The Mawala irrigation scheme

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To the reader

This booklet is the result of a research done in Kahe ward from November 2016 to January 2017. We, two researchers from Tanzania and The Netherlands, did research in the Mawala irrigation scheme of Oria, Ngasinyi and Mawala villages. The objective of the research was to learn about irrigation systems started by farmers, about their benefits and challenges and about how the government interacts with these systems. We interviewed canal leaders, local government and organisations involved with irrigation in Mawala. We did group interviews with farmers from 8 different canals, both men and women. We also talked to people of the Pangani Basin Water Office, the Zonal Irrigation Unit of Kilimanjaro and Moshi Rural District.

In this booklet, you can read the results of our research. Most importantly, we found that:

- Water is not enough for the current area and cropping schedule, with the area increasing and water decreasing due to water weeds and increased water use by TPC
- There are big inequalities in the scheme when it comes to water access, with the head-end benefiting more than the tail-end
- The system of water fee collection is not fair and needs to be reconsidered to become more effective
- There are communication problems between the government and the farmers leading to unnecessary disruptions in farming activities
- The current method of constructing small bits of the irrigation scheme at a time is disrupting farming activities and not leading to major improvements in irrigation practices
- Farmers challenges are larger than only irrigation infrastructure, and more and better extension services could raise yields considerably

We believe that the Mawala scheme has the potential to be a source of food and prosperity for many, if managed and supported well.

We would like to thank all people who participated in our interviews for their time, their energy and their patience. We are also grateful to local leaders for supporting us, and to the representatives of the PBWO and ZIU for taking time to talk to us.

Together, we’ll build the nation.

Chris de Bont and Honorata Mselle
The research area

The Mawala irrigation scheme lies in Kahe ward, 12 km south-east of Moshi town, in the Kilimanjaro region in northern Tanzania. The area is part of the Pangani River Basin, and falls within the Northern Irrigation Region. Kahe ward has roughly 19,000 inhabitants and is comprised of eight villages. In this research, we focused on three of those villages that make up the Mawala irrigation scheme: Oria, Ngasinyi and Mawala. The mean annual precipitation is 365 mm, with most rain occurring between March and May. Agriculture is the main source of income for most villagers. There is a road connecting Kahe and Moshi town, as well as a road connecting Kahe to the Moshi-Himo highway. The closest major market is in Moshi town. Kahe town has a Savings and Credit Co-operative Society, but no bank.

The ward has a long history of irrigation development, both by farmers, companies and the government. The main water sources in the ward are the Rau River and the Miwaleni Springs, which feeds into the Dehu River and the NAFCO canal.
The start of the Mawala scheme

The Mawala irrigation scheme has its origins in 1968, when the government (supported by the Food and Agriculture Organization) started constructing a canal from the Miwaleni spring to irrigate land some 8 kilometers away. Originally, the Kahe scheme was meant to be a village scheme, operated by smallholder farmers who grew both food and cash crops. However, in an attempt to save money on buying gunny bags, the government handed the project over to East African Kenaf Industries Ltd (EAKIL). The plans to irrigate 4,000 hectares of the fibre crop kenaf were never realised due to unsuitable, saline soils. In 1975, the estate came under the management of the parastatal National Agriculture and Food Corporation (NAFCO), which used it for maize and dairy farming. When NAFCO took over, the size of the estate became much smaller. About half of the former estate was given to the village authorities to distribute among farmers, who could claim as much land as they could clear. Already since the main canal was first built, excess water flowed into a dryland primarily inhabited by pastoralists, which is now known as Mawala village. As land became available and the population in the area grew, people started farming. Some were indigenous Kahe people, while others migrated, primarily from the Pare Mountains to the southeast and Kilimanjaro to the north. Water flowed to the fields through earthen canals, plots were far apart and water was sufficient to grow a mix of maize, beans, bananas and sugarcane.

In 1999, the NAFCO estate was privatised and given to the Tanganyika Planting Company for the cultivation of sugarcane. This has resulted in the current situation where water from Miwaleni springs flows through the NAFCO canal to the pumping station of TPC. What is left, flows downstream to the Mawala irrigation scheme. What used to be the drain of NAFCO, is now the main canal of the Mawala scheme.
Maize fields of Mawala

Rice fields of Mawala

Canal dug by farmers

Maporomoko - start of Mawala scheme
The history of water rights

Already in 1976, villagers requested the Water Officer for a formal right to use water from the NAFCO canal, but the estate refused to cooperate. In 1995, villagers applied for a water right again. In order to get a water right, farmers had to form a group. This water group was named after the three villages: ONGaMa (Oria, Ngasinyi, Mawala). In 1996, they were granted a provisional water right for 900 l/s. The same amount was allocated to NAFCO. When TPC took over however, it managed to be granted a water right for an additional 800 l/s. In total, TPC now has a water use permit for 1700 l/s, while Mawala irrigation scheme has 900 l/s. These permits are not rights. They are the maximum amounts that can be used. When there is shortage, all parties are meant to reduce their water use.

When they obtained their water right, some farmers started cultivating rice, instead of the maize, beans and bananas they were growing before. Because of this, and the expanding area, water consumption in Mawala increased. As TPC developed, they started using their full water use permit. As a result, Mawala farmers started experiencing water shortage.
The Mawala irrigation scheme in 2017

The Mawala irrigation scheme has 11 secondary canals, with the latest added in 1999: DO1, Bomba tatu, Samachi B, Farm D, Shule, Samachi A, Mbuyu wa Ndege, Kihara, Chamkea, Masaini and Mapinduzi. In total, there are about 34 km of secondary canal. The canal of Mapinduzi irrigates land in Oria and Ngasinyi, while the other 10 canals irrigate land in Mawala village. Most of the canals are earthen, and were dug by farmers themselves. Since the early 2000s, the government has supported farmers to line certain canals and to build division boxes and intakes for the secondary canals. You can read more about this elsewhere in this booklet.

The head-end of the scheme is used for rice cultivation. Farmers grow two seasons of rice per year and harvests vary from 0-20 bags per acre. The harvest primarily depends on water availability. In the tail-end of the scheme, water is not sufficient and farmers grow other crops. Most farmers grow maize and beans, especially during the wetter season (February-July). During the drier season (August-January), large parts of land in the tail-end are not used for agriculture. Some farmers grow onions, tomatoes or vegetables. There are a few shallow wells that are used for farming these high value crops. Groundwater is shallow, and seems to be sufficient.

Many farmers in the Mawala scheme are renters. They rent the land for longer periods or just one season. Most renters are in the rice area.

The water group of 1995 has been transformed into an irrigation cooperative, also called Ongama, which was formally registered in 2007. Ongama collects the water fees to pay for the water use permit. Each farmer pays 5,000 TSH per acre per season, regardless of crop or location. Ongama also represents farmers when dealing with the government, for instance when there is conflict between farmers and TPC or when farmers want to request support.

Water division is organised at canal level, and the system varies from canal to canal. Usually, there is a canal chairman, a secretary and several members. These organise the cleaning of the canal (often two times a week) and give water turns to farmers who help in this cleaning. When water is enough, there is no schedule at all.
Meeting with farmers and district agricultural engineer

A notice from Ongama to farmers

Built division box

Canal leaders walking in dry canal in downstream area
Map of the Mowala irrigation system with its canals, irrigated area and rice area
Infrastructure without improvement

Most infrastructure in the Mawala irrigation scheme is made and maintained by farmers themselves. The canals are dug by hand and earthen. Because canals are cleaned of weeds and mud, they become deeper over time. Many canals are now below field level, making it difficult to irrigate. To raise the water level, farmers use temporary structures of bags, grass and mud. Some canals (Samachi B, Farm D, Bomba tatu, Kihara) do not have a way of closing or opening their intake, making water division more difficult.

There are no drains in the scheme. This causes problems during the rainy season, when the main canal carries flood waters and some of the fields flood as well. Farmers now claim they cannot stop growing rice because of the floods. Proper drainage could change this, and enable a cropping pattern better suited to the current water availability. If the canals no longer have to carry flood water, they can also be properly dimensioned (now they have to be too big).
Infrastructure improved by farmers

In certain canals, farmers have collected money and built structures to improve their canals. Each farmer contributes, either with money, labour or materials. Farmers do not think this system can be used to upgrade the entire scheme, because they do not have enough money. Many are positive about contributing part of the money needed however, with government paying the rest. There are doubts about who would collect the money however, and whether the money would be used well.

At scheme level, there has not been any improvement projects organised by farmers. The fees Ongama is collecting are supposed to be used for improving infrastructure, but all money is going to paying the water permit. If Ongama would be able to organise infrastructural improvement projects, it would increase their relevance in the scheme, and possibly make farmers more inclined to pay.
This timeline shows all surveys and improvement projects in Mawala irrigation scheme since 2004. These projects have been paid for with different funds, used by the ZIU (until 2013) and district office (from 2014). The total money invested comes close to 650 million Tanzanian Shillings.

Infrastructure improved by government

After obtaining the water right, farmers from Mawala looked for support to upgrade their infrastructure. Already in 1997, farmers asked the Zoal Irrigation Unit to survey the scheme and estimate the costs for constructing division boxes. In the years that followed, letters with similar and different requests were sent to the Regional Commissioner, District Commissioner, Zonal Irrigation Unit and Pangani Basin Water Office. At times, farmers were successful in their requests. This led to different interventions in the scheme, starting with a comprehensive survey in 2004. After this, projects included the rehabilitation of roads, the lining of canal sections and the construction of division boxes. Currently, 9 out of 11 canals have concrete intakes/division boxes. Kihara and Farm D canals are the ones without any division boxes. Two canals are partially lined (Mapinduzi and DO1), as is a section of the main canal (Maporomoko/Maji ya Shingo). The main canal and a main floodwater drain have been widened to accommodate the major floods occurring in the rainy season.
The road constructed by the ZIU along the main canal

**Roads**
The road along the main canal was widened, as was the road to Mawala village. This makes it easier to transport crops, and to access the scheme.

**Remaining challenges**
There are no farm roads, so it is difficult and expensive to get the crops from the field to the road. The Farm D area has no proper road at all, making it challenging to access by car or truck, especially during the rainy season.
Canals
The canal of DO1 was lined for 460 meters, the canal of Mapinduzi was lined for 460 meters and the main canal (Maji ya shingo) was lined for 530 meters.

Remaining challenges
Less than 5% of all canals is lined, the remaining 95% is not. This means water is lost along the way. Also, many canals are at field level or even below, making it difficult to irrigate. Only lining the canals will not change this.
Division boxes
There are 20 concrete division boxes or intakes, of which 19 have been constructed by the government. The gate of D canal was built by NAFCO and is still used.

Remaining challenges
There are few division boxes. Some of the division boxes have broken down and need repairs. All the gates are in the beginning of the scheme, making water shortage worse in the end of the scheme, because water can be closed completely.
Map showing the lined canals (red) and division structures with gates (stars). All are in the beginning of the scheme.
Challenges of irrigation improvement projects

The procedure was similar for each infrastructural project. If the ZIU or District Office received funds for rehabilitation, farmers were consulted and asked to list their priorities. The ZIU then surveyed the area and drafted designs, taking into account the available money. Farmers elected a construction committee to monitor the work on their behalf. Implementation was either done by engineers from the ZIU or by a contractor hired by the district office.

Although this sounds straightforward, farmers brought up different challenges during interviews.

Government-farmer communication

The communication between government and farmers has not always been without problems. At times, projects have started late or lasted longer than planned, without farmers being aware. This has caused distrust among farmers, who are now afraid to plant their crops in case water is cut off unexpectedly. In February 2017, many farmers did not plant because part of the main canal would be lined (see photos). This was in spite of government promising them that there would be a diversion canal and water would not be cut off. During this research, it also became clear that canal leaders, Ongama cooperative leaders and construction committee members were not kept up to date about where the design or tendering process had reached. This made it difficult for them to inform their farmers, and made farmers doubt their leaders.

Unequal farmer participation

Through farmer meetings, all farmers' interests are supposed to be represented when discussing improvement priorities. However, not everybody is equally involved and aware of what is going on. Farmers living in Kahe town are more aware and have more influence than those living in Mawala village. Most meetings are held in Kahe town, and farmers living in Mawala village are less likely to go there. Also, as they get less water and are growing food crops rather than cash crops, they say they have less reasons to attend the meetings. When looking at the map, you see that most money has gone to improving canals at the beginning of the scheme. Although this can be a coincidence, or just because people wanted to start at the beginning, it is important to make sure all farmers benefit equally and feel like they have a voice.
Farmers on the canal of DO1 have started nurseries.

Farmers along the Maporomoko canal have not started farming, because they are afraid water will be cut when construction starts.
Construction committee
The construction committee members have not always received training, and in many cases were not compensated. It is telling that during the last election, people were selected who did not wish to be in the committee.

Dissatisfaction with results
The improvements have not had the results that farmers expected. Many expected water to become more, but instead it became less. Especially in the case of DO1 canal, downstream farmers of Shule and Samachi B complain that water has reduced. It is unclear whether this is because the canal is not built well, or because the new gates can close off water completely where before some water would always pass. Another discussion point are the locations and sizes of the gates. Generally, farmers from the improved canals are happy that they do not have to clean the canal frequently, and that it is easier to block the water using the gates. But still many feel that the standard of the canal is inferior to that of, for instance, Lower Moshi. Part of the discussion is about whether the rectangular canals are good, or whether the sides should be sloped. You can read more about that on the next page.
Farmers do not like the shape of a canal (which they say is built like a house or a box, with straight walls), and would rather have the canals with sloped sides (like a plate, as in the Lower Moshi Irrigation Scheme). They think the canals with sloped sides can carry more water. They see that the Lower Moshi Scheme was built with sloped sides, and wonder why their canals are inferior to this.

This is where it becomes clear again that communication between government and farmers is not good. Where farmers think they were given poor canals, zonal engineers explain that to build canals with sloped sides would be expensive. If there is an existing canal, as there is in Mawala, it first has to be filled with soil, and then dug again with sloped sides. This is to support the tiles or slabs, which would otherwise fall down. This filling and excavating would require more labour and materials, taking longer and costing more. With the straight sides, the canal can be built directly into the old one, saving time, labour and materials.

Building the canal with straight sides therefore makes it possible to build more meters of canal, and to do it quicker.

Canals: sloped or straight sides

A canal in Mawala (left) and a canal in Lower Moshi (right). The top drawing shows the difference in constructing a canal with straight or sloped sides if a dug canal already exists.
Weeds blocking NAFCO canal

Rashes on the arm of a farmer after pulling weeds from the NAFCO canal

Other challenges

Besides the challenges with infrastructural development, which were a main part of this research, farmers have other challenges limiting their agricultural productivity and causing conflict among themselves and other water users. The most important ones are described here.

Weeds blocking the NAFCO canal

There are water weeds growing in the NAFCO canal, which block the water. At its worst, the Mawala scheme no longer receives water. Farmers organise monthly to clean the canal. The men enter the canal and pull out the weeds, which float downstream and are collected there. The weeds irritate the skin, causing rashes and sometimes fevers. TPC clears the canal of mud once a year, but does not help farmers with this monthly cleaning. Without a durable solution to remove these water weeds, farmers will continue to spend their labour and risk their health by entering the canal without protective gear.
Unequal water division
Water division in the scheme is not equal, and rather unfair. Those in the end of the scheme get much less water than those in the start. Although this can be a strategy when there is water shortage, it seems unfair that all people pay the same amount per acre per season. There is not a clear schedule to rotate water between canals, which means the canals further away always get less water and are limited in their crop choice. A cropping calendar and a rotational schedule between canals in times of shortage could improve water equality.

Inputs and extension services
Farmers do not have reliable access to extension services, and want more advice on what to plant, how to plant, what to do with pests and diseases and what kind of fertilisers to use. With inputs being the most expensive part of farming, besides labour, it is important for farmers to buy the right pesticides and fertilisers for their farm.

Scheme leadership
There has been conflict between the irrigation cooperative of Ongama and a group of farmers wanting to start an irrigators association. Although Ongama has certain challenges, it also has experience, is well known by farmers and government and is already registered.

One of the challenges of Ongama is that farmers are supposed to become members to attend meetings, and that it is only possible to become a member when you own land. This excludes all renters in the scheme. It is difficult for farmers to pay, if they can then not attend the cooperative meetings to monitor what the money is spent on. It is important to note that meetings about infrastructural projects are public and open to everyone.

Another challenge is that Ongama has not been able to collect the money effectively. There is mistrust between farmers and the leadership, caused by water shortage and unhappiness about the results of infrastructural projects. Because of this, the irrigation cooperative cannot grow.

The ideal organisation to manage the scheme would be able to divide water fairly among farmers, represent the interests of all farmers in the scheme, and collect money for paying the water use permit and the development of infrastructure. Whatever organisation manages the scheme, there needs to be support to build the capacity of irrigation leaders.

At the moment, the continuous conflict takes attention away from managing and developing the scheme, with farmers as the biggest losers.
Recommendations

For farmers
• Decide which organisation you want to manage the scheme, and what that organisation has to do exactly. What do you want to change?
• Review your rules for water allocation and fee collection, to make them more fair
• Switch meetings between Kahe town and Mawala, so everybody can attend
• Explore other crops than rice, that are just as profitable and need less water (onions, green peppers, tomatoes)

For ZIU/District
• Involve farmers in the design process, and organise one meeting to explain the design and have farmers ask questions
• Make sure the construction committee is elected on time, and receives some training about their task
• During an infrastructural improvement project, have weekly updates with the leadership of the scheme so farmers know where the project has reached (design, tendering, preparation, construction, etc)

For the District
• Make sure farmers get the extension services they need to be productive, and encourage the switch to crops that need less water.

For Pangani Basin Water Office/ZIU
• Facilitate a workshop for farmers and Mawala leadership to discuss the management of the scheme, the fee collection and water distribution.
• Explore possibilities of clearing the NAFCO canal of weeds for a longer period of time.
• Explore the possibility of using groundwater in the scheme to supplement surface water, especially in the area of Farm D

For NGOs
• Involve farmers in value chains for other high value crops, and support the transition to these crops
• Explore the possibility of introducing SRI (system of rice intensification) in Mawala

For businesses
• Set up a rice storage facility, where farmers pay to store rice until prices go up
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