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FOR ALL IN A FAST CHANGING WORLD

Adopting locally appropriate WASH solutions: a case study of rock catchment systems in South Sudan

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Sustainability of water infrastructures is a well-known challenge especially in post-conflict countries, where communities have been used to quick and emergency-focused aid. This article presents a case study on how sustainability can be positively influenced by opting for locally-appropriate technologies and by involving communities in its selection. Considering the abundant rainfall and the presence of rock outcrops in some parts of South Sudan, rock catchment systems are locally-appropriate solutions and good alternatives to the more common hand-pump boreholes. In Eastern Equatoria State, Caritas Switzerland successfully constructed eight rock catchment systems. The potential of using runoff water from rock outcrops to ease communities' water situation and the cost-effectiveness and appropriateness of this technology has generated a lot of interests among communities, local government and other stakeholders, leading surrending communities with similar geological conditions to request for a similar system.

Background

Since the signing of the Comprehensive Peace Agreement (CPA) in January 2005, the Government of South Sudan (GoSS), with support of international donors, has been actively engaging in activities to improve its citizens' access to basic services. Though being well endowed with water resources and rainfall, the actual access of its population to improved water sources has been estimated to be as low as 34%, according to the South Sudan Development Plan 2011-2013 (SSDP). Despite the high potential for rainwater harvesting systems, hand-pump boreholes seem to be the most common solution provided to communities as improved source of water: 33.6% of improved water sources are from a hand-pump borehole according to the National Baseline Survey (NBS, 2009). The predominance of boreholes nowadays is the consequence of technology choices made during the decades of civil war. From April 1989, UNICEF, with the establishment of Operation Lifeline Sudan (OLS), was the lead agent for the Water, Sanitation and Hygiene (WASH) activities and mobilized many resources for hand-pump boreholes construction and rehabilitation, as well as provision of spare parts. The main reason for that being that hand-pump boreholes are relatively cost efficient and quick to implement. Despite those advantages, sustainability of hand-pump boreholes in a post conflict context such as in South Sudan can be questioned: The Water Policy (2007) echoed by the WASH Sector Strategic Framework (2011) indicates that between 30 and 50% of the water points are non-operational at any point of time in the different States. Locally-appropriate solution having less functionality issues should then be promoted.

Introduction

Sustainability challenges and technology choices

Over the past years, one of the key challenges faced by South Sudan in terms of coordination of aid activities has been to ensure a smooth transition from emergency to development. As already identified in the Sudan Joint Assessment Mission[1] (2005), there is a need to 'move away from intensive, short-term initiatives inspired by humanitarian concerns', to longer-term and better planned recovery projects. Often, and particularly in the provision of WASH services, this translates into how to ensure the sustainability of facilities constructed.

Problems of sustainability are mainly due to lack of maintenance of the infrastructure, which is often justified by the users' lack of technical or financial capacity to ensure adequate Operation and Maintenance (O&M) without external assistance. It is true that this is a real challenge in South Sudan, as communities are suffering from a 'dependency syndrome', having gotten used to receiving food and water for free during the war. However, sustainability issues can also be due to geo-physical factors (groundwater level, underground formation, etc.). Similarly, the blame for the lack of repairs can not only be put on communities. Considering that large areas of South Sudan are remote or difficult to access during the rainy season, it makes it difficult to sustain supply chains for spare parts and facilitate transport of pump mechanics to the sites. Before constructing a new water point, it is thus essential to consider what solution(s) would be most appropriate regarding a set of social, geographical but also geo-physical and climatic conditions.

Caritas Switzerland in South Sudan

Caritas Switzerland (CACH) has been active in South Sudan for more than 40 years, in Eastern Equatoria State (EES). Before 2006, borehole drilling was the main activity in WASH, but since the CPA, more innovative and locally appropriate technical solutions to address communities water needs have been adopted. In 2011 CACH started with the implementation of an innovative project designed to turn surface runoff from rocks into an improved source of drinking water. EES being well endowed with seasonal rainwater and given the presence of rock outcrops, the construction of rock catchment systems for collecting rainwater is a good example of adoption of a locally-appropriate solution.

Rock catchment: a locally-appropriate and innovative options to supply drinking water

A simple and robust technology

The principle of a rock catchment system is relatively simple: The run-off water from the rock surface is channeled to the weir(s) by gutters, from where it goes to a filtration box (sand filter principle) before to be piped into closed storage tanks. With this system, water can be stored under safe conditions and is protected from contamination and evaporation. Ideally, the weir is connected to a sufficiently large storage to avoid water remaining in the open weir for long periods of time due to storage tank(s) being full. Open storage is not recommended due to high risk of pollution and huge evaporation losses. The tank(s) is connected to tap stands from where water can be fetched.

Photograph 1. Completed rock catchment system in Mohina. View from the tank.

Photograph 2. Completed rock catchment system in Mohina. View from the weir.

The weir is also connected to a washout pipe as well as additional outlet pipes to allow for future connections to additional storage tanks.

The storage tanks are made of reinforced rubble stone masonry. The storage volume per tank can be from 100 to 150 m^3. The provided storage capacity depends on the yield of each catchment.

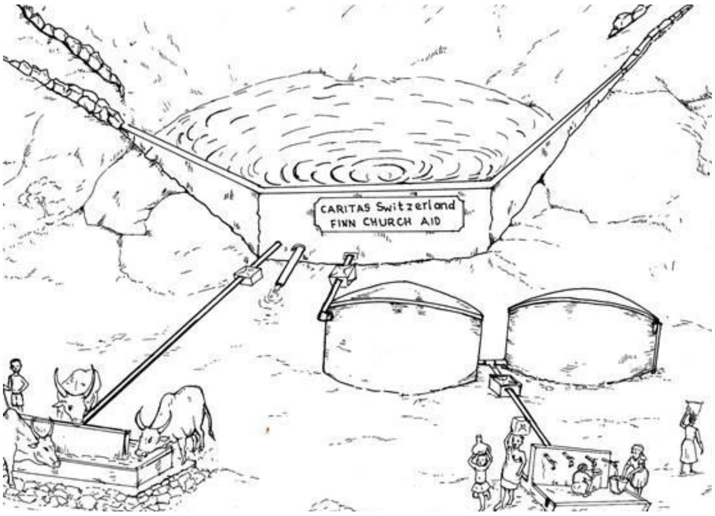

Figure 1. Schematic representation of a rock catchment system

Source: Caritas Switzerland

Advantages of rock catchment systems in Eastern Equatoria State

Appropriateness

South Sudan is well endowed with rainwater: It has an average seasonal rainfall up to 1,000 mm/year. In EES, rainwater fall can go up to 1500mm/year. However, it is mostly erratic and there is no infrastructure in place for water storage. Therefore, a lot of water is 'lost' during heavy runoff in the rainy season. A particularity encountered especially in Ikwotos, Budi and Torit County, is the presence of granite rock outcrops with relatively smooth surface, ideal for collecting large amount of rainwater through the construction of a rock catchment system. Rainwater harvesting system is thus a more appropriate option compared to traditional borehole drilling that has shown low success rates due to the geophysical conditions of the State (Basement rock). Besides, collecting rainwater presents no environmental draw back, contrary to boreholes that can, if too many, deplete the groundwater table. Indirect positive effect is also to mitigate flooding by collecting runoff water in weirs and tanks.

Advantages in quantitative and qualitative terms

In quantitative terms, a rock surface of 1 hectare (100m x100m) can harvest approximately 500 m3 (500,000 litre) of water from a rain of 50 mm. This precipitation is common during a heavy rain in the rainy season in EES. Therefore every rainfall can produce large amounts of clean water. If the storage capacity of the system is large enough and water used economically, it can last through the entire dry season. In terms of water quality, rock catchment systems provide an improved source of water compared to other sources of surface water (river, pan).

Sustainability

When properly constructed, rock catchment systems are solid structures easy to operate and maintain and have a longer lifespan than a borehole. Maintenance consists mainly in regular cleaning of the rock, the weir filter and the storage tank(s). The trained community care taker only needs to open the outlet during the first seasonal rain to ensure flush out. According to experiences from other countries, well designed and built rock catchment systems can operate for more than 25 years.

Affordability

Though a rock catchment system requires a bigger initial investment compared to a borehole, it is a more cost effective solution if one looks at the number of beneficiaries reached and the life span of the system. The cost of a borehole in South Sudan is on average 10,000 USD and, in emergency context, should supply water for 500 people. This means an investment of 20 USD per beneficiary. A rock catchment costs approximately 150,000-200,000 USD. The number of beneficiaries will depend on the number of inhabitants in the vicinity of the structure. Taking 5,000 people on average, it leads to an investment of 40 USD per person at most. However, the life span of a borehole is less than 5 years in South Sudan (due to bad quality construction, low level of maintenance and no-availability of spare parts).

Implementation steps: involving communities during all stages of the process

Whether community members will ensure adequate O&M depends on whether the community feels ownership for the structure, and this requires involving the communities at each stage of the process including even before starting the construction.

Before constructing any infrastructure, special attention to community mobilisation should be given. The way CACH has been implementing the rock catchment projects has been taking this lesson learned into account.

The first step is an introductory meeting between the project staff and the village chiefs and elders. The purpose of this introduction is to assess whether the project idea is well received and if it is worth proceeding with this community. This meeting is followed by a first community mobilisation meeting which ideally should also involve one representative of the local government. The roles and responsibilities and the expectations of each stakeholder (the community, CACH, the local government) are then outlined. It is important to make clear that CACH's role is to facilitate the construction, but that the O&M will be the responsibility of the community and the local government should intervene in case of need for bigger repairs. At this stage, community members are also asked to contribute to the construction in terms of man power and in providing construction materials (water, gravel, sand and rubble stones).

A second community mobilisation meeting is organised a few weeks later, during which a memorandum of understanding, also called cooperation agreement, is signed, at the condition that the community has started mobilising the material to the construction site. During this meeting, people are selected and are given the following responsibilities:

- Five people to be trained as members of the future Water Users Committee (WUC);
- Four people to be trained on-the-job as artisans; and
- 10 people to become Village Hygiene Promoters (VHP).

Since 2011, eight rock catchments have been constructed successfully in EES and three are on-going. Currently, communities living at the vicinity of similar rock outcrops have been requesting the local government for similar structures. The methodology for sanitation and hygiene promotion, which was an integral component of this project, is not described in this article.

Results so far: some numbers

Table 2. Targeted locations and beneficiary population for the completed and on-going rock catchment systems

Village	County	Beneficiaries	Status
Kimotong	Budi	3,800	Completed
Loming	Lopa/Lafon	3,800	Completed
Logurun	Ikwotos	3,800	Completed
Woro Woro	Ikwotos	3,800	Completed
Loffi	Ikwotos	3,800	Completed
Mohina	Ikwotos	3,800	Completed
Lodik	Ikwotos	4'750	Completed
Iloli	Torit	3'250	Completed
Moruhurong	Ikwotos	2'500	On-going

Hirifit	Ikwotos	2'000	On-going
Naviapak	Budi	2'025	On-going
TOTAL		**22,800**	

Main lessons learned from the implementation process

From its experience over the last years, the main lesson learned has been that building community sense of ownership is essential to ensure the long term sustainability of the system. It is a real challenge considering the dependency syndrome of communities used to receive aid for free, but it can be enabled by:

- Dedicating enough time and giving importance to community mobilisation, by visiting the communities several times before the start of the construction, paying proper respect to elders and local chiefs opinions and involving the local government in the initial meetings (through the signing of a memorandum of understanding for example);
- Involving the community members during the construction of the infrastructure, asking them to contribute with local material (water, gravel, stones…) and training on the job some selected artisans, who will be on the longer run responsible for the day to day maintenance of the system;
- Training a WMC and having clear bylaws for the use of the water and its price; and
- Enabling and building the capacity of the local government to ensure minimum monitoring visits (also for water quality testing).

Those steps have been followed in the construction of the recent rock catchment systems and shown to positively influence community ownership. In one case (Loming), the community organised itself and gathered local materials to construct an additional water storage tank of 150 m^3 after coming to appreciate the fact of having water closer to them, and seeing that during rain, the water would overflow while it could be collected and stored. Ownership and thus involvement in O&M would be even more important if the decision and the request for a specific water infrastructure would be initiated by the community itself.

Conclusion

In recent years, there has been an effort from the government and the NGOs to move away from emergency response based on short term and quick implementation activities towards more (re)construction and development projects. Many NGOs and development workers have adapted their implementation strategies to involve communities and address sustainability issues. There is a common understanding that facilities should be handed over to communities who should then be responsible (technically and financially) for its O&M. To reach this, common and good practices include community mobilisation meetings and O&M training of WUC. However, how can the community feel full ownership for a project or a service when the initial request for it does not come from the community members themselves? This point is even stated in the National Water Policy (2007), *'an important principle is that rural water supply services should be provided according to needs and priorities identified by water users themselves'. In remote or inaccessible areas preference should be given to technologies which can be maintained with minimal external assistance. The role of NGOs and other implementing agencies should then be to support communities in making informed choices based on the full range of available technologies'.*

Although the value of rock outcrops for water supplies in arid and semi-arid regions is well documented and has a long history in water scarce regions all over the world, the rainwater's outstanding potential for the sustainable improvement of access to water supply in underserved rural areas of South Sudan was forgotten: The worst enemies of human progress – war, famine, and population displacement – meant that this knowledge of rain as a precious water resource was not transmitted.

In EES, the effectiveness of this technology and potential of using runoff water from rock outcrops to ease the communities' water situation has generated a lot of interest among communities, the local governments and other stakeholders as it seems the most appropriate solution considering the unique geological conditions. This success has inspired CACH to investigate new opportunities for the construction of more rock catchments in other villages based on request from the community through the local government.

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Note/s

1. Carried out jointly by the World Bank and the United Nation, with the full endorsement, guidance and participation of the Government of Sudan (GOS) and the Sudan People's Liberation Movement (SPLM), the JAM sets the framework for the consolidation of peace, and for attaining broad-based growth, poverty reduction and sustained human development and presents the requirements for reconstruction and development for the six year interim period between the CPA and the referendum for independence of South Sudan. Reaching the targets for improving access to basic services and developing infrastructure are key priorities.

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