (Cook & Bakker, 2012). Since then, different definitions were developed based on various disciplines and some on an interdisciplinary basis. The concept of water security varied with the scale for which the concept was developed. There was also a tendency that different disciplines focused on different scales. Consequently, it is important to note that there is no commonly accepted definition of water security. Water security at an individual level exists when a person has access to sufficient safe and affordable water to satisfy her needs for drinking, washing, and livelihood (Rijsberman, 2006). There are several definitions of household level or domestic water security. For instance, Ariyabandu (2001) defines household water security (HWS) as "accessibility, reliability and timely availability of adequate safe water to satisfy basic human needs". A milestone for the concept of water security was the Framework for Action of the Ministerial Declaration of The Hague in March 2000 addressing the water crisis of the 21st century. Water security means that "people and communities have reliable and adequate access to water to meet their different needs, are able to take advantage of the different opportunities that water resources present, are protected from water related hazards, and have faire recourse where conflicts over water arise" (Narcisse, 2010). The Global Water Partnership definition of water security spans over different scales: "water security at any level, from household to the global means that every person has access to enough safe water at affordable cost to lead, clean and productive life, while ensuring that the natural environment is protected and enhanced" (Global Water Partnership, 2000).

The concept of household water security was developed in the late 1990s. For this research the definition of HWS developed by Ariyabandu (2001, p.3) was used as "accessibility, reliability and timely availability of adequate safe water to satisfy basic human needs". The concept of HWS is about the following variables:

- Accessibility depends on its physical location, timely availability of water as a commodity and rights of access. The distance to a water point determines the quantity of water used.
- Reliable and timely availability of water is about physical presence of water and depends to a large extent on environmental factors. These factors may result from hydrological changes and may have seasonal variations. It depends to a lesser extent on human factors such as water supply. Water needs also to be distributed to households. This means that storage and flow of water to households must be sustainable, adequate and reliable.
- Water use, refers to the households entitlement rights required for basic needs and productive purposes. Entitlement rights is a measure of water quantity for survival of people and "water needs", the quantity of water a household needs for domestic and productive use. It was suggested that a water entitlement of a minimum of 20lpcd for survival (Howard & Bartram, 2003). Entitlement rights depend on factors like water quality, social status of the household, environmental constrains, opportunity costs and awareness. Water quantity is important because householders cannot be secure from cutting through transmission paths of water-washed diseases by hygiene practices.

HWS is not without risk and uncertainty. HWS can be affected by hazards like severe drought and flood. These mentioned factors imply that HH are able to obtain the required quantity of suitable quality water for basic needs and other economic activities. The extent to which these factors interact determines water security conditions of households, regions and nations at a point in time (Ariyabandu, 2001). For achieving water security, people often use multiple sources of water. Water insecure households adopt coping strategies such as that people have to use different sources of water to meet water security needs for different purposes and walking long distances for water collection. Coping with unreliable water supply can be costly due to investments in water storage equipment, water treatment and opportunity costs for time spent collecting water (Asare, 2004).

Methodology

The researcher used qualitative and quantitative methods for data collection as a mixed methods approach, in order to achieve both purposes of this research. The sample size of this research was relatively small due to resource limitations. In total, the sample size was ten hand pump fitted boreholes. The researcher used purposive sampling for the hand pump sites. The hand pump model selected was the Afridev hand pump, year of construction was 2002 and 2003 and the implementing stakeholder was Norwegian Church Aid (NCA). Sustainability and household water security factors and criteria were developed each composed of evaluation criteria. Different data collection methods were developed: semi-structured group interviews with key informants, questionnaire survey, and assessment of technical status of hand pumps, sanitary survey, water quality measurement and measurements of distances.

For data analysis of quantifying qualitative data, the researcher developed three situational statements around criteria which define 'sustainability factors' and criteria for assessing hand pump condition and surroundings. The statements were assigned numerical values to represent a relative scale of performance. The researcher calculated the score for a sustainability factor as the average of scores of all criteria related to this score. The average of scores of all sustainability factors represents the overall sustainability.

This research had limitations such as small sample size with the result that this research may not be representative but it is expected to be of an indicative nature.

Results and discussion

A number of research results were achieved based on the empirical study and the inventory list of water schemes in Konso district. These results are as follows:

- In 2011, there were 147 improved water sources in Konso district of which most were boreholes and a significant number were protected springs. The total coverage rate of access to improved water supply was calculated to be 51%. The coverage rate for Konso is at about the same level as for SNNPR (57%) and for Ethiopia (61.5%-44%).
- There were in total 114 water lifting devices installed. The functionality rate was 52% in 2010, whereas 46% were not functioning and 2% had an unknown status. This is about at the same level as other districts in SNNPR and lower than the official average for Ethiopia of 67% in 2007 (Chaka et al., 2011, p.14).

Table 1. Villages with Afridev hand pumps, year of construction, functionality status (F means functioning, NF means not functioning) and overall sustainability score

Sub-district	Village	Hand pump site	Year of construction	Functionality status	Overall sustainability score
Gelabo	Tabate	Tabate	2002	F	2.0
Dokatu	Hakele	Ataro	2003	NF	1.6
Jarso	Allatoyte	Alatoyte 1	2002	NF	2.2
Dokatu	Golonbale	Besse	2003	F	2,3
Teshemale	Tatjmale	Chocate	2003	F	2.3
Gaho	Gelgele	Kota	2003	NF	1.3
Nalaya Segen	Tara Kame	Pasawa	2002	NF	1.6
Debana	Yelkuto	Choloqte	2003	NF	1.9
Debana	Kubala	Baleta	2003	F	2.1
Sorobo	Aletayta	Shawote	2002	F	2.1

- The researcher selected ten Afridev hand pumps in ten villages. Five of these hand pumps were not functioning. The overall sustainability score of six hand pumps was between 2 and 2.3 on a scale ranging from a score of three (3) as most favourable to a score of one (1) as the least favourable. The 2.3 value suggests that the situation was moderately favourable or better. The other four hand pumps received scores between 1.3 and 1.9 as shown in Table 1.
- The sustainability criteria 'institutional arrangement' was composed of five evaluation criteria. The average score was 2.1 or moderately favourable. Lowest score, 1.8, was for the evaluation criteria 'support and follow up of water committees' (WASHCOs). There are a range of thematic areas in which WASHCOs need follow up support. For instance there were management tasks such as continuous and systematic training for capacity building and motivation. Another thematic area was financial support such as cost recovery and realistic water tariffs. Chaka et al., (2011) confirmed this finding mentioning that on a general level, the follow-up of water schemes is limited due to lack of capacity and budget. Budget availability at the district level was recognised as one of the major challenges for the water sector.
- 'Financing and cost recovery' was the second sustainability factor assessed, composed of four evaluation criteria. The average score was 2.2 or moderately favourable.
- 'Community and social aspects' was a third sustainability factor composed of seven evaluation criteria. The overall score for this factor was 2.1. The evaluation criteria 'access to alternative water resources' received a score of 1.3. Generally, access to alternative water source is considered as a threat to sustainability of water schemes. Parry-Jones et al. (2001) concluded in their literature review that access to alternative water sources would limit the motivation to take responsibility for maintaining hand pumps. From the point of view of household water security, alternative water sources are perceived as a back-up in case the water scheme fails. However, effective water management and wise use of water is crucial (AWARD, 2007). Perceiving alternative water sources as an opportunity is the entry point for 'community-driven multiple-use water services' (MUS). It requires lifting the perspective from the point-source to sub-catchment level and from the provision of domestic water to people's water-based livelihood (Maluleke et al., 2005).
- The sustainability factor 'technology and environment' consisted of nine evaluation criteria. The average score was 1.8. 'Number of hand pump users per hand pump' was one evaluation criteria that received a score of 1.3. The evaluation criteria 'preventive maintenance' had an average score of 1, because no systematic preventive maintenance was carried out. The criterion 'average downtime' of Afridev hand pumps received 1.4 score. In many villages, pump care takers were able to repair and change fast wearing parts during a short downtime period as recommended (Dayal et al., 2000). However, the downtime period increased lasting weeks and months when for complex repairs outside assistance was required. This indicates that one reason for the slow assistance from the DWO was due to poor access to slow wearing spare parts. Similar situations are reported from other districts in SNNPR (Abebe & Hawassa, 2008).
- The sustainability factor 'project process' was composed of two criteria and received an average score of 1.7. The evaluation criterion 'participatory approaches' received an average score of 1.
- The rainfall pattern in Konso district is bimodal with in average 765mm precipitation per year. The precipitation is variable with large variations with the least precipitation in 2000 (468mm/year) and the highest precipitation in 1997 (1,024mm/year). Drought occurs periodically.
- In the Konso district people collect rain water, surface water (ponds) and groundwater (springs, wells). The people in the ten villages visited had access to between one and five alternative / traditional water sources.
- In six villages with functioning hand pump a large majority gave first priority to water from the hand pump. The main reasons for this preference were the perceived good water quality, relatively reliable water source, and shorter distances to the hand pump compared with alternative water source(s). The water quality of hand pumps was tested and this confirmed that most hand pumps produced safe water.
- In two villages some respondents gave first priority to water from springs (one protected and one unprotected) due to shorter distances to the water sources compared with the distance to the hand pump.
- Water from all sources was used for the different domestic and productive uses. Hand pump water was preferred for drinking and cooking. Brewing of local beer and watering of animals at homestead for fattening were the two productive uses of water identified.
- A significant number of people stated that they are not able to cover all their water needs. Sixty percent and 53% of hand pump users stated that they have sufficient water during rainy and dry season

respectively. Sixty nine percent and 17% of users of alternative water sources stated that those sources have sufficient water during the rainy and dry season respectively.

- The average water consumption at household per person per day for all villages was 8.3lpcd. The least average water consumption in the household was in Dokatu- Ataro with 5.5lpcd, the highest average water consumption was in Aletayta with 12.9lpcd.
- A sanitary survey showed that the risk of contamination of alternative water sources ranged from very high (river, unprotected spring), to moderate (protected spring). The measured contamination with faecal coliforms bacteria confirmed the risk assessment, showing that rivers were grossly polluted, and pollution of traditional wells/ springs and protected springs varied from no pollution to highly polluted.
- The author assessed the level of household water security (HWS). For this task the author used the criteria: distance from homestead to water collection point, water quantity collected, water quality, reliability of water supply which depends on source reliability, and water supply technology. He then compared the findings with Ethiopian standards such as water entitlement per person and day (15l/pd). The author draws the conclusion that access to Afridev hand pumps provides at least sub-standard service level. The reason for this is the amount of water collected which seemed to be lower than the water entitlement. However, the data of water quantity is not representative and would need more investigation. Access to alternative water sources provided in general no HWS. The assessment of HWS shows that the people in the ten villages investigated probably have no household water security.

Conclusions

The research showed that the following sustainability criteria are likely to determine sustainability of hand pumps in Konso:

- Use of alternative water sources in addition to the Afridev hand pump.
- The number of people served by the Afridev hand pump if this is much higher than the design recommendation of 300 people served per hand pump.
- Poor access to slow wearing spare parts.
- Insufficient support of water committees through the DWO.
- The project implementation process that applied minimally a participatory approach.

Considering sustainability of hand pumps from a household water security perspective the research makes the following conclusions:

- Perceived water scarcity is widespread in Konso, particularly for those relying on traditional water sources. The perceived water scarcity was reflected in the average amount of water consumed per person per day of 8.3 litres.
- Access to groundwater through hand pump fitted boreholes improves household water security and mitigates seasonally caused fluctuations of water availability.
- Access to improved water sources often requires technology that needs to be maintained and hence management arrangements for organising these tasks are needed. Consequently, sustaining the technology such as a hand pump will improve household water security.
- In five out of six villages with a functioning hand pump a majority of people gave first priority to water from the hand pump. The reasons were that hand pumps were perceived to produce safe water and were at shorter distances compared with alternative water sources. In the villages where alternative water sources were prioritized, the sources were closer to homestead and in the case of the protected spring perceived to produce safe water.
- Hand pump water was preferred for drinking and cooking, but also for all other domestic and productive uses. Productive uses were beer brewing and watering animals penned at home for fattening.
- Boreholes fitted with Afridev hand pumps provided at least a sub-standard service level, but no HWS whereas most alternative water sources provided no service. The consequences of non- functioning hand pump for the village community create an increased risk of water scarcity particularly during the dry season in general, walking longer distances to collect water and hence increased drudgery for water transport presents a higher risk of consuming contaminated water depending on the alternative water source used.

Acknowledgements

The author would like to extend thanks to Norwegian Church Aid Ethiopia and the District Water Bureau of Konso District that facilitated this research.

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Contact details

Manfred Arlt
Norwegian Church Aid (NCA)
Tel: +47 93 63 77 98
Email: mar@nca.no
www: nca.no