4th International Dry Toilet Conference

What does it take to convince decision makers in Omaruru, Namibia to scale up urine diversion dehydration "Otji toilets"?

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To provide access to affordable and sustainable sanitation for all Namibians, it is essential to consider dry toilets as a proactive measure to deal with water shortages and as a way to save precious water resources in the wake of climate change. To convince the community and the decision makers of the benefits of dry sanitation, the GIZ Namibian Water Resource Management Project and the Omaruru Basin Management Committee (OmBMC), along with the NGO Clay House Project (CHP), initiated a pilot project in mid 2010 with Otji toilets (Urine Diversion Dehydration Toilets – UDDTs) to provide sanitation facilities to 21 households in the peri-urban informal settlements of Omaruru in Namibia. Approximately 140 people were served by the new toilets at EUR 776 per toilet, which included a future toilet owner's contribution of EUR 15 (2%).

The Otji toilet is a UDDT with a novel type of a toilet bowl, designed in 2010 such that urine touching its wall is collected in a small trough at its base, drained away through a pipe and infiltrated into the ground (or collected and stored). The faeces are collected in a perforated container inside the vault to drain the remaining liquids and facilitate dehydration.

After these Otji toilets were in use for about three months, a small survey carried out by GIZ and the OmBMC showed high acceptance of the toilets among users. Many users were especially happy to have a dry system, as they do not have to pay for water to flush their toilet. The project helped to prove the appropriateness of these dry toilets to the local authorities and residents. However, the authorities still favour flush toilets and sewers (funded with donor support) as they perceive it as a "high class" solution even though it is far more expensive in construction, operation and maintenance.

Keywords: *UDDT, ecosan, Otji, sustainable sanitation, Namibia.*

INTRODUCTION

To achieve the Millennium Development Goals (MDGs) on sanitation, sustainable solutions are required. Solutions can only be sustainable if they are adapted to the local conditions. In many developing countries, especially in the dry regions of sub-Saharan Africa, it is important for decision-makers to consider the appropriateness of implemented technologies. Not only do dry toilets save water and thus facilitate drought adaptation strategies; ideally, they also provide fertiliser to sustain crops, while effectively and safely containing and treating human excreta without contaminating precious water. As Namibia is the driest country in sub-Saharan Africa, a flush toilet system based on fresh water is not

sustainable. To provide access to safe, affordable sanitation to all Namibians, it is essential to consider dry sanitation as a proactive measure to avoid water shortages and as a way to save precious water resources in the wake of climate change.

In the past 20 years, Namibia has made considerable progress in providing safe drinking water to its population. The access to safe drinking water has increased from 63% in 1990 to 93% in 2010. Access to improved sanitation, however, remains low and has only changed from 24% in 1990 to 34% in 2010. Trends even show a growth of 8% in open defecation in urban areas, while 72% of people still practice open defecation in rural areas (WHO/UNICEF, 2012).

Project background

The Namibian Water Resource Management Project of GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH) is supporting the Omaruru Basin Management Committee (OmBMC) to practice improved and integrated water resources management, and ecological aspects of sustainable resource management.

The need for proper sanitation in Omaruru was raised at one of the OmBMC meetings in the beginning of 2010. Members of the OmBMC then travelled to the NGO Clay House Project (CHP) in Otjiwarongo, a town 135 km from Omaruru, to learn about the construction of dry toilets and also looked at examples of Otji toilets which were already in use in this town.

During this exposure trip, GIZ gave a presentation to the members of the OmBMC on different sanitation options and discussed the most feasible options with the members. The informal settlement of Omaruru was selected as a pilot area based on a rapid baseline survey including a demand assessment conducted by the OmBMC in cooperation with GIZ. Future toilet owners were selected on a “first paid first served” basis and in coordination with the ongoing formalisation process of the Omaruru Municipality.

Omaruru lies about 135 km Northwest of Namibia’s capital city Windhoek, at an altitude of 1200 m above sea level, in the Erongo region. The climate in the area is arid with a yearly precipitation of 280 mm on average. The depth of the groundwater table in the Omaruru basin varies. Two borehole measurements in the area indicated a depth of 2.46 m and 3.40 m respectively (Kleemann and Berdau, 2011).

Omaruru has about 12,000 inhabitants. The population lives in the town of Omaruru (2,000 inhabitants) and in the partly informal settlements of Hakahana (6,000 inhabitants) and Ozondje (4,000 inhabitants). The project area is located on the edge of Hakahana and can be described as an informal, peri-urban settlement.

Many people live in shacks they build from scrap metal and wood, some buildings are also made from bricks. Drinking water is provided through communal taps. Depending on the location of their house, people have to walk up to 300 m to fetch water. People living in the project area have no access to safe sanitation and therefore defecate in the open. Especially for women and children, the traditional way of “going to the bush” is dangerous. During the rainy season, water-related health problems, such as diarrhoea, are increasing. Due to the Omaruru River, the groundwater level is quite high and vegetation is relatively dense. Pit latrines can therefore cause groundwater pollution. For the people living in the town of Omaruru itself, sanitation is provided through flush toilets, septic tanks, suction trucks and oxidation ponds.

Against this background, the OmBMC decided to pilot 21 Otji toilets serving approximately 140 people in Hakahana. The project was planned as a pilot study to demonstrate that if dehydration toilets with urine infiltration are an appropriate sanitation solution for the informal settlements of Omaruru. The aim of the project was also to involve the local authorities in such a way that they can implement Otji toilets in the future, based on the findings of the pilot study.

What are Otji toilets?

The Otji toilet is a type of Urine Diversion Dehydration Toilet (UDDT) that separates urine and faeces at source and sanitises the faeces by the process of dehydration (Rieck et al, 2012). The Otji toilet does not require any water for flushing, and only minimal quantity of water is required for regular cleaning of the toilet bowl. Thus, it is very well adapted to dry climates and areas with water scarcity. The first version of the Otji toilet separated the urine and faeces using a perforated container (Fig. 1, left) with urine contaminated by faeces infiltrating into the ground below the toilet. With the new urine diversion bowl (Fig. 1, right: top), tests show that 80% of the urine is separated at source with relatively little contamination and infiltrated into the ground. As most of the urine is kept separate, the faeces remain drier and the dehydration process is more effective. The narrow inlet makes it possible to capture maximum amount of urine touching the surface. Also as the inner edge of the urine trough is 10mm wider in radius than the edge of the toilet bowl only liquids can "jump" over this open space to reach the trough. Chances of contamination during watery diarrhoea are minimal.

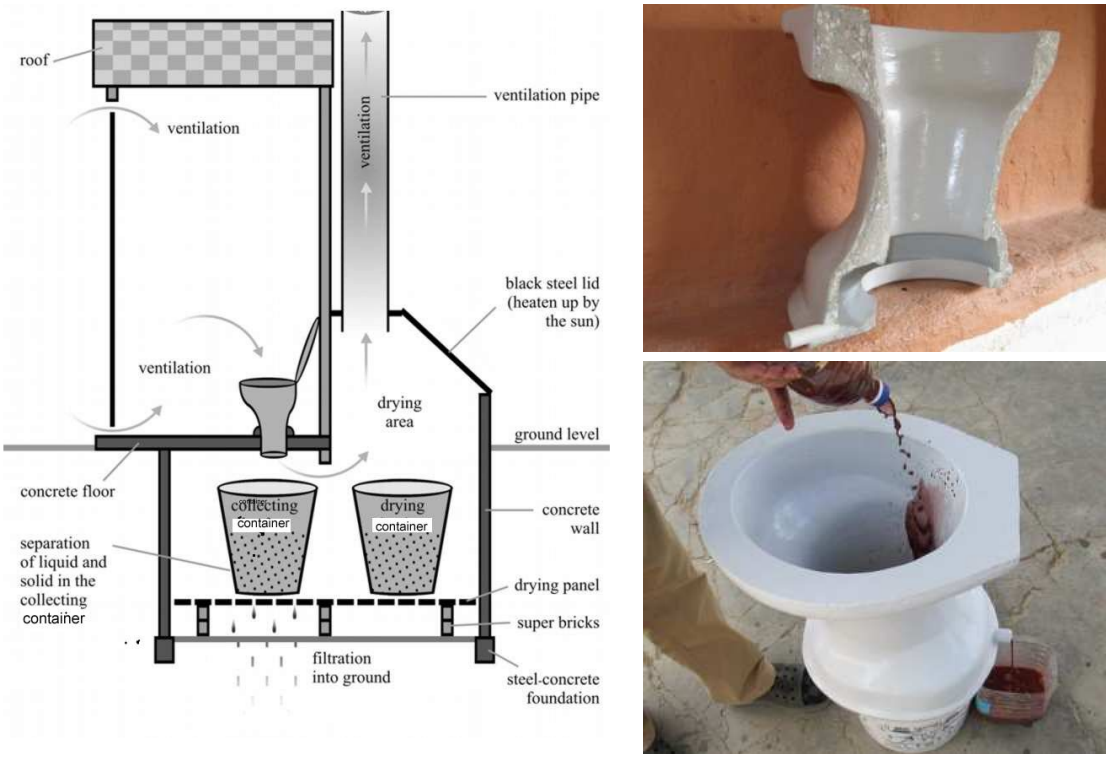

Fig. 1: Left: Functional plan of the Otji toilet without urine diversion bowl which was later developed (source: CHP, 2009a). Right top: Cross section of the new urine diversion bowl where urine collects in the trough at the base. Right bottom: Demonstration of urine diversion (source: CHP, 2009b).

Design

The functional plan (Fig. 1) shows the main features of the Otji toilet. The entrance is at the ground level as the vault is below the ground. The ventilation and dehydration is driven by the sun. Therefore, the back of the toilet's superstructure is always oriented North in the Southern hemisphere. The black steel lid heats up by the sun and facilitates the dehydration process within the vault. Air then circulates through the toilet into the drying vault and out through the ventilation pipe, which makes the toilet odourless. The 90-liter perforated collection container is situated under the toilet bowl and is moved to the adjacent drying area when full. The perforated container with the dried faeces (still inside of the vault) is later emptied and moved back beneath the toilet bowl.

Urine Diversion System (UDS) toilet bowl

In urine diversion systems, the urine is separated at the source (von Münch and Winker, 2011). The urine diversion toilet bowl is designed in such a way that urine touching the wall of the bowl is collected in a small trough (Fig. 1, right), drained away through a pipe and infiltrated into the ground. Alternatively, the urine could be collected in containers and stored for reuse, most likely as fertiliser. No problems of blockages of the collection trough or the urine pipe, which is 20 mm in diameter, have been reported. The new urine diversion bowl has been in use since early 2010. The perforated collection container for faeces is still used, even though the urine diversion bowl significantly reduces the amount of liquids in the excreta. Some users have indicated that they use ash to cover the faeces after defecation, but this is not widely practiced at the moment, and is not necessary.

Indoor Installations

The installation of indoor Otji toilets in an existing house is quite complicated because of the need to cut through the foundation of the house as half of the storage vault is underneath the house (under the pedestal) while the other half (with the opening) is above the ground. These problems would be avoided if the toilet is built extending out from an existing house. Moreover indoor installations develop some odour nuisance during the night when the sun (heat) ventilation stops. Therefore the inclusion of an Otji toilet in a new house does not really save costs as the space that is needed for the Otji toilet causes additional construction cost and even more importantly because of the required expensive electric ventilation. Consequently, indoor Otji toilets are recommended only for middle income and above households.

Construction

The toilets in Omaruru were built by staff members of the CHP in Otjiwarongo and locally available labour. Except for the brick walls, the toilets were prefabricated in Otjiwarongo and delivered as self building kits. The presence of the team of the CHP was important to ensure the proper construction of the toilets and to train local labourers. In some cases, the future toilet owners contributed to the construction of the toilet by digging and painting.

Otji toilets becoming popular

The Otji toilet works quite well in Namibia and contributes to an improvement of the local living conditions (Uhlendahl, 2011). There are no rights reserved on the Otji toilet technology or on its name. Since 2011, self building kits have been manufactured by the local company, Eco Solutions C.C., in Otjiwarongo. It is expected that other companies will follow in various regions. The Otji toilet seems to be ideal for small-scale business. The Urine Diversion System (UDS) bowl developed at the end of 2008 is a registered patent of Eco Solutions in South Africa and Namibia. Since the beginning of 2009, a number of prototypes have been tested at the CHP compound in Otjiwarongo (see video link on Otji toilets on last page) and, since 2010, they have also been installed for customer's use (57 toilets in Windhoek, 21 in Omaruru, 115 in Oshikoto, 130 in Gobabis, 40 in Gibeon plus several individual customers).

Otji toilets are not only becoming popular in Namibia but also in Latin America. The CHP is a partner of the EcoSur Association (www.english.ecosur.org/index.php/component/content/article/97-news/480-dry-toilets-in-latin-america) and has passed its knowledge on to its Latin American partners, who are now building Otji toilets in Ecuador, El Salvador and Haiti. The toilets here are often combined with a shower cubicle. EcoSur partner Sofonias has installed 250 such "sanitation units" in different projects in Haiti, especially for "Habitat for Humanity" in some of its large housing projects.

PILOTING OTJI TOILETS IN HAKAHANA, OMARURU

As mentioned above, the toilets were partly prefabricated by the CHP. The most important parts were made from metal (steel vault lid, door, doorframe, roof structure, ventilation pipe, steel foundation ring) and concrete (floor plates, side plates for vault lid). Apart from that, the toilet bowl and materials such as screws, nuts, silicon and wire were also used. For the toilet super structure, bricks, cement and sand were used. The roof tiles were also fabricated by the CHP and designed to keep the toilet cool.

Fig. 2: Left: Otji toilet in Omaruru; Middle: Perforated faecal containers in the vault; Right: Basic handwash basin attached to the toilets. The pink bucket provides fresh water, the cup is used to fill the basin and the black bucket collects the greywater which can be used for irrigation (photos: F. Kleemann, GIZ, 2011).

The construction of 21 toilets for 140 users was completed by the end of 2010. Since then, the toilets have been maintained by the owners. Basic handwashing facilities were attached to the toilets. A short awareness-raising campaign for a period of one week was conducted to further promote the toilets and to highlight the importance of handwashing after using the toilet. After the dry toilets had been in use for about three months, GIZ and the OmBMC carried out a brief survey in early 2011 in order to assess the satisfaction among 13 out of the 21 toilet owners. Not all questions were answered by everyone, sometimes also due to linguistic barriers. The average number of people using one toilet was 6.5 and was highly variable, ranging from 2 to 13, due to different household sizes.

At the time of the survey, none of the faeces containers had been emptied yet as one container usually takes six months to fill up. About half (54%) of the toilet users can imagine using dried faecal matter as fertiliser for plants, while 23% cannot. 33% of users have a garden on their plot and all of them have neighbours with gardens.

Further, people seem to be very happy with these toilets as 100% promote the system amongst their friends and 92% think it is an appropriate solution for Hakahana. However, still about half of the people (46%) would prefer a flush toilet, but they did not state why (lack of odour was mentioned once). About 92% of the toilets were equipped with handwashing facilities and instructions, and 85% of the users used the handwashing facilities. Forty six percent thought that awareness raising about sanitation and hand washing would be important for the people in the area.

The distance from the households to the next water tap ranged from 10 m to 500 m. 100% of the surveyed users were of the opinion that the municipality does not care enough to provide sanitation for the area.

During a visit by a GIZ staff member after 1.5 years in use, in April 2012, the toilets were still in good condition and users were still very satisfied with their toilets. Some of the owners have created a business and allow other people to use their toilet for a small fee.

Operation and maintenance

Operation and maintenance costs are very low. Apart from regular cleaning, no maintenance is necessary. But incase the pedestal gets soiled, it is easily accesible from top with a brush or a cloth. With four people using one toilet, it takes about six months for the 90l container to fill up. After the first year of operation, the container with the dried faecal matter has to be emptied every six months depending on the number of people using the toilet. When one faeces container is full it is replaced by an empty one while filled container is kept at the back of the vault for dehydration. Once the two collection containers for the faeces are full, the one with dehydrated faeces is emptied and put into use again. In some cases it was observed that plastic bags were used as toilet paper, hindering the drying process and leaving more moisture making the container heavy. The filled containers are pulled out of the vault without entering it with the help of hook at 1.6 m height by two men (CHP, 2009c).

Collection of the dehydrated faeces by the Municipality has not yet materialised as planned. In the absence of a proper collection and recycling system, most of the toilet owners fill the dehydrated solids into rubbish bags and dump them into the municipality rubbish waste bins.

Economic viability of Otji toilets

High costs of construction are generally typical for Namibia. The total investment cost for the 21 toilets was EUR 17,000. One Otji toilet costs about EUR 776, which makes it unaffordable for the people living in the target area without subsidies.

The costs for 20 toilets of the pilot project were covered by GIZ on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ), and one toilet was paid for by the European Commission[1]. Future toilet owners contributed a minor part (EUR 15 or 2% of the total costs) to the toilet which is approximately 20% of one month's income. A few also contributed by digging pits. The contribution served as a "registration fee" and was important to create a feeling of ownership to encourage people to look after their toilets and to maintain them well. Once the toilets are built no further investments are necessary as the emptying can be done by household members or by locally available labour.

Prior to the introduction of the new concrete UDS bowls, the plastic and non-UDS toilet bowls had to be imported from South Africa, which was double or triple in price. After the NGO CHP stopped its activities, due to lack of housing programmes, a local company (Eco solutions C.C.) took over the production of Otji toilets in Otjiwarongo. If there was a local producer in Omaruru (potentially a franchise of Eco Solutions) in Omaruru, it might be possible to lower the prices. Mass production can also help to reduce the costs of the UDS bowls. Costs of the toilets can also be reduced by using cheaper materials for the superstructure. To reach the poorest segment of the population, there is generally a need for subsidised sanitation facilities, as these people will not be able to save money to get a toilet in the first place. Society as a whole will benefit due to reduced health-related costs.

Reuse activities

The small scale of the project makes it difficult to establish a community reuse scheme other than the use on a household level. No households have been reported to reuse the dehydrated faecal material. Water from the handwashing basins is used for irrigating gardens. The Otji toilets in Omaruru all infiltrate the urine below ground instead of using it as a fertiliser. However, urine could be easily collected through the urine diversion bowl and attached to a jerry can at the end of the pipe. It could then be used as fertiliser. The

[1] EuropeAid/124568/C/ACT/TPS-1 - Cofinancing with European Development NGOs Actions in Developing Countries (PVD)

dried faeces can be used as soil amendment or can be co-composted with other biodegradable material. On a small scale, the material can easily be used by the households, as many of the toilet owners or their neighbours have gardens. Awareness raising among the population and trainings is necessary.

CHALLENGES IN SCALING UP OTJI TOILETS

The pilot project has proven that the dry toilets are an appropriate technology for the conditions of the project area, except for the relatively high capital costs in case of Otji toilets. The acceptance of the toilets is high, which is not surprising, as people who were without sanitation facilities now have one and appreciate it. Many of the users are especially happy to have a dry system instead of a water-borne system, as they do not have to pay for flushing water.

So far, only 21 Otji toilets were built in Omaruru, even though OmBMC had evidence for a demand of 100 additional toilets. Funding or subsidies for additional toilets should ideally come from the Municipality of Omaruru via the Ministry of Agriculture, Water and Forestry as a general service provision. This pilot project helped to prove the appropriateness of these dry toilets to the local authorities and residents, but the authorities still favour the flush toilets and sewers as they perceive them as “high class” modern solutions, regardless of the fact that they are very expensive in terms of construction, maintenance and operation. Without the support of decision-makers, it will not be possible to establish a dry sanitation system on a large scale.

One reason for low political acceptance and willingness to construct Otji toilets on a larger scale is the municipality’s hope for international donor funding to build a sewer system and treatment plant and thus fulfill their aspirations for a ”modern” solution. This is a perfect example where donor funding could have very negative effects by distorting the real costs of the chosen sanitation system. The scaling-up of Otji toilets has proven to be difficult also due to their relatively high construction cost owing, in part, to the transportation of pedestals from Otjiwarongo.

The Ministry of Agriculture, Water and Forestry, hosting the DWSSC (Directorate of Water Supply and Sanitation Coordination) followed the cabinet’s mandate to implement the National Sanitation Strategy from 2009. It has listed Otji toilets as an appropriate solution to address the sanitation needs in Namibia (MAWF, 2009). It is expected that local companies will start to produce Otji toilets in all regions. DWSSC has therefore started with training workshops in “Advanced dry sanitation” for its maintenance staff. Over 200 staff members from all regions of Namibia are currently being trained in prefabrication, construction and maintenance of Otji toilets by Eco Solutions.

CONCLUSIONS

The pilot project established the appropriateness of dry sanitation technologies in Namibia by successfully demonstrating the benefits of Otji toilets in providing safe sanitation and water conservation. However, the Otji toilets are still considered inferior to flush toilets by the local authorities who are keen on receiving possible funding from an international donor agency to construct high-tech water-borne solutions. More effort is required to change the mindset of the local authorities with respect to dry sanitation and Otji toilets as high-class solutions. Donors and funding agencies should also take a holistic approach before investing in high-tech sanitation solutions and be aware of the repercussions their funding decisions can have on the local sanitation market.

One of the biggest advantages of the Otji toilet is its ease of usage. It provides the user with the convenience of ‘poo and forget’ similar to that of flush toilet. Therefore, acceptability among users is relatively high. Also, the simple operation and maintenance cause minimal issues of misuse. As Otji toilets save precious water and are based on sun-

driven ventilation and dehydration, it can be described as especially appropriate for Namibia's climate. Water saving is also a persuading factor to the people, as they do not have to pay for water for flushing compared to flush toilets.

High capital costs of the Otji toilets make them an unaffordable solution for low-income people and therefore it is difficult to scale up their provision without external funding. Alternative construction materials, especially for the superstructure, together with mass production efficiencies, can make the toilets more affordable. A subsidy from the municipality can also stimulate their production.

Otji toilets are slowly but steadily becoming more appealing for decision-makers not only in Namibia but also in other low income regions of the world, such as some Latin American countries.

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