Rainwater Harvesting in Guinea-Bissau

A report
by Hans Hartung
Consultant for rainwater harvesting
based on a visit in Feb./March 2013
Rainwater Harvesting in Guinea-Bissau

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1. Introduction

Rainwater harvesting as a source for water in households all over the globe is getting more and more recognised as an old and traditional but as well as a new way of providing water and/or supplementing existing supplies.

New developments such as the big success of the Thai water jar (up to 2,000 l water jar made of concrete), the ferro-cement tanks in East Africa or the recent introduction of flexible tanks in Western Uganda have contributed to a new appreciation for rainwater harvesting.

On invitation of Paul Akkerman and the organisation “Iagu limpo – tabanka san” (Clean water – healthy village) I had the opportunity to spend 10 days, i.e. from Feb. 24 to March 6, 2013 in Guinea-Bissau to see and experience rainwater harvesting in this part of the world. Between 2005 and 2012, the organisation was constructing more than 1,000 rainwater tanks in two Southern provinces of the country.

The aim of my stay was
* to look closely at a variety of rainwater tanks built so far and evaluate their quality and
* to get feedback from the users with the MAPP method (explained later).

During my visit, I was able to
* participate some hours in the training of masons in building water tanks in Mansoa (10 trainees, visiting 3 tanks under construction)
* seeing tanks built in Buba, Catio and many more villages, while passing through
* staying on 3 islands (Widikea, Samka & Cajar), looking at the rainwater tanks built there and doing 2 (short) MAPP exercises
* doing another MAPP exercise and looking at the water tanks at Quebo town and
* discussing with the coordinators (Paul Akkerman, Willfaba Narungha and Sadjaliu Djalo), project representatives, masons and their helpers.

2. The Balanta tank

2.1 The rainwater tank construction

The Balanta tank is a development on its own. While the “IAGU LIMPO – TABANKA SAN” organisation makes a difference between tanks on a square foundation (then called the Fossa Hollandes), and tanks sitting on the ground (Fossa Balanta), for simplification reasons we refer to all tanks here as Balanta tanks, as the tank itself is of the same construction. Tank building at “Iagu Limpo – Tabanka San” started in 2003 and went through several stages. Trials with underground tanks and bamboo reinforcement have led to unreliable results, however, much experience had been gained.
The ferro-cement tanks of East Africa were finally combined with elements of the Thai jar clay formwork. People in Guinea-Bissau use clay not only for their houses, but make characteristic pots and are very familiar with clay and working with it.

Therefore, the formwork of the 5,000 l tanks (standardised to this size by now) is being made with clay blocks, which sit on the newly made concrete foundation and get a smooth shape with a sand mix. Two layers of concrete follow. The blocks - which are taken out when the layers are stable - and a third layer of concrete is put on from the inside. The outside gets horizontal and vertical wraps of mild steel wire. Two more layers from the outside and a cement slurry on the inside for water tightness and from the outside for a smooth, pleasant sight follow. The roof is made separately and put on the cylindrical tank. Annex 1 shows the steps of building the tank.

Only 9 sacks of cement (50 kg) are used and 10 kg of steel wire, which compares favourably with other concrete tanks. Costs for a tank amount to appr. 200 Euros for “outside” materials and labour. The future owner will have to pay upfront the equivalent of 35 Euros. Additionally he has to provide the clay blocks for the formwork and sand.

Annex 2 gives an overview of the materials needed and the associated cost in Guinea-Bissau.

### 2.2 Basic data on villages/town with tanks visited

The table shows some basic data on population, ethnic group but as well on tanks built and planned for 2013 for the villages / towns where the MAPP exercises have been made. Data are based on fact sheets from “Iagu Limpo – Tabanka San”

<table>
<thead>
<tr>
<th>Criteria // site</th>
<th>Fatima</th>
<th>Samka &amp; Cataban Ntunda</th>
<th>Québo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>260</td>
<td>350</td>
<td>7,000</td>
</tr>
<tr>
<td>Ethnic group</td>
<td>Balanta</td>
<td>Balanta</td>
<td>Fula</td>
</tr>
<tr>
<td>Water problem</td>
<td>Wells in bad condition, partly salty water, 7 months water problems in wells</td>
<td>6 months without water from wells</td>
<td>Not enough wells, little water available in the wells from April to June</td>
</tr>
<tr>
<td>Rainwater tanks (end of 2012)</td>
<td>16</td>
<td>60</td>
<td>46</td>
</tr>
<tr>
<td>Tanks repaired 2012</td>
<td>11</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>leakage due to bad sand</td>
<td>-</td>
<td>(2 at lid, 3 at wall, 3 at foundation)</td>
</tr>
<tr>
<td>Tanks planned for 2013</td>
<td>30</td>
<td>80</td>
<td>24</td>
</tr>
</tbody>
</table>
3. A short introduction to MAPP and its use in Guinea-Bissau

In order to get a better insight into the value systems of the users and their own evaluation of development efforts by outsiders, the MAPP method was used. MAPP is a participatory evaluation method working with discussion groups and reflecting the perceived social key processes in a community. The results of the evaluation process show the direction of the social development, giving an idea of how much influence development projects have. The method may reflect practical starting points for further activities.

As there were only 2 to 2.5 hours time available for the village meetings, the MAPP exercises had to be reduced to its absolute minimum.

The tools used in the MAPP exercise in the 3 places in Guinea-Bissau were:

1. Lifeline → identification of good and bad years of the place
2. Identification of criteria for the quality of life
4. Activity list → identification of project activities
5. Influence matrix → attribution of impacts of project activities to identified criteria.

The translation from Kriol to English and vice versa was done by Paul Akkerman from “Iagu Limpo – Tabanka San” – in some cases the Kriol had to be translated to Balanta and back by the coordinators.
4. Life line

The years were evaluated on a scale from 1 to 5. A value of 3 meant that it was a “normal” year, a value of 4 was good and 5 was a very good year, whereas values of 1 and 2 were reserved for very bad and bad years respectively. People would explain why it was a normal, a (very) bad or a (very) good year.

4.1 Life line Fatima (Widikea)

The lifeline shows a steady improvement from 2006 and a drop in 2012. Life is largely dependant on climatic conditions such as rainfall for rice production.

Some comments of the community about the years discussed:
2005 : Cholera, hunger, too much water, dikes broke, no rice
2006 : No rice as well
2007 : Inauguration (Fanado), little rice
2008 : continuation of inauguration (Fanado), some rice
2009 : the rainwater harvesting project started; problems with the transport of pregnant women, rice crop normal
2010 : Rainwater harvesting project continued, rice crop ok.
2011 : Same as in 2010
2012 : The school started, water was high so dikes broke, little fish
4.2 Life line Samka

The lifeline shows some strong changes from one year to the other. Life is largely dependant on climatic conditions such as rainfall for rice production.

Some comments from the community about the years:
2006: No rain, no rice, dikes brake
2007: ONG Nimba supplies food, as no rice; inauguration (Fanado)
2008: Rice, good rains
2009: People die of diarrhoea adults and children (4 deaths in a year)
2010: Good rice crop, rainwater tank project starts
2011: No good rains, no rice
2012: UNICEF builds latrine for school, more tanks but bad rice crop
4.3 Lifeline for Quebo

People in Quebo are rather pessimistic (in comparison to the villages on the islands, see 4.1 and 4.2 lifelines) and have no one year rated above 3 (average). They are in another agro-ecological zone and depend mostly on cashew for their economy.

Here are the comments of the community regarding the years:

2005: No rains, no peanuts, rice only from the forest (small crop)
2006: Same as 2005
2007: Normal year, rains were good
2008: Diarrhoea
2009: No rains, no drinking water, people have to walk more than 2 km to get water
2010: Normal year, rains, but crop disease
2011: Good crops, drinking water projects (rainwater tanks) started
2012: Problems to sell the cashew crop, because of military coup; no water for animals
5. **Criteria for social development**

In order to determine the quality of life, four main criteria have been given:
- Economy, sources of income
- Access to resources
- Information and communication
- Freedom and autonomy

In discussion with the community, 3 to 5 sub-criteria have been determined which define the main social criteria.

<table>
<thead>
<tr>
<th>Social criteria</th>
<th>Sub-Criteria Fatima</th>
<th>Sub-Criteria Samka</th>
<th>Sub-Criteria Quebo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economy</td>
<td>Rice</td>
<td>Rice</td>
<td>Cashew</td>
</tr>
<tr>
<td></td>
<td>Fish</td>
<td>Animals</td>
<td>Rice</td>
</tr>
<tr>
<td>Horticulture</td>
<td>Fish</td>
<td></td>
<td>Peanuts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Horticulture</td>
<td></td>
</tr>
<tr>
<td>Access to resources</td>
<td>Water</td>
<td>Potable water</td>
<td>Water</td>
</tr>
<tr>
<td></td>
<td>Health</td>
<td>Health</td>
<td>Health</td>
</tr>
<tr>
<td></td>
<td>Light</td>
<td>Firewood</td>
<td>Light</td>
</tr>
<tr>
<td></td>
<td>Transport</td>
<td>Light</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Latrine</td>
</tr>
<tr>
<td>Information and</td>
<td>School</td>
<td>Transport</td>
<td>School</td>
</tr>
<tr>
<td>communication</td>
<td>Radio/TV</td>
<td>Mobile Phone</td>
<td>Mobile phone</td>
</tr>
<tr>
<td></td>
<td>Mobile Phones</td>
<td>Radio</td>
<td>Radio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>School</td>
<td>Guests (from</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Guinea Conakry)</td>
</tr>
<tr>
<td>Freedom and</td>
<td>Associations</td>
<td>Justice (by chief)</td>
<td>Political Freedom</td>
</tr>
<tr>
<td>autonomy</td>
<td>Fanado (inauguration ceremony)</td>
<td>Decision making</td>
<td>Women's Freedom</td>
</tr>
<tr>
<td></td>
<td>Political Parties</td>
<td>Justice by the state</td>
<td>Religious Freedom</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Trad. Justice</td>
</tr>
</tbody>
</table>

The economy for the Balanta (= ethnic group, here the villages of Fatima and Samka) agricultural society is largely determined by a very well developed rice growing system. Cows are holy and will be slaughtered only for burials. The economy of the Fula (here the small town of Quebo) is based on cashew cultivation.

For the people of all visited sites, access to potable water is important. They put a lot of emphasis on the access to health services – the difficulty in accessing the regional hospital in Catio (for pregnant women) because of transport problem was mentioned many times by the people from Fatima and Samka. Transport for access to markets was also rated as important for these two villages.

Within the criteria “information and communication” school enrolment plays an important role. Beside school enrolment, people value the access to a mobile phone network very much. The last category consists of Freedom and Autonomy and was interpreted very differently in the different sites visited.
6. Influence matrix

Impacts are attributed systematically with the aid of a matrix in which the strength of the influence of each project activity on each social criterion is again evaluated on a scale of one to five.

6.1 Influence matrix for Fatima

There are only the rainwater harvesting project and one microcredit as project activities in the village. The mobile phone network was used in this case as a project activity to compare the criteria developed. The participants in the meeting were not willing to rate from 1 to 5 but rather gave 5 for an influence and nothing for no influence. The result is shown below:

![Influence Matrix Image]

Summary of the results of the influence matrix

On the active side of the influence matrix, the rainwater tanks and the mobile network have been the most important “project” activities for people in Fatima. Drinking water has helped them when working in the rice fields or when fishing. It was as well important when travelling (transport).

On the passive side, we see that project activities in the village so far have been supporting fishing and transport.

People insisted that they do not only need drinking water but also water for cleaning, washing and asked for help in increasing the number of wells. Latrines were also rated as
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important and mentioned a few times during the discussion. A concern of the men was steel wire for fencing and keeping the cows out of the rice fields.

There were about 20 women and 16 men present during the exercise. Two elder men were leading the discussion, but when specifically addressed, and at the end, women voiced their concerns, mainly for more water availability for non-drinking purposes!

6.2 Influence matrix for Samka

On the active side, the rainwater tanks clearly are valued very much. Other development efforts were:
- support of rice in a year when the crop was very bad and
- the ongoing water and latrine construction for the school by UNICEF.

On the passive side, rice growing, health and the school have received most attention from the projects so far.
The exercise has allowed the people of Samka to see the (few) development efforts of their village. They especially saw the importance of drinking water and how much it influences many of the criteria which they value.

15 men, 8 young men and 5 women attended the meeting. As in Fatima, esp. women spoke out in favour of more water wells for non-drinking purposes. They also mentioned the need for latrines and steel wire for fences to keep the cows out of the rice fields.
6.3 Influence matrix of Quebo

On the active side, the rainwater harvesting project was a big support for people in Quebo which influenced many different aspects of their life. Other development efforts were supporting horticulture in a small way. Over and over again people expressed their water problem and stressed as well the importance of wells in the town. (Wells are around 20 m deep; water is taken out by bucket and rope). The wells in town dry up at the end of the dry season, when women have to walk longer distance (2 km was given as an average distance) to get water. 25 men and around the same number of women attended the meeting. Although the discussion was dominated by two men only, women voiced their concerns regarding the water situation and their concerns at the end!
7. Observations

Rainwater tanks and their construction

- The rainwater tanks are an integral part of life in the families
- People appreciate them very much as a source of clean water for drinking, whereas water for other purposes (such as cleaning, washing) is usually coming from wells (there the quality maybe a bit salty)
- Water from tanks is especially valued at the end of the dry season (starting from February) when many wells dry up or have very little water
- Water from the tanks is not the only source of water but an additional source, as people use different water sources for different water needs at different times of the year. Rainwater is especially liked for its good taste, its cleanliness and its availability at the house (in the tank)
- Contrary to many beliefs, people collect water from (mostly) thatched roofs in a traditional way (binding the ends of the thatch together), collecting it in available vessels and then storing it in the tank. The brown colour disappears during the storage as well as bacterial count goes down significantly (as evidence in literature and own earlier tests show, e.g. J. Heyworth\textsuperscript{1}, who compared a sample of more than 1000 school children, who were regular consumers of tank rainwater. They were at no greater odds of gastroenteritis than those who drank treated public mains water).
- The construction quality of the tanks is good. Leaks are reported (no statistics available), repair experience is with the masons. A system of monitoring is being set up with the introduction of “representatives” in the areas where tanks have been built. Monitoring of the construction quality is important to make masons responsible for their work; their remuneration should be dependant of a good performance (see as well the recommendations)
- An efficient and cost-effective organisation has been developed. The work is directly benefitting the future users, who are involved from the beginning. In contrast to many organisations, which are spending an increasing amount of funds on project/programme administration (including offices, cars,…), administration cost here are at an absolute minimum. Paul Akkerman and his two coordinators are able to handle the situation well. If activities should increase, the organisational set-up has to be “rethought”.

Water supply in general:

- People in Widikea, Samka and Québo wanted support for wells, as some families could solve their drinking water problem by rainwater harvesting, but enough water for cleaning and washing is still needed (even if “a bit salty”).

8. **Recommendations**

- **Register**
  A detailed register of tanks built should be introduced to give an identification number to each tank so that it can be traced back. A software programme and the use of „smartphones“ can help to register the tank, take a photo and register its geographical position. This data helps for statistics e.g. to find faults by geographical spread or responsible masons.

- **Monitoring**
  The register is a good instrument for monitoring the tanks as well, have an overview of the activities going on and eliminate problems and mistakes immediately as they are reported.

- **Technical aspects**
  Monitoring sand quality is crucial for a good and water-tight tank.
  Keeping the fresh mortar continuously moist for at least a week is well a crucial aspect that determines the quality and durability of the tank.
  There are good, simple designs for gutters of zinc roofs, which can be adopted from East Africa or Ghana.

- **Future related aspects for extension**
  The Balanta tank is technically mature, cheap and simple and contributes to solve drinking water problems. In the coastal region of Guinea-Bissau, with more than 100,000 inhabitants, every household with a kitchen would benefit from such a tank. In the suburbs of Bissau as well, people can make use of a rainwater tank as an additional water source, when the town water system is broken down or hand pumps are out of order. Having clean water in stock with such a tank or a number of tanks is equally a big support for a school, a church, a mosque, or a hospital.
  The same is true for the neighbouring countries Senegal, Gambia and Guinea-Conakry, where conditions and drinking water problems are similar: Balanta tanks can supplement as well the existing and often scarce water supply.
  The organisation IAGU LIMPO – TABANKA SAN has experience in giving training in tank building for masons in different regions of Guinea-Bissau and neighbouring countries (more information from their website: www.degevuldewaterkruik.nl)

- **Sustainable funding**
  - **General considerations**
    People appreciate the tanks and find them useful. Demand is high, more tanks can be built if more qualified coordinators are found.
    But then it would be even more important to guarantee permanent funding over the next years.
    Institutional funding by development donors is difficult, as they are not able to fund „individual“families and rainwater harvesting is in their view doing exactly this – supporting individual families.
  - **Associations**
    One strategy to overcome the individual funding problem might be to organise villages in „associations“ or any other organisational unit so that the support goes
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to these associations (examples in Kenya and Uganda prove this argument, as there women’s groups drive the rainwater tank projects and are funded by donors)

- Contribution by the users

As tanks become more and more popular, the cash contribution by the future users should be raised gradually as is already being done

- Microfinance

One idea could be that beneficiaries of tanks take a loan to build their tank. A prerequisite would be a functioning microfinance banking system, which is not (yet?) available in Guinea-Bissau. As the tanks do not directly contribute to cash income, even microfinance banks might be reluctant to finance them.

- Possible funding

Funders of rainwater harvesting so far have been

- Rotary clubs, SIDA Sweden, Embassies, Fondation Ensemble, Blue Schools Project (by IRHA = the International Rainwater Harvesting Association).
- Small organisations with no preconceived ideas and fixed agendas.
- It is always important to discuss in depth with the possible funder before developing a proposal. Bigger organisation (in case they would consider funding) usually fund only if they are already having projects in the country.
- Funders need well developed and presented proposals. In the long run, relationship with people in Guinea-Bissau should be thought who are able to support proposal writing and approaching possible funders.

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Annex 1:

The Guinea-Bissau tank / Balanta tank
### Annex 2: Bill of quantities and prices for a standardised tank

#### Guinea–Bissau tank / Balanta tank 5000 liter, 2013

<table>
<thead>
<tr>
<th>Materials</th>
<th>CFA each</th>
<th>CFA one tank</th>
<th>Euro one tank</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 bags ciment</td>
<td>5.500</td>
<td>49.500</td>
<td>76,23</td>
</tr>
<tr>
<td>10 kg steel wire</td>
<td>1.000</td>
<td>10.000</td>
<td>15,40</td>
</tr>
<tr>
<td>7,50 m. Wire netting</td>
<td>5.000</td>
<td>7,700</td>
<td></td>
</tr>
<tr>
<td>8,00 m. plastic sheet</td>
<td>500</td>
<td>4.000</td>
<td>6,16</td>
</tr>
<tr>
<td>small material</td>
<td>500</td>
<td>1.000</td>
<td>1,54</td>
</tr>
<tr>
<td></td>
<td></td>
<td>69.500</td>
<td>107,03</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tools</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 wheelbarrow</td>
<td>45.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>various tools (spade, levelling instr.)</td>
<td>55.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 total tools for 25 tanks</td>
<td>100.000</td>
<td>4.000</td>
<td>6,16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.000</td>
<td>6,16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transport</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport</td>
<td>8.000</td>
<td></td>
<td>12,32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8.000</td>
<td>12,32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Labour and coordination</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mason</td>
<td>25.000</td>
<td>25.000</td>
<td>38,50</td>
</tr>
<tr>
<td>2 helpers</td>
<td>7.500</td>
<td>15.000</td>
<td>23,10</td>
</tr>
<tr>
<td>1 coordinator</td>
<td>13.000</td>
<td>13.000</td>
<td>20,02</td>
</tr>
<tr>
<td>material for administration</td>
<td>2.000</td>
<td>3,08</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>55.000</td>
<td>84,70</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total for one Balanta tank</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5000 L</td>
<td>136.500 CFA</td>
<td>€ 210,21</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contribution of owner</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(with tap, in concert with owner)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 barrows sand</td>
<td></td>
<td></td>
<td>38,00</td>
</tr>
<tr>
<td>130 blocks of clay</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>600 Ltr water</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Annex 3: Pictures of Balanta tanks in different variations.

Balanta tank, original shape

Balanta tank with tap, local name: Fosa Universal

Balanta tanks on platform with tap, local name: Fosa Holandes

Fosa Universal, 5000 liter

Fosa Holandes, 10.000 liter