# *Chapter 18*

# The Calabash Cistern 5000 L in Africa

*P. Akkerman*

*Independent consultant Netherlands and Guinea-Bissau*
*info@degevuldewaterkruik.nl, www.cleanwaterhealthyvillage.com*

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## 18.1 INTRODUCTION

Skillful farmers and local masons have constructed thousands of 5000 L cisterns in remote villages and on far away islands, in more than ten African countries (Figure 18.1). The cisterns are built at low cost, approximately €240 in 2019, and are made with locally available tools and materials. The idea is to collect rainwater and store it close to the kitchens of farmer's wives. The basic issue is the existential necessity for small peasant families to have safe drinking water. The driving force is to relieve millions of women and girls from their heavy burden of having to carry drinking water, every day and for many hours. This chapter tells the story of the Calabash Cistern in short.

## 18.2 THE DESIGN OF THE CALABASH CISTERN (FIGURE 18.2)

### 18.2.1 Development

It has taken nine years to develop the design of the Calabash Cistern. In this story we call our project 'The Calabash Project'. The original name is CLEAN WATER – HEALTHY VILLAGE.


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**Figure 18.1** Calabash cistern 5000 L. (*Source*: Author's own).


**Figure 18.2** Calabash cistern spread over Africa. (*Source*: Author's own).

To reach the Calabash design and the construction technology with an outside mould, there were eight steps in the development.

Since the start of our project in 2005 we have improved the technology and the shape of our cisterns. All the experiments were performed in one of our three small water centres and in the African villages. Once a year we invite our best trainers and masons for a training meeting and an exchange of new ideas. Our development is a typical African development. Our manual for the construction of the Calabash Cistern is published in three languages. Our knowhow is available for free. RWH-consultant Hans Hartung visited and evaluated our project. In his report he writes: The Calabash Cistern is a development of its own.

## 18.2.2 The 5000 L Calabash Cistern

The overall shape is a vertical cylinder with a round-shaped bottom and a slightly conical roof. The material used is ferrocement. The cylinder has an inner diameter of 200 cm. The round shape of the connection between the bottom and the wall has a radius of about 40 cm. The height from bottom to the edge of the roof is between 1.70 and 1.80 m depending on the size of the mould.

We chose ferrocement as the material to construct the water cisterns, because we want the cisterns to be constructed by local craftsmen in rural areas. Cement is a very good material to store water. It is cheaper than stainless steel and more resistant than plastic. It can be constructed on the spot using hand tools. Cement is available almost everywhere in rural areas. A leaking wall is reparable. The life span can be 50 years, depending on maintenance.

## 18.2.3 Shape

The round-shaped connection between bottom and wall is essential in the design. The round shape looks like the shape of a water drop and is related to the

**Figure 18.3** Preparing the hollow part of the mould. (*Source*: Author's own).

**Figure 18.4** Plastering the inside of the mould. (*Source*: Author's own).

traditional African water jar. Being the designer, I felt very happy when I found the technical solution to make a globe or round shape for the cistern. I remember the moment when the idea struck me: 'In Guinea-Bissau I was staring out of the window of a hot bumpy bus driving through a Fula-tribe village with its round houses made of clay blocks. All the time I had been trying to imagine how to construct a suitably shaped water cistern. It had to be a round, comfortable and pleasant shape for water storage. All at once I got an idea: why don't I use a round outside mould instead of an inside mould?' An outside mould gives the possibility to shape a hollow curve in wet sand by hand on the inside of the cylindrical wall of blocks (Figure 18.3, 18.4 & 18.5). The method is similar to the work of an African smith, who is casting melted aluminium in a mould to make a globe shaped marmite pot. When the pot is finished, the smith takes off the mould from the outside (Figure 18.6).

**Figure 18.5** Finishing inside a calabash cistern. (*Source*: Author's own).

**Figure 18.6** Finishing the outside. (*Source*: Author's own).

Our project already worked with an inside mould of clay blocks. Now we changed the method. Together with Julio, my best mason, we constructed the new round-shaped cistern and we called it the Calabash Cistern.

### 18.2.4 Advantages

An important advantage we found on construction is that the round shape avoids the sharp edge where the bottom of the cistern meets the wall. The mechanical tensions are spread over the surface. In practice we do not see any cracks in the body of the Calabash Cistern. Another advantage is that the new shape saves one bag of cement. Also, most of the plastering can be done in the shade inside the cistern, which makes the quality of the cistern better.

## 18.3 THE CALABASH PROJECT IN GUINEA-BISSAU

### 18.3.1 How it started

The Calabash Project started in a small village and it walked over the narrow roads and footpaths of friendship and families to the next families and the next villages, like a cascade. Several years later big leaps were made to extend the reach of the projects in different countries. On the African family and friendship roads, one sometimes meets unexpected problems, but African families have proved to be very powerful. In every village we entered, the project leader was welcomed by motivated and skilful farmers. The pillars of the project proved to be: (1) the skilful African village; (2) the unbearable burden of women carrying so much water; (3) the local invitation.

No time for school.

I worked and lived in a village called Bedanda for almost four years (1987–91) and I earned my living at a rural vocational training centre as a mechanical engineer and teacher. My personal motivation was to experience more about the cooperation and friendship with African farmers. I had met them on my long holiday walks. They were very vital, skilful and hospitable people. I decided to go and work in an African rural area and I was lucky enough to get a job in Bedanda, a village of animist Balanta rice farmers.

A Balanta village has many spirits. When, the first monsoon rain arrives in Bedanda, the rice farmer awakes from his winter sleep and the rice-spirit affects the whole village population. People start their yearly dance of ploughing, sowing, harvesting, etc. Men and women, boys and girls are fully involved. Rain brings happiness. I met my best friend Bicosse Nandafa and he introduced me to many aspects of the Balanta society: birth, life and death. In this period, we started several projects to support children. The awareness of a drinking water project came later. Bicosse introduced me to working and communicating with the biggest tribe in Guinea-Bissau.

### 18.3.2 The 1st pillar of the project: The African village

The farmers of Bedanda invited me to work together with them on the rice fields with their very special hand plough, called the aradu. The Balanta farmers have a well organised agricultural system. They are skilful, hardworking self-sufficient farmers in a complicated society. During a few seasons, I was almost one of them, both in working with them and taking part in their parties and ceremonies. They welcomed me and I learned the language. I was amazed about their extraordinary effort to plough thousands of acres by hand. (The Dutch Agricultural University Wageningen did local research). Balanta men and women maintain an extended network between independent villages for exchange of labour, marriage, education of children and inauguration. Because of their skills, I felt sure that I could start a project directly with the village population instead of a complicated cooperation with an instable government.

### 18.3.3 The 2nd pillar (and driver): A private water cistern

Imagine, a private water cistern belonging to your own household! This was the driver of the project. Balanta women suffer because of bad drinking water, for the women it is a hard working life.

In the coastal area of Guinea-Bissau there is abundant rainfall during five months, then not a single drop of rain for seven months. The groundwater is saline because of intrusion of seawater, so the wells provide polluted water. In the dry season women and daughters have a daily walk of several hours to fetch and carry clean water from inland wells. (Figure 18.7 & 18.8) Women do not like living in the village of Bedanda, because of these heavy duties. For men it is difficult to find a wife who is willing to marry them.

Women and men want to store drinking water safely at home in large amounts, just as they store their rice at home, inside the house. A village well, a village pump and a village tap belong to the community. Something for common use, unfortunately, will not be maintained and suffer 'the tragedy of commons'.

**Figure 18.7** Drinking water taken from a shallow well. (*Source*: Author's own).

**Figure 18.8** Long walks to transport drinking water. (*Source*: Author's own).

### 18.3.4 The 3rd pillar: The initiative

On behalf of the village population, my friend Bicosse asked me for help to find a solution for the drinking water problem in his village Bedanda. Very importantly, he asked me and not the other way round. In the village, Bicosse was an adult and inaugurated man, aged around 40 years. He had an important position in the community of men. His younger brother was a mason in the capital Bissau. I found some financial support from my friends in the Netherlands and some technical information about storing rainwater. We started right away like amateurs. In the same year, 2005, we constructed three 5000 L cisterns in the ground. They were filled up by rainwater from the roof. One of the three cisterns was good and leak free. Even after six months, the taste of the water was very good. Nobody had seen anything like it in the village. Big local news.

### 18.3.5 The start of the Calabash project was booming

The second year I brought an experienced mason from the Netherlands to train a team of local men. We constructed ten underground cisterns. The 3rd year another training and we started to construct the cisterns above the ground, which is easier to control, more reliable and reparable. We constructed 50 cisterns above the ground. The 4th year we constructed 100 cisterns. Every household wanted to have water in stock, the neighbours, the brothers and the sisters, the neighbouring villages.

We started to ask a contribution in money. A cistern is not for free, it is not an easy present, ('You can just put it there!'). A cistern needs a serious owner, who will think and care about it and lock it at night!

### 18.3.6 The Calabash Project sails to the islands of Guinea-Bissau

South West Guinea-Bissau consists of many fertile islands and peninsulas. Around the islands there are broad salt water sea-arms, estuaries and rivers. A tidal landscape, originally covered with mangroves. It is the biggest sea area with coastal islands in West Africa with many birds. The rice farmers know how to cultivate mangroves into rice fields. Families have settled there because of the fertile soil and rich fishing grounds. They suffer but accept bad and saline drinking water, they have little knowledge of the cause of water-related illnesses.

Through friendship and family connections, my friend Bicosse and I visited the isolated and beautiful islands. We could only sail there in a well carved, hand-powered canoe, made out of the trunk of a 'canoe-tree'. Welcoming inhabitants informed us about the drinking water problem, which was even more serious than on the mainland. One of the islands is called Widekea. It means 'no water'.

**Figure 18.9** Polluted water. (*Source*: Author's own).

**Figure 18.10** Clean water at home. (*Source*: Author's own).

As a result of its isolation, healthcare was very poor. It took four or five hours to paddle pregnant women to the hospital in Catio. Many times the baby died half way. The mortality rate of children under the age of five was 20%. Local nurses told us that mortality depends on a combination of illnesses, which make a child weaker and weaker. Illnesses like diarrhoea, malaria, infections, etc. The animist population believes that illness and death are not caused by bacteria or dirty water, but by ghosts and curses (Figure 18.9). The following story about the influence of safe water (Figure 18.10) on the perception of cholera is striking.

### 18.3.7 Clean water changes opinion about cholera

In 2014, my wife (she is a family doctor) and I visited the very fertile island of Catunco. The project had been constructing Calabash Cisterns since 2010 and we wanted to visit the population and to inspect the results. There had just been a cholera epidemic in 2013. 20 people had died and half of the population of 3500 souls had fled for fear of infection. We watched a very big meeting on the football field with hundreds of people, men, women, old and young in different groups together. We did not want to disturb them. Our host, a teacher, explained that the goal of the meeting was to find out who was responsible for the curse. An explanation and a discussion between my wife, the doctor, and the teacher did not work out. The teacher assured us that only the old, male village leaders have the power to solve the problems and not the doctors from the universities.

In 2018 two project leaders of Catunco came and visited the project centre in Catio. We were sitting in my room. It was a conversation about money, so I closed the door. They told me that since the Calabash project started 10 years ago, there had not been a cholera epidemic on the islands for five years now. They shared with me that their families and friends had started to believe that a cholera outbreak depends on water and that the illness is not the result of a curse. They confessed that until five years ago people were killed in the night or expelled from the island because of the suspicion of black magic.

### 18.3.8 Transport and salty sand

As the Calabash Cistern is constructed on the islands, the project has to deal with transport of the materials. One Calabash Cistern needs eight bags of cement, 10 kg of steel wire, 8 m of chicken mesh and a tap. One hand-driven canoe can easily transport two masons, the materials and the tools for five cisterns. Nowadays the project has its own motorized canoe, big enough to transport the material for 10 Calabash Cisterns.

The first cisterns on the islands were made with beautiful white sand, straight from the beach. In the first year these cisterns worked well. In the second year most started leaking. The sea salt in the sand diluted and made the wall permeable. The lesson was to start washing the sand thoroughly in the rainy season.

### 18.3.9 Another change

In 2015 Nobel Peace Prize winner, José Ramos Horta was working in Guinea-Bissau as a representative of UN. After several requests and a long period of waiting, he decided to visit our project on four of the islands. He showed enthusiasm about the cisterns and he talked with the population about their needs. They asked him to get help with transport and Mr. Ramos Horta offered each of the four islands a motorised canoe, so that the islands would have better transport to the hospital on the mainland.

## 18.4 THE FIRST SUCCESSFUL INTERNATIONAL TRAINING IN DR CONGO

### 18.4.1 The importance of the manager

During our first successful training, we learned the importance of a good manager. In two earlier international projects, we had trained very good masons. Yet, in spite of training, the projects failed. However, in Kinshasa we not only met masons, we also trained the local project coordinator or manager, Ir. Roger Mbumbu. Ir. Roger has his own team of masons and for us he has become a role model as a local project coordinator.

In the Netherlands we have hundreds of private development organisations working for small and poor communities in Africa, Asia, etc. They support hospitals, they build schools, they finance pumps for irrigation, etc. Our foundation is one of them, Foundation Friends Holten Bedanda - friendship between a Dutch and an African village.

To bring all these private foundations together, we have an umbrella organisation, called Partin. Once a year Partin organises a congress for all her members. In 2013 they invited me to give a presentation about our drinking water project and the cisterns. There I met Gustave, who is the coordinator of a project in DR Congo. Gustave was very enthusiastic about our cisterns, we made a plan and his organisation invited our trainers to train their masons in the town Menkao not far

from Kinshasa. (The groundwater in the area is 200 m deep.) They found funds to pay for the training and the tickets for the trainers from Guinea-Bissau. African trainers train African masons! (Figure 18.11) My role was to supervise the training, to be an interpreter and to work with the local manager. So I met Ir. Roger Mbumbu. He invited me to a meeting with the chief and representatives of the town. Roger organised all requirements and we agreed about future cooperation and some support from our side. Since 2014 Ir. Roger has constructed about 100 Calabash Cisterns for 100 families in Menkao. After some years Ir. Roger and Gustave succeeded in raising their own funds.

**Figure 18.11** Certificates for participants, DR Congo 2014. (*Source*: Author's own).

In 2019 a Tanzanian project invited Roger to be a trainer in Tanzania. It was the first time in his life he travelled that far. He trained his Tanzanian colleagues using the Swahili language, a language he spoke because he was born in East Congo. Roger's African horizon was opened.

This is only one example of how Partin supports us. The umbrella organisation linked us with projects of at least ten African countries in West and East Africa.

## 18.4.2 Menkao town

Menkao town has about 35,000 inhabitants and has a history with drinking water. In the middle of the town is an impressive water castle with a 250 m deep borehole. Beautiful taps in different quarters of the town. Around 500,000 Euros was financed by the EU. After half a year, the pump broke. No money and no expert to repair.

Ours is a very different approach. For the same amount, we could have constructed more than 1000 Calabash Cisterns. Even if 10% of the cisterns had a problem, that would still be 900 working Cisterns. And the broken cisterns could be repaired by local masons.

## 18.4.3 Calabash Project becomes specialized in training

First we became specialized in the construction of the Calabash Cistern. After that we became specialized in the training of masons and managers. There is no need for us to grow, no big centres, no offices and cars. We like to stay small and basic and keep in touch with the African farmer. Don't forget: our trainers and masons are as famous as local football stars.

## 18.5 OTHER REMARKABLE RESULTS OF THE INTERNATIONAL TRAINING

### 18.5.1 CBR Effata

CBR Effata is a community-based rehabilitation program in Nigeria and in Guinea-Bissau. One of the activities is to support deaf children. They are brought together from different villages and trained in using sign language; the deaf boys and girls go to school and get a vocational training for a job. Several boys chose to be masons and construct Calabash Cisterns. They were trained by the trainers of the Calabash Project. Now they have their own teams for the Calabash Cisterns and every year they construct about 120 cisterns in Nigeria from their own Effata funds.

### 18.5.2 Reforestation Project, Senegal

For a few years the Calabash Project has been closely cooperating with the International Rainwater Harvesting Alliance (IRHA). Han Heijnen, president of IRHA invited us to participate in this Reforestation Project. In 2019 our trainers from Guinea-Bissau trained six Senegalese masons and a manager (Figure 18.12). They are now able to continue their project independently.

Together we created safe drinking water possibilities for peasant families by means of the Calabash Cisterns. Our trainers participated in many more African projects, and also in Panama and Mexico (Figure 18.13).

The training is supported by a well illustrated manual of 40 pages. It takes six days to construct a Calabash Cistern. A team of three masons can construct three cisterns together in one week by working parallel.

**Figure 18.12** Participants Senegal 2019. (*Source*: Author's own).


**Figure 18.13** Indigenous people in North Mexico. (*Source*: Isla Urbana, 2018)

### 18.5.3 The manual (Figure 18.14)


**Figure 18.14** Calabash Cistern manual 2019. (*Source*: Author's own).

The illustrated manual of 40 pages leads the managers and the masons through the six-day construction period, day by day. Many years of experience have been collected in the manual. It is a supporting guideline and standard. Harry Chaplin director of Tatirano Social Enterprise in Madagascar studied the manual and was able to construct the Calabash without further training. Though this is possible, the great advantage of a training is that participants will teach each other many small tricks and details, that are not all in the manual. Information about our method of training is found on our website: www.cleanwaterhealthyvillage.com

### 18.5.4 The PVC tank (Figure 18.15)

The PVC tank is a competitor to the Calibash Cistern. Many thousands of plastic tanks are used in urban centres such as Dakar, Dar Es Salaam, Nairobi, etc.

In Ghana masons have constructed Calabash Cisterns in towns. Cement cisterns are cheaper, more durable and their production supports the local economy. The water in a cement cistern will stay cooler than in a plastic one. Cisterns are heavy, but can be transported with a bulldozer (Figure 18.16).

**Figure 18.15** PVC tanks in Dar Es Salaam. (*Source*: Author's own).

**Figure 18.16** Town transport of a 6000 L Calabash Cistern. (*Source*: Author's own).

## 18.6 SOME CONCLUSIONS AND OUTLOOK

It is not so difficult to construct the Calabash Cistern. It can be learned by skilful men, women and by normal masons. The discipline regarding the quality of mortar, reinforcement, wall thickness, keeping the cement wet, etc. is important, but not difficult. The Calabash Cistern is cheap and in many villages there is somebody who can construct and repair them. Calabash Cistern can reach remote households and is suitable for small projects and self help.

Detailed information cannot be explained in this short chapter. Please find the manual and more information on our website: www.cleanwaterhealthyvillage.com.

The 10,000 L Calabash Cistern is also generally constructed at schools and enterprises.

The 5,000 L Calabash Cistern is a practical volume for families. If more volume is required, then two Calabash Cisterns can be constructed.

Industrial growth in urban centres is possible like that of the production of Thai Jars.

In Brazil I visited PIMC, Program for 1 Million Cisterns, in rural areas and was very impressed with the work there.

I wish all RWH practitioners good luck and would be pleased to hear from anyone who has constructed or uses the Calabash Cistern. RWH is like singing in the rain.