10 CHALLENGES AND BENEFITS OF PARTICIPATORY INTERVENTIONS IN RAINWATER HARVESTING: IMPROVEMENT OF CHARCO DAMS IN TANZANIA

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Summary

Participatory approaches to development are increasingly being advocated by development organizations and NGOs. However, putting these methods into practice is difficult, particularly where beneficiaries have to contribute in kind and in cash. This presentation discusses the experiences, constraints and achievements in a participatory project, where beneficiaries were involved, in identification of problems, design of solutions and equity investment in the improvement of charco dams.

A university research unit and an NGO were involved in providing technical backstopping with costs covered by a small grant from a regional programme. The project targeted agro-pastoralists who own private charco dams for harvesting and storing rainwater to supply water to livestock. However, although the group of agro-pastoralists was expected to be homogeneous, with common interests, it was very difficult to achieve common understanding. Had the charco dams been communally owned, it would have been difficult to implement the project. Only 50% of the targeted agro-pastoralists participated in the first year. However, nearly all have signed for the second year. It is important to identify their differences in objectives, interests and problems in-order to ensure a cross cutting participation in project planning, design and implementation.

Furthermore, the experience also shows that very few individuals influenced those who did not participate in the first year. Therefore, it is necessary to be careful with PRA planning as it could give opportunities for the more articulate members to dominate the decisions.

On the other hand, the project revealed the potential for combining small grants with local technical know-how and owners equity. The charco owners who participated in the project were willing to invest up to 50% of costs, because of the feeling of reduced risks of failure due to the participation of a research group, an NGO and a development support programme. The greatest lesson learned through the project is that agro-pastoralists will invest even 100% of the cost if they get partners to underwrite the technical risks.

10.1 Introduction

Poor availability of water and pastures has been identified as the single most important factor constraining productivity of livestock under pastoral and agro-pastoral systems in dry areas of Tanzania. Semi arid Tanzania is home to over 25 million animals, mainly cattle and goats under traditional pastoralist systems. The average live weight of cattle in Shinyanga Region, a semi–arid area, is only 200-250 kg (Hatibu and Mtenga,1996). According to the 1994/95 agricultural census, the livestock sub-sector contributed only 18% of the national GDP, which is very low when compared to livestock population (URT, 1996).

In the past (during the 1950s) the Government promoted and supported the construction of charco dams to harvest rainwater, which had proven a viable alternative to water distribution. Charco dams are essentially dug out ponds constructed in flat semi arid areas for storage of water. Normal earth dams are constructed by erecting a wall across a valley, such structures are not therefore feasible in flat landscape as is the case in Makanya village. The four charco dams, built by the central government in the village to provide water for livestock, had silted up completely because of poor operation and maintenance. In the absence of water, pastoralists had to move their livestock to other districts/regions (more than 40 km) in search of water during the dry season.

The collapse of these facilities exposed both farmers and pastoralists to high risks of failure in crop and livestock production. However, there are several lessons that can be drawn from this approach. Whereas charcos are a common system of rainwater harvesting with storage in semi-arid areas, the system is bound to fail if key issues are not critically analysed and understood. For example, the purpose of the

dam should be clearly defined as the first step in planning. In addition, the following are some of the main questions to deal with that will define the purpose:

- Will the storage be required throughout the year or only for a few months?
- Who are the targeted stakeholders?
- Can the reservoir be anywhere?
- Who will be responsible for operation and maintenance?

As an illustration, according to Hammond Murray-Rust (1973), accelerated erosion in the Kisongo catchment area (Arusha region) developed as a result of changing land use immediately after the construction of the reservoir in the 1950s. Erosion was intensified in the vicinity of the Kisongo reservoir as stock numbers rose in response to the new water supply. The consequent increase in pressure on available grazing led to a progressive increase in the severely eroded area. In addition, stock routes leading to cattle troughs were developed which further aggravated the problem. This example demonstrates the importance of catchment management upstream of reservoirs. It is necessary therefore, to develop plans for managing the catchment area so as to ensure that runoff is produced with minimum erosion. The most important issues to be observed to achieve this include:

- Choice of the catchment
- Land use in the catchment and
- Silt traps in the water harvesting system

In the past ten years or so, Tanzania has undergone drastic changes under the Government's structural Adjustment Programme. The private sector or NGOs are now executing many activities and programmes that were formerly performed by the Government. This change has necessitated the private sector and individuals to initiate projects and schemes, which are fully owned and supported, by private individuals. A good example is the charco dam owners of Makanya village in Same District, Kilimanjaro Region.

On their own initiative, pastoralists have constructed individual charco dams for providing water for their domestic and livestock use. The charcos are located in the grazing land allocated to each pastoralist by the village government. Pastoralists usually have two residences, one in the village main built up area and the other in the bushes near the charco dams. They have developed a rainwater system from their own indigenous knowledge but it is felt that there is room for improvement. It is based on this argument that the pastoralists designed interventions with support from the Sokoine University of Agriculture in collaboration with a local NGO (SAIPRO) based in Same and financial support from Sida-RELMA.

10.2 Background information

Makanya village lies between latitude $4^{o}12'$ to $4^{o}23'$ S and longitude $37^{o}43'$ to $37^{o}52'$ E. It lies at an altitude ranging from 500 to 700 m above sea level (masl). On the eastern side, the village is bounded by the South Pare mountain ranges while, on the western side, the Pangani River forms the boundary. The village is within Same District, in Kilimanjaro Region. It is located about 150 km to the south of the Kilimanjaro Mountain and about 450 km from Dar es salaam, the commercial centre of the country. The nearest city is Arusha that is about 250 km from the village. The Dar es salaam–Arusha highway, which was built in 1967, passes through the village. The Dar es salaam–Moshi Railway line and high-tension electricity pylons also pass through the village. It is located within the Western Pare Lowlands (WPLL) which have a semi-arid climate.

Annual rainfall rarely exceeds 300mm. Residents are predominantly agro-pastoralists. The nearest permanent river (Ruvu) is 40 km away. Survival in this harsh environment is through rainwater harvesting (RHW). Crop production is not feasible without RWH. Run-off water from the southern Pare Mts. that flows through the Makanya gully is the lifeblood to Makanya residents. Diversion of runoff water from the Makanya gully coupled with in-situ RWH makes it possible to produce two crops a year. It is necessary to temporarily transfer livestock to other regions/areas away from Makanya, especially during the dry season, in search of water. With the construction of private charco dams, the problem has to a certain extent been alleviated. Clean drinking water is also in short supply. Piped water runs to a trickle and stops altogether during the dry season. Water stored in charco dams is thus increasingly being used for gardening and to meet domestic requirements.

According to De Pauw (1984) the WPLL is classified under one major physiographic region, known as Eastern Plateau and Mountain Block. The plains between the foot slopes of the Pare Mountains and the

edge of Pangani river basin is characterised by a series of scattered hills. The slopes are good sources of run-off while the plains and depressions are run-off concentration points.

The private charco dams are however faced with low performance, because of poor planning and design, and inadequate management and maintenance. The purpose of the reported project was to improve the performance of charco dams in Makanya village through the development of local capacity for planning, design, management and sustainable maintenance. The project is expected to achieve the following:

- To increase the efficiency of water capture and transfer through diversion structures and channels from the catchment or off-take point to the charco dams.
- To establish and enhance local capacity for management and sustainable maintenance of charco dams, especially reducing siltation
- To reduce water loss by seepage and evaporation from the charco dams
- To produce a simple guide on charco design, construction, management and maintenance
- To develop a plan for watershed management through participatory approaches and negotiation
- To reduce demand of water from charcos, through the promotion of alternative RWH systems for domestic water supply

10.3 Methodology

SWMRG involvement in Makanya village started way back in 1999, when it was implementing a DfID funded project namely “Promotion of Adoption of Rainwater Harvesting Technology in Tanzania”. This particular project was targeted at enhancing efficient use of scarce rainwater for crop production. It became apparent that apart from crop production, there was also serious shortage of water for livestock.

An NGO based in the area (Same District, Kilimanjaro region) known as SAIPRO (Same Agricultural Improvement Project) had for some years been collaborating with SWMRG in the implementation of a number of projects in Same District. At the same time Sida-RELMA based in Nairobi, was in the process of implementing a project aimed at improving the productivity of livestock in the area. This included improvement of pastures and availability of drinking water. From the above, it became apparent that SWMRG, SAIPRO and Sida-RELMA had similar objectives and could therefore work together to improve charco dams in the village.

10.4 Process description

The process of improving charco dams involved several meetings pooling together a university research unit (SWMRG) and an NGO (SAIPRO) who provided technical backstopping with costs covered by a small grant from a regional programme (Sida-RELMA). The need for a subsequent meeting, and the course of implementation, were not predetermined, they rather originated from each preceding meeting as is outlined below:

- The first general meeting of stakeholders was held in Makanya village on 13 May 2001 to assess and document the main causes of the low performance of existing charco dams. Twenty-six pastoralists who own RWH charco dams attended the meeting.
- As a result of the first meeting, it was proposed to come up with a project write-up on how to improve charcos in the target area.
- The project write-up was undertaken during a meeting between RELMA, SAIPRO and SWMRG-SUA staff in June (12 -14), 2001 at SAIPRO headquarters, which is located 30 km from the project area.
- A field visit to the charco dams was undertaken during which each charco owner gave a brief history of his/her charco.
- A second stakeholders’ general meeting was held in September 2001. This particular meeting had the following aims:
  - To administer a short questionnaire which aimed at obtaining information on the status of charcos
  - To brief stakeholders on the progress of the proposed project since the last meeting
  - To chart out modalities for participation
  - To prepare a plan of action for implementing project activities

10.5 Discussion

10.5.1 First meeting:

The meeting related the low performance of charcos with poor planning and design, and inadequate operation and maintenance. Specifically, the meeting identified and prioritised through pair-wise ranking the following as the main causes of poor performance of their charco dams.

- Inadequate flow of water from the catchment into the charcos due to poorly graded channels.
- Rapid siltation of the charcos.
- High rates of water loss through percolation/seepage and evaporation.
- Low capacity of charco dams.

A further analysis of the situation showed that other underlying constraints also exist in the target area. These included:

- Inadequate extension support for the charco owners.
- Poor plans for watershed management.
- Poor management and utilisation of demand for water from the charcos.

10.5.2 Site visits:

An inspection of each charco, its supply channel, silt trap and cattle drinking facilities was done during which answers to asked questions were given. All charcos had water and some were being expanded at the time. Owners indicated that the stored water was sufficient to last up to September – November (about four months). The actual length depended on the size of the livestock herd. Although most pastoralists indicated that they own 20-50 head of cattle, it was later found out that they gave low numbers. We learned that it is customary among pastoralists to understate the actual number of their livestock. This can be a bottleneck in designing charcos and drinking troughs of adequate size.

Pastoralists lamented that the central government had abandoned the charco dams it had constructed and requested assistance. This is what we have come to refer to as “the dependence syndrome”. It defies logic to note that the pastoral community was not prepared to rehabilitate charcos constructed by the government, but were ready to invest a lot of time and money to construct their private ones. The construction process employs human labour and therefore is very slow. On the average, it has taken 5 to 10 years of excavation to attain the current size and it is never-ending because of the yearly de-silting process. It was observed that in the absence of the commitment shown by pastoralists to remove silt annually, the private charcos would have been abandoned as was the case with the communally owned ones.

10.5.3 Second meeting:

This particular meeting lasted for almost six hours during which the following was agreed, to facilitate the implementation of the project:

- SWMRG deployed its own extension officer at Makanya to enable constant backstopping.
- Each charco owner was requested to make an assessment of the critical problems facing his/her charco and come up with a list and decide which problem they wanted to solve first.
- Each charco owner had to prepare cost estimates for solving the problem.
- Each charco owner was to submit these estimates to the Village Livestock Extension/Project Extension Officer on or before an agreed deadline as an indication of willingness to participate in the project
- The assistance that was requested by the charco owner from the project was not to exceed 50% of the total cost of the intended works. The maximum the project could assist was Tanzanian sh.80,000 (US$ 100).
- After the charco owners had submitted their own assessments, a joint assessment (between the owner and technical staff from SUA and SAIPRO) was to be made on-site. This was aimed at streamlining and verifying the proposed solutions submitted by each charco owner.
- There would be a signed agreement between each charco owner on one hand and SWMRG and SAIPRO on the other. A draft agreement was prepared by SWMRG/SAIPRO and later jointly discussed with charco owners to come up with the final version which was used.

Twenty pastoralists agreed to participate by submitting their estimates. A team made up of the charco owner and staff from SWMRG and SAIPRO later conducted an on-the-spot assessment of the problems facing each charco in September 2001. This was meant to verify the problems already submitted by the charco owners as indicated above.

10.5.4 Problem identification and prioritisation by charco owners

Charco owners clearly identified problems affecting their charcos. It should be noted however that, none of them had listed the problems in a ranked order. Instead, each had submitted cost estimates for the materials/working tools required for carrying out rehabilitation and maintenance work on their charcos. On-site discussion with charco owners and the assessment of the rehabilitation works, which was being undertaken at the time, revealed a number of critical problems. After visiting 20 charco dams, a cross section of problems was identified. The critical ones are listed below:

- Lack of or inadequate working tools in the construction and de-silting of charco dams
- Low capacity of charco dams (small size)
- Rapid siltation of the charco dams creating labour crisis and reducing storage capacity
- Erosion of the channel and steep side slopes of the charco, especially where water flows into it. This problem was accelerated by uncontrolled entry of livestock into the charco (soil from dyke falls into charco).
- High rates of water loss through evaporation
- Inadequate length of the supply channel
- Water loss from the shallow supply channel
- High rates of water loss due to large surface area and shallow depth of the charco
- Absence of drinking troughs
- Destruction of the fence and invasion of the charco by neighbour's livestock
- Falling of dry soil from dyke (usually too close to the charco) into the charco
- Wrong location of charco with regard to seepage losses (soil type)

The problem of scarcity of working tools in the construction and de-silting of charco dams was resolved by reaching an agreement with individual charco owners to contribute money towards the purchase of required working tools. The purchased working tools and the contributions were as shown in Table 1.

Out of the 20 charco owners who filled the forms, only 11 had already started to de-silt and increase the capacity of their charcos by using family and hired labour even before receiving requested assistance, albeit by using inappropriate and worn out tools. The requested tools included wheelbarrows, spades, pick axes and hand hoes. The construction of drinking troughs was also an important issue. Almost all had indicated they planned to spend over Tsh. 100,000/= each to meet the cost of hired labour to improve their charcos that season. Their commitment was clear from individual contributions that ranged from 50% to 100% (Table 1).

10.5.5 Implementation strategy

A representative of the charco owners accompanied the project extension officer to purchase the required tools from a nearby trading centre. Cement required for the construction of silt traps was also purchased at this stage.

A SWMRG technician designed the silt traps and prepared a bill of quantities in consultation with the charco owner. The supply of stone aggregates, and the engagement of skilled labour (masons) in the construction of silt traps was arranged by charco-owners. The project contributed cement and money for meeting skilled labour costs. With regard to the construction of silt troughs, the following procedure was observed:

- The charco owners were assisted to thoroughly understand the design of silt traps
- The builders were hired and supervised by the charco owners
- The charco owners issued the job completion certificate after which payment was effected by the project

10.5.6 Agreed interventions

Through pairwise ranking, a priority list of interventions was drawn for each charco. An agreement form was signed by each participating charco owner. A range of agreed interventions is given below.

- Improvement of channels supplying water
- Construction of simple silt traps/check dams

- De-silting of charcos
- Increasing capacity of the charco through deepening/increasing depth
- Construction/improvement of fence
- Stabilisation of inlet channel by cement and stones
- Planting of wind break trees and increasing height and repositioning of the dyke to reduce evaporation
- Construction of simple drinking troughs

Table 1: Purchase of working tools

Name of charco owner	Material supplied	Contribution by charco owner	Contribution by project (RELMA)	Total cost
Hamis Hussein Mkanza	2 wheelbarrows 4 spades 2 hand hoes 2 pick axes	30,000	32,000	62,000
Gaddy Ally	2 wheelbarrows 2 spades 4 hand hoes 3 fork hoes	30,000	32,000	62,000
Zuberi Senzighe	2 wheelbarrows 4 spades 1 water hose 1 Treadle pump	108,000	22,000	130,000
Ramadhani Mrindakaa	2 wheelbarrows 2 fork hoes 4 spades 4 hand hoes 2 pick axes	41,000	32,000	73,000
Abdallah Sekiete	2 wheelbarrows 5 fork hoes 5 spades 5 pick axes	49,000	32,000	81,000
Athumani Mshitu	1 water hose 1 treadle pump	102,000		92,000
Eliapendavyo Juma	2 wheelbarrows 2 fork hoes 4 spades 6 hand hoes 4 pick axes 6 metal trays	60,000	32,000	92,000
Hatibu Athumani	2 wheelbarrows 6 metal trays 3 spades	27,000	32,000	59,000
Kanyika Kirema	3 wheelbarrows 3 fork hoes 3 spades 3 pick axes 6 timber (1x6)"	76,000	29,000	105,300
Mkenga Senzia Juma	3 wheelbarrows 2 fork hoes 2 spades 2 pick axes 1 timber (1x6)"	55,000	31,000	86,800
Omari Abeid	2 wheelbarrows 4 fork hoes 4 spades 4 hand hoes	42,000	28,000	74,000
Grand Total		620,000	300,000	917,000

The severity of the above problems varied from one charco to the other. Generally however, siltation was a major problem faced by all charcos. This was worsened by the fact that animals enter the unfenced charco from all directions pulling back soil and causing the steep sides of the charco to collapse in. Free entry of livestock into the charco presented a challenge with regard to hygiene bearing in mind that domestic water also came from the same charcos. Fencing of charcos and construction of simple drinking troughs are being undertaken by some charco owners as a way of preventing siltation and contamination of water.

The allocated land is not fenced and therefore boundaries between grazing land for any pastoralist and his neighbours are not that clear cut. Invasion of charcos by neighbours' livestock is a big problem and a source of conflict, which can be solved only through fencing. A similar problem also faces small vegetable gardens located near charcos. The water harvested into the charcos comes from sheet flow originating

from the grazing land and beyond. The water is concentrated in furrow/channel leading into the charcos, which are sometimes more than a kilometre long. Damage to water-collecting channels is thus very common and a workable solution does not exist in the short run.

The success registered in the first phase has attracted more participants in the current phase who had doubted the project in the first place. The main lesson from this project, includes the fact that adequate planning and proper designs of the water-storage systems should be made and put in place in order to avoid any negative impacts that may result from implementing the scheme. It is for this reason that stakeholders' opinion as far as the problems, solutions and their contributions are concerned should be the starting point.

10.6 Conclusions

We conclude that there is a big potential for combining small grants with local technical know-how and owners' equity in undertaking grass-roots projects. The charco owners who participated in the project were willing to invest up to 50% of costs, because of the feeling of reduced risks of failure due to the participation of a research group, an NGO and a development support programme. The greatest lesson learned through the project is that agro-pastoralists will invest even 100% of the cost if they get partners to underwrite the technical risks. Finally, it can be concluded that where individual farmer initiatives are supported by local research/NGOs working together using a participatory approach, chances of success of rural development projects and their sustainability are greatly enhanced. This is contrary to what the government used to do as highlighted in the literature review.

10.7 References

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