Sanitation Study

Evaluation of Dry Sanitation Systems in Namibia 2011

Master of Science Geography of Global Change

Albert Ludwigs-Universität Freiburg

Authors: Ameli Cosenza; Sören Haxsen; Yara Sattler; Thomas Uhlendahl; Kai Wucherpfennig

Supervision: Dr. Thomas Uhlendahl, Institute of Cultural Geography

The project was conducted in cooperation with the Namibian Desert Research Foundation (DRFN), the Habitat Research and Development Center of Namibia (HRDC), The City of Windhoek and the Clay House Project (CHP).

Contents

List of Figures

List of Tables

List of Pictures

List of Abbrevations

CHP	Clay House Project
COW	City of Windhoek
DAC	Development Assistance Committee of the OECD
DRFN	Desert Research Foundation Namibia
DWSSC	Directorate of Water Supply and Sanitation Coordination
E-CAP	Sustainable use of Namibia's natural resources: contributing towards enhancing the capacity of future decision makers
EU	European Union
GIZ	Gesellschaft für Internationale Zusammenarbeit
HRDC	Habitat Research and Development Center
IWRM	Integrated Water Resources Management
LAs	Local Authorities
MAWF	Ministry of Agriculture, Water and Forestry
MDG	Millennium Development Goals
MET	Ministry of Environment and Tourism
MoF	Ministry of Finance
MoHSS	Ministry of Health and Social Services
MRLGHRD	Ministry of Regional and Local Government, Housing and Rural Development
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
OmBmc	Omaruru Basin Management Committee
RCs	Regional Councils
SWOT	Strength-Weakness-Opportunity-Threat
UDS	Urine Division System
UNDP	United Nations Development Programme
UDDT	Urine Diversion Dehydration Toilet
VIP	Ventilated Improved Pit-Latrine
WASP	Water Supply and Sanitation Policy
WATSAN	Water and Sanitation
WDM	Water Demand Management
WHO	World Health Organisation

Abstract

The provision of appropriate sanitation services for all citizens is one of the biggest challenges for a sustainable development in Namibia. Considering the arid climate, the water scarcity and the high percentage of people without access to sanitation, especially in rural areas, dry sanitation systems seem to be an appropriate solution to reach the Millennium Development Goals which implicate the improvement of the access to basic sanitation.

The following report provides detailed information on a project study which was conducted to identify factors contributing to the success and/or failure of dry sanitation systems in Namibia on a long term.

During the project study several implemented dry sanitation systems around Namibia were evaluated. The evaluation was conducted by observing already implemented dry toilets (mainly Otji-Toilets), carrying out standardized interviews with users of dry sanitation systems as well as expert interviews with stakeholders related to the sanitation sector in Namibia. The accomplished survey in this context was structured regarding participation, financial, technical and maintenance aspects, cultural background as well as natural conditions.

Implemented on individual household level, dry toilets work quite well in Namibia. Besides the sensitization and the involvement of potential users of dry sanitation it is essential to empty the dry toilets on a regular basis and to allocate precise responsibilities for the entire maintenance process. For an increasing provision of dry sanitation on a larger scale in Namibia, new instruments for financing and subsidization have to be developed and a higher political support is needed.

1. Introduction

Access to improved sanitation is one of the basic needs of people. In the year 2009 only 13% of the rural and 61% of the urban population in Namibia had access to improved sanitation services (MAWF 2009a: 9). It is estimated that about 80% of people living in Namibia's rural areas and 15,7% of the urban population do not have access to sanitation at all and practice therefore open defecation (MAWF 2009b: 20).

The lack of basic sanitation services is one of the biggest problems which constrain the living conditions and health of many people in Namibia. In order to improve their quality of life and well-being, to promote the conservation of water resources and prevent pollution, and to stimulate economic development (MAWF 2008: 4) it is reasonable to implement dry sanitation systems on a large scale in Namibia.

The following report gives detailed information on a study about dry sanitation which was conducted during a project of four weeks (from the 15th of September until the 14th of October 2011) in several Namibian regions by Master students from the University of Freiburg, Germany. **The objective of the survey was to identify factors contributing to the success and/or failure of dry sanitation systems in Namibia** on a long term and was orientated at the research question if "alternative sanitation concepts are appropriate for Namibia". The survey was structured regarding participation, financial, technical and maintenance aspects, cultural background as well as natural conditions. The survey was the first supraregional evaluation on dry sanitation systems in Namibia.

The results of this study should encourage ambitions to reach the Millennium Development Goal (MDG) target seven which implicates "*to reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation"* (UNDP 2011) and should support the mission of the Sanitation Strategy "*to provide, with minimal impact on environment, acceptable, affordable and sustainable sanitation services for urban and rural households* (…)" in Namibia (MAWF 2009a: 7).

The study was conducted in cooperation with our project partners the **City of Windhoek**, the **Desert Research Foundation (DRFN)**, the **Habitat Research and Development Centre (HRDC)** and the **Clay House Project (CHP)**. We are thankful for the productive cooperation with these project partners who gave us access to the project sights and shared their time, knowledge and experience with us. Furthermore we owe special thanks to the Experts of the

Ministry of Agriculture, Water and Forestry and of the Ministry of Environment and Tourism, as well as the Town Councils of Aranos and Gobabis who supported the study with their valuable insights. We thank the Shack Dweller Federation of Namibia for their support in translations on sight. The research is based on the contributions of numerous interviewed people living in the project areas who impressed us by their frankness and always welcomed us warmly.

2. Description of the Project Area

Namibia is a country in southern Africa bordered by Angola in the North, by Botswana, Zimbabwe and Zambia in the East, by South Africa in the South and by the Atlantic Ocean in the West. Namibia has a total area of 825.418 km^2 and is the homeland of approximately 2.1 million people. The **population** density is around 2.5 per km^2. A more accurate statement of the population size will probably be gazetted in October 2012, when the results of the census 2011 are expected to be published (HOFMANN 2010). The highest population density is to be found in the North of Namibia in the districts Omusati, Oshana, Ohangwena and Oshikoto (CENTRAL BUREAU OF STATISTICS 2011).

The **climate** in Namibia is characterised by dry winters and humid summers with two rainy seasons (ALLGEMEINE ZEITUNG 2003, 2004, 2011). The small rainy season takes place between September and November, and the larger one between February and April. Precipitation rates vary highly within the country: the values fluctuate between almost zero in the coastal desert and 600 mm in the Caprivi Strip. The coastal desert, the Namib, is one of the two deserts which characterize Namibia. The second desert is the Kalahari, with its popular red sands in the East. These regions, even though distant to each other, are the driest regions in the country (UNIVERSITY OF COLOGNE 2002).

However, the precipitation rates vary not only in space, but also in time, between different years: for example, the year 2011 will witness an overrunning of the average precipitation rate. For the year 2011 the Namibian Weather Station measured a value of 1164.8 mm so far (NAMIBIA WEATHER 2011), which is already much more rain than usually expected for one year. The mean temperature for Namibia varies from more than 22°C in the northern part of Namibia to 16°C in the coastal zone (UNIVERSITY OF COLOGNE 2002). The average evaporation varies between 2400 mm in the coastal zone and more than 3600 mm in the south of Namibia (UNIVERSITY OF COLOGNE 2002).

Despite its small population and density, Namibia is home to various ethnic groups that differ in terms of culture, language and background (MALAN 1998: 7). A total of 9 large ethnic groups as well as 30 different languages or dialects, that can be classified into the three major language families Bantu, Khoisan and Indo-European, are present in Namibia (BROCK-UTNE 1997: 244). An overview of these 9 large ethnic groups is given in table 1.

Table 1: Ethnic Groups in Namibia

Ethnic Group	Percentage of Population
Owambo	49,8%
Kavango	9,3%
Damara	7,5%
Herero	7,5%
Nama	4,8%
Caprivans	3,7%
San	2,9%
Rehobother Baster	2,5%
Tswana	0,6%
Others	11,4%

Source: Malan 1998: 10

Since Namibia is such a large country with so many different landscapes, varied climatic and geomorphic conditions and socio-cultural variations, it is essential to get a deeper insight into the project area where the evaluation study (which will be presented in this report) was conducted. The evaluation took place in six cities, towns and villages, marked on the following map. A brief description will introduce examined projects in Windhoek, Aranos, Gobabis, Outjo and Otjiwarongo, as well as in the area called Odendaal Farms.

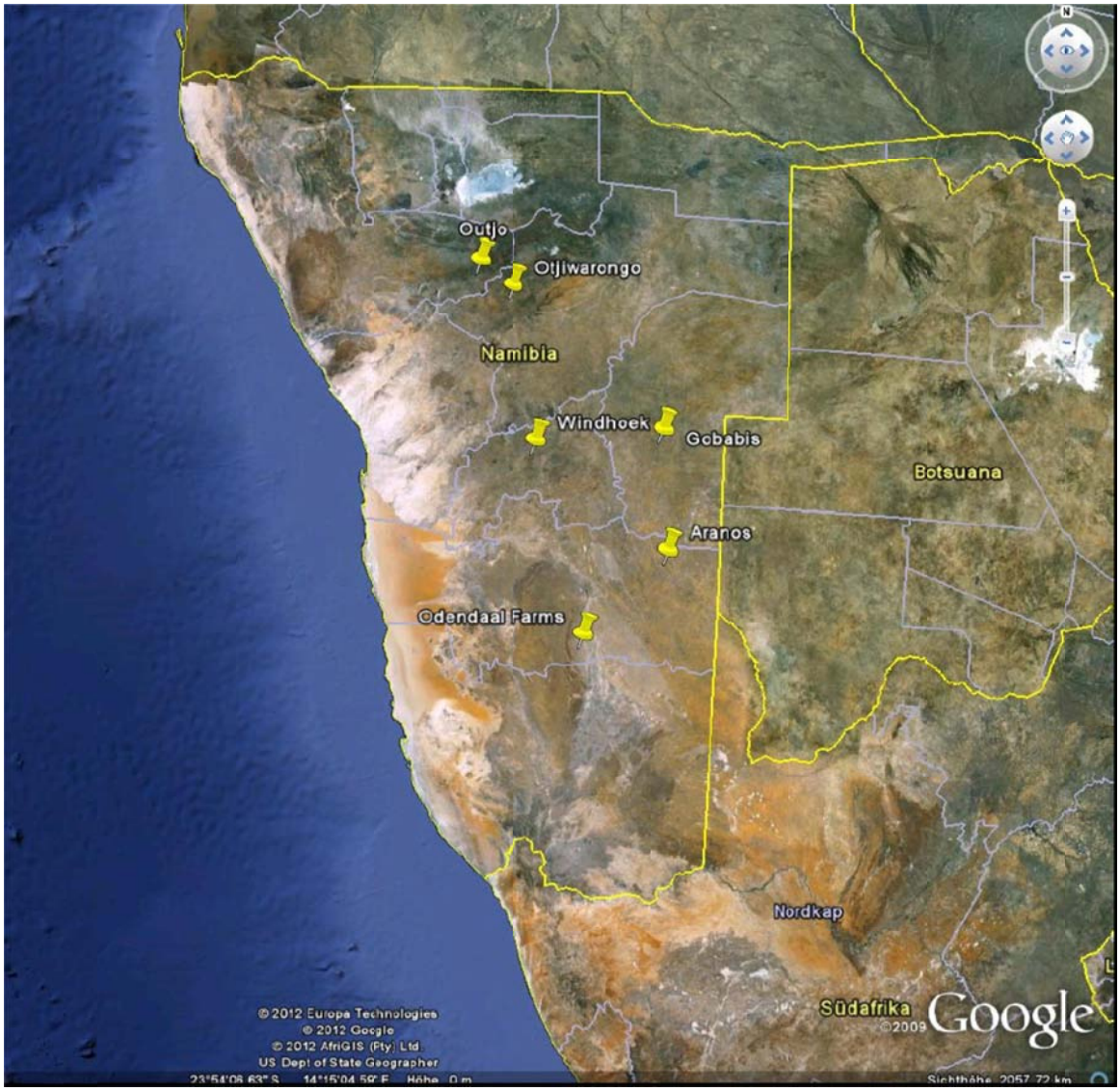

Figure 1: Project area in Namibia
Source: Google Earth 2012

Windhoek is the capital and the largest city of Namibia. It is located in central Namibia in the Khomas Highlands plateau area. The population of Windhoek amounts to around 233.500 inhabitants (NATIONAL PLANNING COMMISSION SECRETARIAT 2001). A more accurate statement of the population size will probably be gazetted in October 2012, when the results of the census of 2011 are expected to be published (HOFMANN 2010). Since Windhoek is the political centre as well as the economic centre of the country, the city is growing fast: the annual growth rate of Windhoek is 5 % **(**CITY OF WINDHOEK 2011). The informal settlements of Windhoek are expanding quickly as a result of the influx of the population into the city districts and the strong population growth. That is why the necessary infrastructure (especially sewage systems) cannot be provided. Therefore the City of Windhoek implemented **58 Otji-**

Toilets in the informal settlement **Havana Extension 6**, which were evaluated during the project study.

Aranos is a settlement in the electoral constituency of Mariental in the Hardap Region and has a population of approximately 3.000 inhabitants. Mariental itself is home to about 10.000 inhabitants. **Gobabis** is the regional capital of the Omaheke Region and has a population of approximately 13.000 inhabitants. **Outjo** is located in the Kunene Region, is the district capital of the Outjo constituency and has approximately 6.000 inhabitants. **Otjiwarongo** is the district capital of the Otjiwarongo electoral constituency and also capital of the region Otjozondjupa. Approximately 20.000 people live in Otjiwarongo (NATIONAL PLANNING COMMISSION 2003: 21).

The **Odendaal Farms** are seven farms in the Hardap Region in the South of Namibia. The name Odendaal goes back to 1962, when the Odendaal Commission was established with the goal of promoting the economic development of South West Africa. Main content was the creation of homelands for various ethnic groups and the relocation of their relatives. The Odendaal Farms are now residential areas where the Nama people live (LEGAL ASSISSTANCE CENTRE 2005: 11).

3. Dry Sanitation in Namibia

Water in Namibia is a scarce resource and in some areas it has to be taken from aquifers in depths of up to 110 m. This process needs a lot of energy (CHP 2007: 2). Also water preparation and its distribution as well as the maintenance of water pipes needs often more money than many Namibians can afford. Nevertheless there is a growing demand for water, especially as a result of the increasing population (UHLENDAHL ET AL. 2010).

The growing demand exacerbates the water scarcity, which is closely related to appropriate sanitation. The implementation and maintenance of flush toilets as well as working sewage systems are very expensive, which lead to the development of dry sanitation systems. These systems are more affordable for the population in informal settlements, are adequate for rural areas and guarantee access to improved sanitation for everyone. Furthermore these systems can help to protect the limited water resources in Namibia. "*Waterborne systems were developed in countries with a high rainfall and did not have to be concerned with water availability*" (MARITZ & WIENECKE 2006: 7). „*Western lifestyle (waterborne sanitation) does not make sense in the driest country south of the Sahara*" (WIENECKE 2006: 11). The concept of dry sanitation fits in the approach of ECOSAN (SEI 2009 & GIZ 2009), promoting the recycling of resources, reducing the consumption of water and providing natural fertilizer in a more cost efficient way (MARITZ & WIENECKE 2006: 8). In the following chapter the functionality of the Otji-Toilet, the Enviroloo and the Pit Latrine, e.g. the mainly implemented dry sanitation systems in Namibia will be explained.

3.1 Improved Dry Sanitation

"*An improved sanitation facility is defined as one that hygienically separates human excreta from human contact*" (WHO 2011). This definition includes flush toilets, toilets with septic tanks, flush/pour flush to pit latrine, ventilated improved pit latrines (VIPs), pit latrines with slab as well as certain composting toilets. 18% of the urban population in Namibia use shared toilets (often flush toilets), which are not included in the list of improved systems according to the definition by the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (MAWF 2009b: 3).

3.1.1 The Otji-Toilet

The Otji-Toilet is a dehydrating toilet and was developed in Otjiwarongo by the Clay House Project. Dehydrating therefore means that the solids dry out. The Otji-Toilet consists of a toilet pot, a superstructure, a ventilation pipe and two 90 litre bins, which are placed on drying panels in an approximately 2 m^3 big hole underneath the toilet. The bins are perforated assuring that the liquids can drain out and as well to improve the drying out of the waste (see fig. 2). It takes approximately six month to fill up one bin within an average household with five members (CHP 2011). The newest version of the Otji-Toilet is conceptualized as a urine diversion dehydration toilet (UDDT). In this case, the toilet pot has a special ring at the bottom (see fig. 3), so that approximately 80 % of the urine is divided from the solid waste and infiltrates through an extra pipe directly into the underground or is collected in a tank. The advantage of UDDT is that the bins take much longer to fill up and the dry waste can dry out more quickly. The volume can be reduced up to 95 % (DEPARTMENT OF WATER AFFAIRS & FORESTRY 2010: 15). Using an Otji-Toilet, the solids fall into the bin underneath the toilet. When the bin is filled up, it can be changed with a second bin, standing behind the first one inside the containment, by using a hook. The waste in the first bin is drying out and can be emptied later. The process of "drying out" is improved by ventilation, which should also avoid smelling. For a better air movement the ventilation pipe and the containment are painted black and should always face north in Namibia, to heat up more intensely.

The concept of the Otji-Toilet is that it is built with materials which are locally available in Namibia itself. In this context, the wall of the Otji-Toilet was firstly constructed with clay, while it is nowadays built with general bricks, cement and sand (Interview CHP 2011). As bins for the collection of the waste, big rubbish bins are used. Holes are drilled in these bins to allow fluids to flow off. Door, lid box, doorframe, roof structure and ventilation pipe are made out of metal (KLEEMANN 2011: 4) and the roof is constructed with cement tiles.

In Namibia approximately 1400 Otji-Toilets have been implemented, most of them in Otjiwarongo and Outjo. Despite these implemented toilets, which were evaluated in the context of this project study, the Namibian Water Resource Management, the German Agency for International Cooperation (GIZ) and the Omaruru Basin Management Committee (OmBmc) Omrauru additionally have implemented 21 Otji-Toilets in Omaruru.

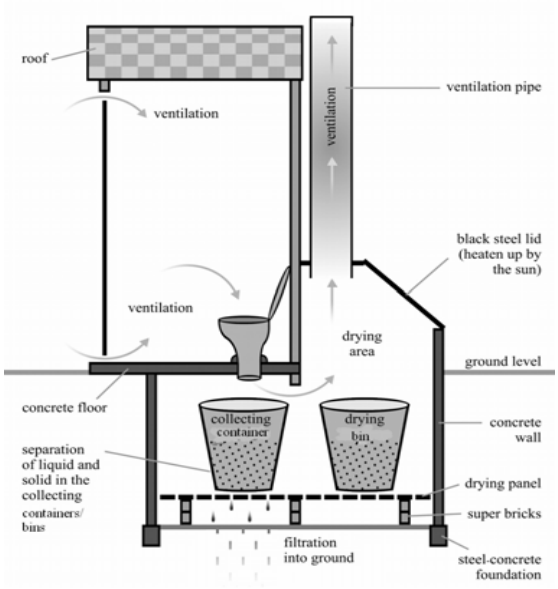

Figure 3: The Otji-Toilet
Source: CHP 2011

Figure 2: Cross Section Urine Catching Bowl
Source: CHP 2007: 4

3.1.2 The Enviroloo

The Enviroloo was one of the first industrial sanitation systems in Namibia. It was imported from South Africa. The solid and liquid waste is separated in a container below the toilet. In this container adjudges an organic medium which consists of grass or leaves on drying plates. The principle functionality of the Enviroloo is that the waste falls on the organic bed in order to dry out, while the liquids fall to the bottom of the container and evaporate. The processes of evaporation and drying out are accelerated through air movement of the ventilations system, consisting of an outlet ventilation pipe with a whirlybird on top of it (see fig. 4) (ENVIRO OPTIONS 2011). The black color of the inspection cover and the ventilation pipe increases the air temperature inside the containment and has the effect of a better air movement. This results in fewer odors and better dehydrating and decomposing of human waste. Most of Enviroloo Systems in Namibia have been

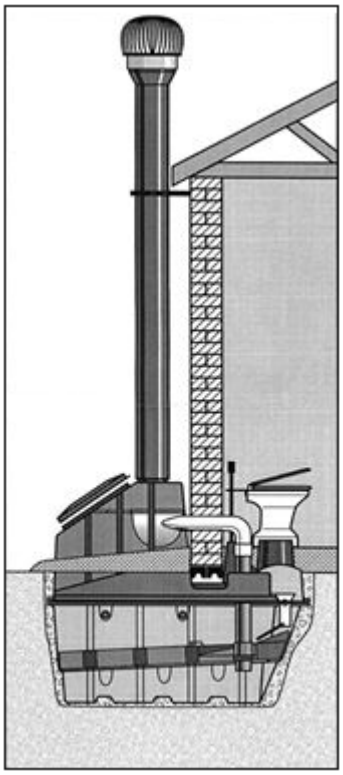

Figure 4: Section through the Enviroloo
Source: MARITZ & WIENECKE 2006: 7

implemented as part of 310 VIPs in Okahandja Park in Windhoek and can be classified as shared toilets.

3.1.3 The Cool Maintenance

The design and functionality of the Cool Maintenance Dry Toilet is very similar to the Enviroloo. It has the same superstructure, whirlybird and toilet pot like the Enviroloo. In contradiction to the Enviroloo the Cool Maintenance has a cement basin underneath the toilet where the waste is collected and can be removed (GAGNON et al. 2005: 59).

3.1.4 The Single Pit Latrine

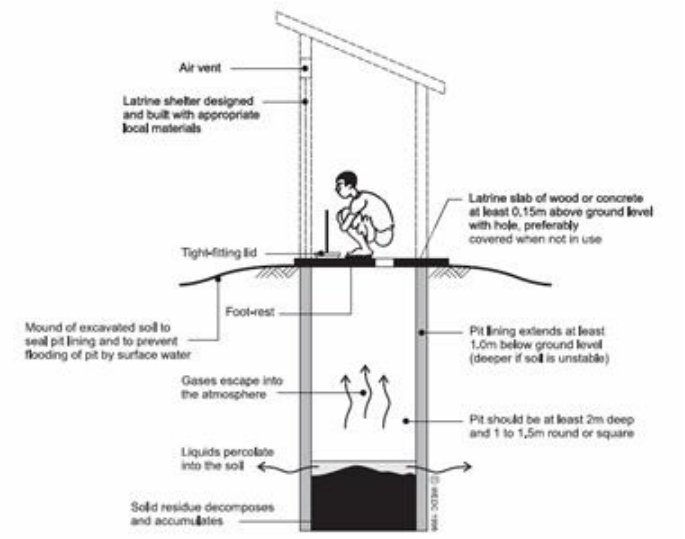

Figure 5: Pit Latrine
Source: STAUFFER & SPUHLER 2011

"*The single pit latrine is one of the most widely, cheapest and easiest used sanitation technologies*" (STAUFFER & SPUHLER 2011). The waste falls in a hole or tank in the ground. The pit latrine in general has a slab above the hole where a toilet pot can be installed as well. Like other dry toilets it consists of a superstructure with roof, door and wall around the place (see figure 5). When the pit is filled up, it is common to close the pit and relocate the superstructure. There is also the possibility of emptying the pit. Although this type of Pit Latrine is categorized as improved sanitation, odor and fly nuisance are common (can be reduced with a ventilation pipe → VIP), the groundwater and the environment can also be contaminated. Another aspect is the lack of space in high populated areas. When the pit is full, there is no room to relocate the superstructure.

A lot of Single Pit Latrines have been built all around Namibia. These systems are often the only facilities in landmarks like Sossusvlei. Ventilated improved toilets are sometimes built from the local users themselves without external support. At last 900 Single Pit Latrines, financed by Lux Development, have been constructed in Rundu (Interview Lux Development 2011).

3.2 Unimproved Dry Sanitation

Considering unimproved sanitation in Namibia, the most common “systems” are the bush & bucket system and the open pit latrine. The open pit latrine has the same functionality like the single pit latrine apart from having no bearing superstructure and often just a small hole in the ground. The open pit latrine is often built by local habitants themselves, so they can avoid open defecation and do not have to walk far distances to the bush.

4. Political Framework

To give background information and to illustrate the issues concerning the sanitation sector in Namibia, this chapter deals with the political framework in the country.
The first Water Supply and Sanitation Policy (WASP) was adopted in 1993 and replaced by an updated version in the year 2008. The principles of the policy are "*in line with Integrated Water Resources Management (IWRM) including a strong focus on Water Demand Management (WDM)"* (MAWF 2008: 1).

The Ministry of Agriculture, Water and Forestry (MAWF) therefore is responsible for the overall management and regulation of the water cycle and water resources in the country.

4.1 Key Principles

The key principles of the Water Supply and Sanitation Policy (MAWF 2008: 3) therefore are:

1. Essential water supply and sanitation services should become available to all Namibians, and should be acceptable and accessible at a cost which is affordable to the country as a whole.

2. This equitable improvement of water and sanitation services should be achieved by the combined efforts of the government and the beneficiaries, based on community involvement and participation, the acceptance of a mutual responsibility and by outsourcing services where necessary and appropriate, under the control and supervision of government.

3. Communities should have the right, with due regard for environmental needs and the resources and information available, to determine which water and sanitation solutions and service levels are acceptable to them within the boundaries of the national guidelines.

Beneficiaries should contribute towards the cost of the water and sanitation services they desire at increasing rates for standards of living exceeding the levels required for providing basic needs.

4. Environmentally sustainable development and efficient utilization of the water resources of the country and environmentally sustainable development of sanitation services should be pursued in addressing the various needs, and should be strongly supported by information campaigns and continuous educational interventions at all levels.

Related to this report, these principles are essential. It is obvious, that in a dry country like Namibia, the costs for the implementation, maintenance and water supply of and for flush toilet are simply not affordable for most of the poorer citizens. Therefore, this study explores dry sanitation systems as an alternative. In the future it might be possible to provide dry sanitation to all Namibians, who do not have proper sanitation. Therefore it is necessary (considering the third principle) to compare the advantages and disadvantages of dry sanitation and flush toilets in this country as well as reduce prejudices towards these kinds of sanitation systems, if they are adequate. During this study, the attempt was taken, to find out whether dry sanitation systems fit in with the policy principles and are accepted by the people.

4.2 Responsibilities

Concerning the responsibilities of **sanitation issues**, the problem of coordination and the lack of interest of some (political) stakeholders were identified (MAWF 2009b: 3). Six Namibian ministries are involved in sanitation issues and additionally the larger towns and municipalities work independently in this matter. This leads to isolated work and therefore inefficiency. "*The lack of coordination was identified has a major reason for the poor achievement of the sub sector. Six ministries are involved in sanitation issues, large municipalities and largest towns are rather independents and work in isolation. The lack of interest for sanitation issues and the poor attendance of some Ministries to key meetings were also observed (…). There is a general lack of knowledge on sanitation issues – hardware and software – at all levels. Smallest LAs have difficulties to properly managing sanitation systems and water treatment plant*"(MAWF 2009b: 3).

In the following the most important stakeholders and their function in the sanitation sector will be mentioned without intending to be exhaustive. The key sanitation stakeholders are pictured in figure 6. All of these stakeholders are represented in the Namibian WATSAN (water and sanitation) committee, and therefore attempt to construct a network to regain more efficient coordination.

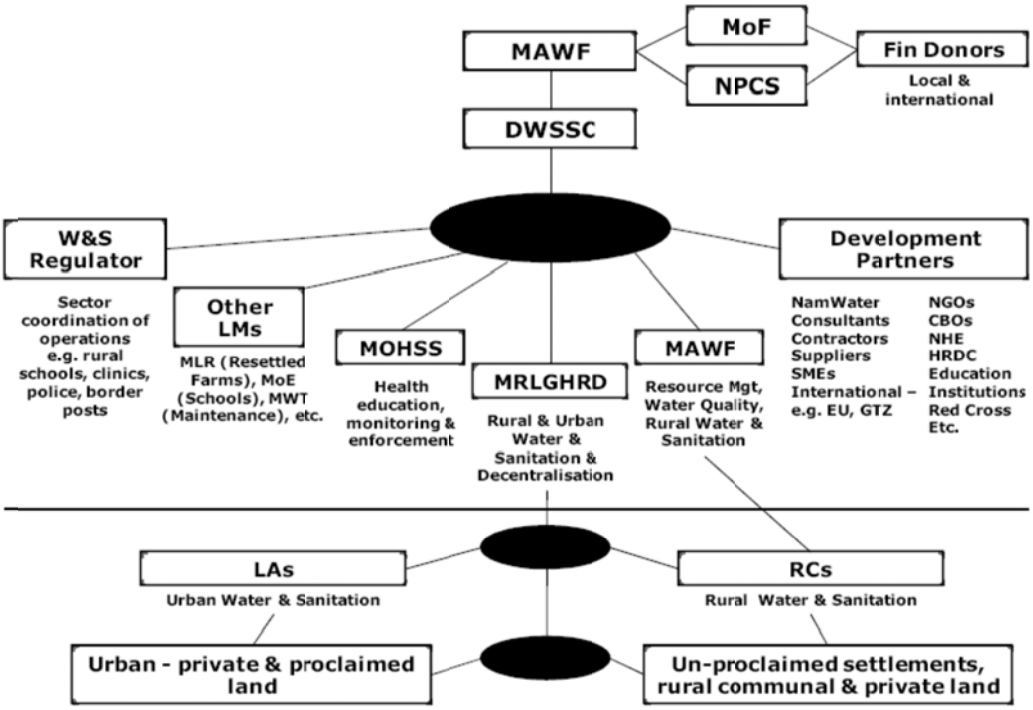

Figure 6: Key Sanitation Stakeholders of Namibia
Source: MAWF 2008: 14

Referring to the Namibian Water Supply and Sanitation Policy (MAWF 2008: 15) the supply of water and provision of sanitation services to **urban areas** is the responsibility of Local Authorities (LAs) and Regional Councils (RCs) within their areas of jurisdiction. In context of **rural areas** the Regional Councils and the Division of Rural Services are responsible. In this regard the water and sanitation sector is organized after the principle to delegate the responsibilities to the lowest appropriate level (MAWF 2008: 15). The function for rural sanitation was allocated to the Ministry of Health and Social Services (MHSS) but according to the Water Supply and Sanitation Policy (MAWF 2008: 1ff.) it has been transferred to the Ministry of Agriculture Water and Forestry.

The establishment of water supply and sanitation on **resettlement farms** therefore is directly responsible to the Ministry of Lands and Resettlement. Thereafter the farmers of the resettlements are responsible for operation, maintenance and replacement of the sanitation facilities. These three areas are coordinated by the Directorate of Water Supply and Sanitation Coordination (DWSSC) in the Ministry of Agriculture, Water and Forestry. The provision of sanitation on **private land** (communities, farmers) lies in the responsibility of the residents. The DWSSC may provide information and exercise control, inspection or monitoring functions if necessary (MAWF 2008: 15).

For the provision and budgeting of sanitation facilities in **National Parks**, the Ministry of Environment and Tourism is responsible.

For the development, implementation and enforcing of health policies to promote good sanitation practices the responsibility is allocated to the Ministry of Health and Social Services (MOHSS) (MAWF 2008: 15).

The Directorate of Housing and the Directorate of Rural Development of the Ministry of Regional and Local Government, Housing and Rural Development (MRLGHRD) also have the assignment to "*facilitate and support Regional Councils and Local Authorities in infrastructure development, including sanitation provision*" (MAWF 2009b: 35).

The Namibia Sanitation Situational Analysis Report (2009: 35) already warns about the risk of overlapping functions between MAWF and MRLGHRD. The MRLGHRD also is amongst other things responsible for the provision of flush toilets connected to sewerage throughout housing programs.

Additionally the Habitat Research Development Centre (HRDC), which is subordinated to the MRLGHRD, is responsible for conducting research and development on appropriate technology in the context of (dry) sanitation as well as it being used as a training centre (MAWF 2009b: 35).

International (e.g. EU) and National Organizations (e.g. German GIZ) also play an important role in the sanitation sector of Namibia. These organizations finance projects in the sanitation sector and in particular the GIZ has implemented Otji-Toilets in Namibia as well.

5. Methodical Design of the Study

The objectives of this study were to identify factors contributing to the success and/or failure of dry sanitation systems in Namibia, to demonstrate advantages and disadvantages of dry sanitation systems in the country and to get an understanding of the perception Namibian beneficiaries have towards dry toilets.

In this chapter the methodical design of the study will be explained, to clarify the theoretical and practical approach, which was conducted during the study.

This study was based on a methodical integration of a qualitative and a quantitative approach which was mainly realized by a survey of dry sanitation systems and the accomplishment of expert interviews. A preparation phase of several months was conducted at the University of Freiburg by the Master students. For this survey, questionnaires were designed and adjusted when required. During a time period of four weeks for the fieldwork in Namibia, three different focus groups were examined: (1) experts of the Namibian sanitation sector, (2) users of dry sanitation systems and (3) people without access to improved sanitation were interviewed. The multi-method-strategy, which will be exemplified in the following chapter, was conducted to validate the findings of the highly complex object of investigation.

5.1 Framework: The DAC Evaluation Criteria

The constitutional idea of the field study was to conduct a holistic evaluation of implemented dry sanitation systems in Namibia. The theoretical framework considered therefore the principles for Evaluation of Development Assistance, formulated by DAC, the Development Assistance Committee of the OECD (OECD 1991). The principles chosen for measuring the impact of implemented sanitation systems in Namibia referred to the following categories:

Relevance: *"Are the impacts of the facilitated dry sanitation system consistent with the intended goal to improve livelihoods of users?"*

Efficiency: *"What were the major factors influencing the achievement or non-achievement of the objectives?"*

Effectiveness *"To what extent were the objectives achieved?"*

Impact: *"What real differences has the delivery of the toilet made for users?"*

Sustainability: *"What were the major achievements and challenges to assure the sustainability of the projects?"* (OECD 1991).

All qualitative and quantitative instruments for conducting the survey were developed in accordance to the mentioned evaluation principles. The DAC criteria directed especially the result orientated analysis of the findings.

A further structuring element constitutes the framework of the study: Five central categories to be considered for assuring a long term success of dry sanitation were identified by means of a broad literature review*: participation, financial aspects, technical and maintenance aspects, cultural aspects*, as well *as natural conditions* had to be considered (BETSCHART 2011; DEPARTMENT OF WATER AFFAIRS & FORESTRY 2010; WIENECKE 2007, 2008; SUSANA 2011). The mentioned research factors appear throughout the study and provided a theoretical framework for the development of interview guidelines and questionnaires, as well as during the analysis of results.

5.2 Problem Centered Expert Interviews

As decisive methodical part of the study, expertise of stakeholders with experience, skills and knowledge about dry sanitation systems in Namibia was gathered. Eleven experts were interviewed (labeled in the following as Focus Group I), pursuing an open and qualitative approach. The intention of interviewing experts was on one hand to collect information and broaden the state of knowledge about the Namibian sanitation sector, and on the other hand to identify core areas of success and concern in the commitment to provide improved sanitary access to the Namibian population.

To become familiar with the knowledge of experts, an interview guideline was developed and used as methodical tool for all accomplished expert interviews. The methodical approach is known as “problem-centered-interview” (WITZEL 1982).
The interview guideline (in form of a semi structured questionnaire) had the purpose to provide the interviewer a framework and a thematic margin for keeping the focus on the main research questions during the conversation. At the same time, the method stresses flexibility, allowing new aspects to be brought up during the interview. Moreover additional questions were tailored to the individual background of the respective expert.

5.3 Interview Guideline and Procedure of Interviews

The methodical arrangement of the interview guideline acknowledged a broad scope for experts to bring in their own perspectives, focusing on information they considered as important. The guideline was designed in thematic sections, which will be introduced briefly in the following.

Getting to know the professional background and functions of the interviewee within the Namibian sanitation sector, was purpose of the introducing part.

Several interviewees were responsible for ongoing dry sanitation projects in Namibia, these experts were therefore interviewed about different project related phases (e.g. the participation of users in the planning and construction phase, the organization of cleaning and emptying the facilities, or the question about funding the implementation of dry toilets were aspects of interest).

The main section of the interview was introduced by open questions regarding dry sanitation systems in Namibia. Selected questions will be stated exemplarily, to get a full overview of the interview guideline, please see the annexed documents (annex 2 and 3).

- *Referring to your experience, what are prominent challenges related to dry sanitation systems?*
- *Which dry sanitation system is most adequate for Namibia?*
- *Please name advantages of dry toilets in Namibia.*
- *What are the risks of using dry sanitation systems in Namibia?*
- *Does Namibia has specific natural conditions which make dry sanitation systems favorable in this country?*
- *Which financing instruments are most appropriate for the implementation and cleanout of dry sanitation systems?*
- *Which problems occur relating the construction and maintenance of dry sanitation systems?*

Thanks to the exceptional cooperativeness of the Namibian Desert Research Foundation (DRFN), the City of Windhoek, HRDC and the Clay House Project, as well as the MAWF, MET, Lux Development, and several Regional Town Councils, eleven expert interviews were accomplished.

All interviews have been conducted face-to-face and one-on-one and took between one to two hours. The interviews were recorded and notes were taken. For reasons of confidentiality, the transliterated interviews will not be annexed. A broad result-orientated analysis of all interviews will be provided in chapter 8 of this report.
The analysis of the interviews was methodically controlled by use of the software MaxQDA, which supports a structured analysis of interview contents. The interviews were split up thematically and related to codes. The codes reflect all aspects of the theoretical framework underlying this study.
To organize the findings, a SWOT analysis of the dry sanitation system "Otji-Toilet" was accomplished. SWOT stands for the identification of Strengths, Weaknesses, Opportunities, and Threats (HILL & WESTBROOK 1997: 46).

5.4 Evaluation of Dry Toilets

The quantitative part of the study was carried out by using a fully standardized questionnaire (see annex 1: 78) which was read out to users of dry toilets in (former and current) Namibian informal settlements and rural areas (labeled as Focus Group II). The current appearance of dry toilets belonging to the interviewees was furthermore evaluated by the students, on the base of an observation sheet (see annex 4). The observation was conducted via a look at the entire facility of the dry sanitation toilets and when possible the researchers took a look inside the facilities to assess the cleanness and comfort.
The methodical design is a one-shot case study (also known as ex post facto design), which implies that users of dry sanitation systems were interviewed only once. Of interest was, to evaluate the impact (dependent variables) of the dry toilets installed (treatment) (BERNARD 2000: 119). The main goals of the quantitative survey were to conduct an evaluation of existing dry toilets, to find out whether dry sanitation is appropriate for Namibia, hence it did not make methodically sense to work with a control group design. It turned out, that this study was the first evaluation of dry toilets which was conducted in numerous Namibian regions and whose results would be freely accessible. Due to the restricted time schedule of four weeks for the fieldwork, the survey was carried out as a cross-sectional study (BERNARD 2000: 123).

5.4.1 Operationalization and Design of the Questionnaire

The theoretical framework of the study implies several keywords which play a decisive role concerning the sustainability and success of implemented dry toilets in Namibia. The research factors *participation, financial aspects, technical and maintenance aspects, cultural aspects,* as well as *natural conditions* influence the long term success of providing dry sanitation systems. To identify the impact, the concepts had to be translated into measurable attributes which is also known as operationalization (RAITHEL 2006: 37). The operationalization went through several working stages; finally indicators were identified, which intend to define the respective attributes.

The design of the questionnaire was divided into four main subject areas (SCHNELL et al. 2008: 343) and started with enquiring general information about the household size, the property rights, and if the toilet is being shared with neighbors or other people etc. The second topic was mainly related to questions about the participation and feeling of ownership users have towards the dry toilets. As third and fourth part of the questionnaire the general perception of the toilet was asked, referring for example to the design and to advantages and disadvantages of having the dry toilet. Another important subject area was the organization of the regular maintenance of the facility and cleaning out of the dried matter. The interview was brought to the end with an open question about ideas of the users to improve the toilet system.

The language of the questionnaire has been kept simple to avoid problems during translation. Due to the fact, that the students read the questions out loud and made notes themselves, the layout of the questionnaire played a minor role. The standardized questionnaire is annexed (see annex 1) to this report.

5.4.2 Pretest

The first version of the questionnaire was discussed with the cooperation partners of the study during a meeting at DRFN in Windhoek. The Namibian experts of the sanitation sector gave valuable recommendations, which were assigned to the questionnaire. To prove its functionality, the questionnaire was then tested in Havana, Windhoek and readjusted to the findings (SCHNELL et al. 2008: 347). Especially the wording and format of the questions had to be reformulated after the pretest; furthermore the questionnaire had to be shortened.

5.4.3 Procedure of survey

The choosing of samples in the informal settlements of Otjiwarongo, Outjo, Aranos and Mariental, Gobabis and Drimiopsis took place randomly not controlled. The only criterion for the constitution of samples was that the interviewees had access to a dry toilet, and that the toilet could be observed too. Usually the samples were chosen within a cluster sampling, which implies that several households with access to dry toilets were interviewed within the vicinity. Exceptionally in Havana and in the Odendaal Farms a full coverage evaluation of all implemented Otji-Toilets was accomplished.

The procedure considering the individual interviews during the sanitation study proceeded insofar, that the students introduced themselves to the specific household member as German students and asked for the permission to interview them about their sanitation facilities. In many cases the interviewees were supported by local translators. After conducting the interview, the interviewees asked whether it was possible to have a look inside the facility in order to complete the observation sheet. The method of attending observations was used in order to review the situation and do an inventory. The observation form is annexed (see annex 4). All in all 146 members of households with dry sanitation toilets were interviewed[1] and 168 dry sanitation toilets were observed.

5.4.4 Exploring Perceptions of People without Sanitation

Moreover residents of informal settlements in Windhoek and Otjiwarongo were interviewed, who do not have access to sanitation at all (Focus Group III). The so called use of a “bush and bucket system” is a common practice in informal or rural areas without sanitary infrastructure. The methodical design, to explore information on people without access to sanitation, was conducted in form of narrative interviews (REUBER & PFAFFENBACH 2005: 129). The interview focused on most important questions (e.g. “Which toilet system would you prefer and why”) to discover trends in context of the opinion of Namibian people towards dry sanitation.

[1] The sample size is classified with the letter “n” in this report. Figures in the following chapters don’t feature the total sample size of 146 interviewees. When it comes to the analysis of answers regarding a specific question of the questionnaire, “n” consist of only the interviewees who were asked this question and responded to it. The sample size differs from the total in some questions, because some questions were not asked either due to lack of time or the non-answering or negation of one question, so that the following question was not necessary any longer.

6. Analysis of Expert Interviews

This chapter gives a result orientated overview of the interviews conducted with experts of the Namibian sanitation sector. A methodically controlled analysis of the transliterated interviews was carried out taking the following steps:
As mentioned before, five central categories to be considered for assuring a long term success of dry sanitation were identified by means of a broad literature review:

> *Participation, Financial Aspects, Technical and Maintenance Aspects, Cultural Aspects and Natural Conditions*

Working with the interview statements of experts, it soon became obvious that additional categories had to be formulated, which in advance were not identified during the literature review. Crucial requirements for ensuring the success and sustainability of implemented dry sanitation systems in Namibia are also related to the *backup in the political sphere* and the covering of precautionary measures against *health* hazards.
Using the Software of MaxQDA, interview statements touching these seven categories were identified and assigned to codes. This methodological approach is known as qualitative induction (KELLE 2010: 61).
Besides this approximation, the analytical tool of SWOT was used to examining the particular inner qualities of the dry system Otji-Toilet in form of strengths and weaknesses, as well as the external situation they face observably in opportunities and threats (HILL and WESTBROOK 1997: 46). The following part will give a result orientated overview of the interviews based on the methodology of SWOT. This method was used, because it is one of the most important strategic analysis methods and enables a differentiated interpretation of the collected information. In context of Otji-Toilets, the utilization of the SWOT analysis on the one hand, reveals strengths and opportunities, which in turn can be used to promote dry sanitation. On the other hand it is possible to identify weaknesses and threats, which offers to propose the adaption of the system to the population and conditions in Namibia.

6.1 Results of the SWOT Analysis

The SWOT analysis focuses particularly on qualities and challenges related to the Otji-Toilet, as the study focused especially on this dry concept. On average the interviewees identified

more factors threatening the country wide distribution of dry systems, in comparison to naming weaknesses dry sanitation systems generate.

6.1.1 Strenghts of the Otji-Toilet Identified by Local Experts

A brief summary of strengths of the Otji-Toilet, mentioned during the expert interviews, will be provided on the following: A considerable convenience of the Otji-Toilet is based on the technical development which took place close to the circumstances of users living in Namibian informal settlements over a period of some years. The **technical design** of the Otji-Toilet is therefore adapted to user habits and emphasizes on essential functions. Contrary to water borne systems, the Otji-Toilet allows materials which cannot dissolve (like stones, sticks and garbage as for example nappies) to be thrown in, without resulting in disturbances at operational level (as long as the collection bins are emptied on a regular base).

The interviewed experts confirmed that different **cultural backgrounds**, which generally play a major role in Namibia especially in terms of ethnic groups dominating different regions of the country, are not influencing the acceptance of dry sanitation systems.

Interviewees remarked directly related to the mentioned negative perception of dry toilets, that the Otji-Toilet in particular is not the reason for the dissatisfaction of the people using them (Interview Community Leader 2011), it's rather the desire for and expectation of **owning a modern sanitation** service as it is usually existent in high income households.

The fulfillment of the desire for flush toilets is obviously not possible with the provision of dry systems, but at least partly approached having in mind the idea of dry systems as a stepping stone: experts believe that when it comes to a legal upgrading of an informal settlement, the Otji-Toilet might be connected to a water borne system without the necessity of deconstructing the former toilet. As the economical dimension seems to be a major reason for the fact, that only 13 % of the rural and 61 % of the urban population in Namibia are having access to improved sanitation, the question of the affordability of improved systems becomes eminent (MAWF 2009a: 9).

The **affordability** of Otji-Toilets for households with low income was acknowledged by the interviewed experts, as one of the mayor strength is the cost efficiency for implementing and maintaining the sanitation service. This financial advantage for users, stands out in contrast to the implementation- and maintenance costs of flush toilets.

A further strength of dry systems is linked to **environmental friendly** alternative, as water is a scarce resource in Namibia. Due to the fact that the dried waste is basically not reused as fertilizer throughout Namibia, experts did not see any ecological concerns to use cleaning agents for the toilet itself. Summing up the interviews, experts seem to be convinced of improved dry sanitation systems as the best solution to provide sanitary services, especially to low income households in Namibia. An interviewee stated that "*dry sanitation is absolutely the solution for Namibia*" (Interview Town Council 2011: 2).

6.1.2 Weaknesses of the Otji-Toilet Identified by Local Experts

The most pressing weakness of the Otji-Toilets is seen by experts in the **lack of hand washing facilities**, which should be provided directly in combination with the sanitation system to meet health care measures. A rather slight weakness on operational level of the Otji-Toilet is that the functionality of the system might be affected when **too many people use** one sanitary unit or big amounts of wastewater are discharged into the bins, resulting in an overflow.

Practical experience taught that Otji-Toilets, which are set up inside dwellings, may bother by **smells** at night time, even when the facility is supported by solar powered ventilation equipment. As consequence these inside Otji-Toilets are not being constructed anymore.

Until today, no research has been done to estimate the amount and the effect of the **infiltration of urine into the ground**; experts are therefore concerned about potential ground water contamination which might occur when urine is frequently discharged directly to the ground due to a Urine Division System (UDS) under the circumstance of water bodies at a low altitude.

6.1.3 Opportunities Identified by Experts

On contrary of these difficulties, experts mentioned a variety of opportunities which make dry sanitation systems a favorable solution.

An interviewed expert pictured the Municipalities perspective on dry sanitation systems as **financially attractive** solution for local authorities in terms of comparatively low investment costs and affordability for low income households. To give an example, the Town Councils of Aranos and Gobabis identified the Otji-Toilet as most appropriate solution for informal areas,

as "*the system works perfectly, once people know how to use it and the question of the disposal of waste is solved*" (Interview Town Council 2011).

The Management of the Clay House Project stated that approximately 80 % of the Namibian population are potential clients for dry sanitation systems. All interviewed experts agreed on dry sanitation systems as most appropriate system to provide sanitation services to informal settlements or areas, which are within the process of formalization. "*You can response quickly [to fast expanding settlements] with a dry system but not with a waterborne system. We have recognized if you want to respond and give the people at least a service, the best way is to use dry systems*" (Interview Ministry 2011).

A mayor opportunity for a broad acceptance of appropriate functioning dry sanitation services like the Otji-Toilet, was associated with a target group of users who have understood, that they will not be provided with a water borne system in the near future. Therefore governmental bodies should **communicate straightforward** to (future and current) users. Experiences from a practical perspective demonstrate that the acceptance of users for (in this case of Otji-Toilets) rise, when the **outer design is attractive**, even though when the material costs are slightly higher (Interview CHP 2011).

As the Otji-Toilet is mainly a sanitation system which is implemented in households without existing sanitary facilities, the impact exceeds the provision of a basic sanitation service in providing health and safety enhancement as well as an integral part of poverty reduction. The opportunity to support local development is deepened, when toilets are constructed with local materials and local manpower. First experiences in the towns of Aranos and Outjo were gained, where Otji-Toilets were set up by local enterprises (thanks to the fact, that in contrast to the main component parts, only the Urine-Division-Pot of the Toilet is patent-registered).

6.1.4 Threats Identified by Local Experts

Besides few weaknesses identified by the interviewees, several external influences were reported, which constrain the spread of dry sanitation systems in Namibia.

A major threatening factor is the **feeling** people have towards dry sanitation systems. A community leader of an informal settlement summarized to the point that user of dry sanitation systems will **always demand for water borne systems**. The negative discourse about dry sanitation systems will be considered later in this report (cp. Chapter 7, 8.2.4, 10), a very revealing statement might help to explain the behinds of this negative perception:

*"Everybody prefers water borne systems." (Interviewer: "Why is it?") "Because it is **associated with development**"* (Interview Ministry 2010). This perception might be strengthened by **political campaigning** where dry **toilets are claimed as temporal solution** and water borne systems are promised on the long term to gain votes. Experts stressed out the danger of negating, that many Namibian households are not able to expend the costs of water born sanitation.

The opposing behavior against dry systems saturates through different levels. Several interviewees of different professional backgrounds saw the **missing backup of the government** as most pressing thread towards a broad implementation of dry sanitation in Namibia, a development which works against the formulated goals of the National Sanitation Strategy.

Another problem was stressed by experts, which is connected to a **missing feeling of ownership of communities** provided with dry systems. This situation becomes apparent, when users don't feel responsible for cleaning and repairing broken parts of the toilet, or stop using the facility when the collection bins are full without reporting it etc.

6.1.5 Essential Factors for Success Stated by Experts

Experts were asked to state exclusively essential factors for the long term success of improved sanitation services in Namibia. All experts assured that "*the solution [for providing a major part of the Namibian population with sanitation service] has to go with the **affordability of the people***" (Interview Lux Development 2011). "*The technical solution is already existent with the Otji-Toilet"* (Interview CHP 2011*) "but infrastructure never makes the solution on its own, people make the solution"* (Interview Lux Development 2011). On one hand **beneficiaries of the dry systems need to be satisfied** with the respective situation, an important precondition is that users of dry toilets, as well as people without access to sanitation, are aware of the fact, that the likeliness to receive flush toilets is mostly small. The **support of the governmental bodies is crucial** on the other hand. The latter implies that lessons learned about different sanitation concepts and approaches for the implementation at local level must be handed on to the government to be considered in decisions to subsidize the allocation of sanitation. Essential for the long term success of dry systems is moreover a **regularly and well-organized maintenance** of the facilities, which include the management of removing the waste containers on a regular basis.

7. Results of Interviewing People without Sanitation

Several residents of the informal settlement Freedomland in Windhoek were interviewed who do not have access to sanitation facilities at all. All interviewed people stressed the vital importance for getting **access to a sewage system**. Surprisingly some people made clear, that they wouldn't accept dry sanitation systems, even if this implies not getting access to sanitation at all. Others pointed out, that they **would only pay for flush toilets** and not for Otji-Toilets. The main reason explaining these statements was that the waste has to be removed from dry systems, and that everyone prefers to flush the waste away. An interviewee stated that it is also a question about maintaining dignity and that **being provided with a sewage system is a basic human need**. Interesting was that interviewees stating an opinion clearly against dry systems have never seen a dry toilet. Other respondents pointed out, that an Otji-Toilet would be **better than to have nothing**. One interviewee without access to sanitation in Otjiwarongo stressed, that he prefers an Otji-Toilet, as he knows from his neighbors that they do not smell like pit latrines. In summary the impression was generated, that a mayor part of interviewed people without access to sanitation had a negative attitude against dry sanitation systems.

8. Project- specific Analyses

The following chapter describes the results of the evaluation which was conducted in different Namibian regions. Before it comes to an overall analysis of the survey in chapter 9, a summary of the investigated dry sanitation concepts is made, focusing particularly on the respective situation of the different sights visited.

The project study began with a full coverage evaluation of the Otji-Toilets in Havana Extension 6 (see 8.1 and 8.2). In addition some Enviroloo in Okahandja Park in Windhoek were observed and some users of the Enviroloo were interviewed. The study was continued by surveying recently implemented Otji-Toilets in the Hardap Region in the margin of the ECAP Project of the Namibian Desert Research Foundation (see 8.3).

Afterwards the study was carried on in Mariental, Gibeon and Aranos. Unfortunately all contact persons of the sanitation sector in Mariental were not available at the time of the survey, however three different systems of dry sanitation were observed, which will not be explained further in this report due to a lack of representativeness. The implemented vacuum sewer system in Gibeon was visited afterwards, which obviously alarms concerns due to massive problems on the operational level. As this vacuum system does not belong to the dry sanitation systems, which are matter of this study, the topic will not be discussed further. Part 8.4 of this report summarizes the findings of the evaluation of Otji-Toilets in Aranos. The practical part of the project study was continued with a broad evaluation of Otji-Toilets in Otjiwarongo and Outjo (see 8.5 and 8.6) and finalized with a survey in Gobabis and Drimiopsis (see 8.7; 8.8).

8.1 Dry Sanitation in Windhoek: Okahandja Park

The first improved dry sanitation systems in Windhoek were implemented as Enviroloo and Cool Maintenance Units in 2003 in the informal settlement Okahandja Park in the north of Windhoek. The aim of the Okahandja Park A, B and C upgrading project was to improve the formalization of Okahandja Park, to grade up the road structure, to build communal water points and to deliver Ventilated Improved Pit Latrines for individual households or one for four households in one block (CITY OF WINDHOEK 2011: 5).

In total 310 Ventilated Improved Pit Latrines for 910 households were installed. The experience with these toilets was that the residents did not receive it well. As a result of the cultural background, the people did not want to maintain the facilities and dispose the dried

solids. Also the fear of contagious diseases detained many residents in even using the toilets. The whole process of management, operation and using and as well the possible risks of handling human waste had not been entirely discussed with all members of the community. The outbreak of Polio in 2006 threatened the residents even more and contributed to the aversions against the implemented dry sanitation systems (CITY OF WINDHOEK 2011: 7).
Currently only a few of the implemented Enviroloo Dry Toilets are still operating. Some of those more or less functioning toilets are used by 80 up to 100 people. This results in big problems in cleaning and maintaining these facilities. One important reason for the failure of the dry toilet systems in Okahandja Park seems to be that they were implemented as shared toilets, what causes problems in cleaning, quickly filling up the containment and huge challenges in maintaining the facilities. In this consequence the City of Windhoek started a new sanitation project with the implementation of 58 individual Otji-Toilets in Havana Extension 6 in 2010.

8.2 Dry Sanitation in Windhoek: Havana Extension 6

To put the Development and Upgrading Strategy of the City of Windhoek into effect and therefore to provide sanitation systems which are „*in line with reasonable health standards, affordability levels, social acceptance and environmental conditions*" (Development and Upgrading Strategy: 5) the City of Windhoek has started a pilot study with dry sanitation systems in Havana Extension 6 in the north-east of Windhoek. After consultation with the Oshitenda Community living in Havana Extension 6 the City of Windhoek decided together with the Water and Sanitation Committee (WATSAN) to start the upgrading project which implied the implementation of 49 Otji-Toilets (UDS) on each site. Despite the implementation of dry toilets the upgrading project includes the possibility of tenureship, block erven, gravel and graded roads and finally communal water points per residential block erf (Otji-Toilet Social Compact 2008: 3). The City of Windhoek was supported by HRDC in the upgrading process in sanitation. The Otji-Toilets were completely available for use in December 2010. In this context the pilot study is going on until December 2011. Depending on the results the City of Windhoek will decide if and how to expand the implementation of dry sanitation systems across the informal settlements of Windhoek (Interview CoW 2011).

Differing from the 49 planned Otji-Toilets on each site, 58 individual Otji-Toilets were constructed. The material used for the superstructure was, like for all new Otji-Toilets, cement.

Out of these 58 existing Otji-Toilets, 44 facilities were observed and 43 beneficiaries were interviewed during the sanitation study. Picture 1 illustrates the project sight and gives an overview on the location of Otji-Toilets in Havana Extension 6.

At time of the survey 41 Otji-Toilets were actually in use. Interviewees stated that four Toilets were just temporarily not in use: two beneficiaries stopped to use the toilet because of filled up collection bins and two beneficiaries left their home on a temporary basis.

The number of toilets, which were generally not in use was smaller than expected by the researchers: 13 Otji-Toilets were generally not used (four facilities were abandoned and four Otji-Toilets were still not allocated to a house and therefore locked by the authorities. And the reasons for the disuse of the remaining toilets is not known by the authors).

Picture 1: Otji-Toilets in Havana ext. 6
Legend: Green dots: evaluated Otji-Toilets (three of those are not in use); red dots: evaluation not accomplished (reasons differ and are described above); blue dots: water points; the GPS data for one toilet was not collected

8.2.1 Financing

The costs for one Otji-Toilet was approximately 6000 $N, which was financed exclusively by the City of Windhoek. Therefore members of the community did not have to pay anything, but five community members were participating in the construction phase mainly by digging holes for the containment of the Otji-Toilet. These members were trained in construction under supervision of a builder from Clay House Project.
On the long run the users shall pay a monthly installation and user charge (Otji-Toilet Social Compact 2008: 4) for financing the cleanout and maintenance.

8.2.2 Maintenance and Technical Aspects

For the collection and removal of the solid waste, a ward contractor of the City of Windhoek is responsible. This procedure should be executed every six months.
Furthermore, the Oshitenda Community is responsible for cleaning the implemented toilets, keeping the toilets working and repairing the facilities, if necessary (Otji-Toilet Social Compact 2008: 5). In practice the community members should report to the contractor if something is broken. The contractor also has to rotate the bins, because currently it is not possible for the households to rotate and empty the bins on their own. Nevertheless it is an opportunity to train one of the community members in this process when the project is working (Interview CoW 2011), so that jobs are created and it is becoming cost-effective.
The cleaning of the Otji-Toilets in Havana works quiet well. Out of the 44 observed facilities from 37 facilities data were collected regarding the cleanness of the toilets. 29 of these 37 toilets in Havana were clean, while five toilets were more or less clean and only three toilets looked dirty in the students perception. It is obvious that in most cases women are responsible for cleaning the toilets. 47 % of the 43 users questioned in Havana said, that cleaning is in the responsibility of women, while 42 % users answered that all members of the household clean the toilet and in only 11 % of the cases men were responsible for cleaning. Nevertheless there is no correlation between cleanness of the toilet and size of the household. It could be asserted, that the toilets are cleaned on a regular basis which guarantees good hygiene conditions, even if more than five people use one facility. The aspect of the cleaning process to be functional is even more mentionable under consideration that 20 toilets out of the 41 toilets in use were shared with neighbors, customers and in one case with children on their way to school. Nonetheless five persons mentioned a problem of sharing the toilet is that the

people do not clean it. In this context 76 % of the 41 asked people in Havana cited that they were trained in cleaning the toilet and they did it every five days (in average). Two users did not answer this question. So it can be concluded that the cleaning of the toilets is well organized by the users themselves, although the men could be more involved in the cleaning process.

Furthermore it is noticeable that all toilets were locked with the exception of one toilet. This avoids that unauthorized people use the toilet, make it dirty, destroy something inside or fill the bins up more quickly.

Regarding to the changing and emptying of the bins only 18 of 30 interviewees knew who is responsible for changing and only 15 from 26 people knew who is responsible for emptying the bins. From the remaining 13 interviewees regarding the responsibility for changing and from the remaining 17 interviewees regarding the responsibility for emptying the bins the data were not collected (the reason that data were not collected are in this report that the question was not asked, the aspect was not observed or that the interviewee did not answer).

Although this aspect was clearly defined in the social contract between the City of Windhoek and the Oshitenda Community there seems to be a lack of knowledge regarding the maintenance process. This can contribute to a failure of dry sanitation systems, because the users do not know who to contact when a bin is full. This aspect is especially important, because only 5 out of 28 users said that they are able to change the bins on their own. From the remaining 15 users not data were collected. On the other side, these answers show the opportunity to create jobs when a clear responsibility for changing and emptying the bins is given to a company which conducts the maintenance service on a regular basis and on time.

At the time of the evaluation out of the 41 toilets in use from 23 toilets one of the two bins was already full while by 18 toilets no bin was filled up so far. But in relation with the lack of knowledge it is evident that in the case of 16 toilets with one bin filled up, the full bin was not changed until the survey. This fact can be accounted for the aspect that the user did not know who to contact. "*They are asking the neighbors*" (Interview Community Leader 2011). In consequence, it is necessary that the users know the contractor and his contact number and are motivated to call, when required. On the other hand, the contractor could be urged to check on the toilets on a monthly basis. This is notably essential, because two people said they did not use the toilet at the time because it is full, five from 36 people cited that one disadvantage is that no one changes or empties the bins, respectively it takes too long and even 16 people mentioned the smelling of the toiled is a disadvantage which is worsened when the toilets are

not changed and emptied on time. "*The toilet itself is no problem, only the bin changing by CoW*" (User in Havana 2011). From the remaining seven interviewees the data were not collected regarding the disadvantages of the Otji-Toilet.

Nevertheless the students never recognized odor during the survey in Havana, but this can be explained by the time of the visit at daytime. For a good working air movement with little smell the ventilation has to be advanced by the sun (see chapter 3.1.1). In contrast to the personal observation of the students 24 of 37 interviewees answered that their toilets smells or smells sometimes, while from six interviewees no data are available regarding this question. In this context, there is potential to educate the users in using ash to improve dehydration and avoid smelling, because at the time of the interviews only five persons used ash inside their toilets to prevent smell.

Furthermore it is mentionable that only eight out of the 44 facilities checked by the students had been damaged. Mainly the pipe was broken and in one case the toilet was totally broken. But only one broken roof and pipe were repaired by the households and one time the pipe was fixed by an external. So it is obvious that there is still training and/or sensitization in repairing needed, so that the people can do it themselves. Otherwise a clear responsibility for repairing to an external contractor has to be arranged, financed and communicated to the users.

Table 2 gives an overview about the relevant information for the maintenance and management of the 58 implemented Otji-Toilets in Havana.

Table 2: Maintenance aspects of the Otji-Toilet in Havana

Usage of the toilet		Cleaness		Toilet shared		toilet broken		knowing responsibility for changing the bins		satisfaction without having the Ojit-Toilet	
Yes	41	clean	29	yes	20	door	1	yes	18	yes	8
temporary not in use	4	more or less clean	5	no	23	roof	1	no	10	no	24
not in use	2	dirty	3	no data	15	pipe	3	no data	30	better now	9
abandoned	4	no data	21			Gluematerial around pipe	1			no data	17
no house	7					UDS Pipe	1				
						toilet totally broken	1				
						in total	8				

Source: compiled by authors

8.2.3 Participation

The users of the Otji-Toilets were in general participating in the whole process of the implementation of the toilets. Most of the residents explained that the City of Windhoek talked to them before starting the implementation of the Otji-Toilets and public meetings were held to integrate the community. Some members of the community were responsible for digging the holes for the facilities and were even paid for that work (150 N$ per hole from the COW (Interview Community leader 2011)). Before the construction process started, five members of the Oshitenda Community had been invited to visit Otjiwarongo to get an impression on how the system of the Otji-Toilet works. Furthermore a DVD from Clayhouse Project about the Otji-Toilet was presented to the whole community in a public meeting. The City of Windhoek is still staying in contact with the community during the pilot phase, which will end in December 2011. Detailed information regarding the consideration of the wishes of the users and the integration in the planning phase were not delivered by the evaluation.

8.2.4 Cultural Aspects and Education

The cultural background plays an important role for the acceptance and usage of dry sanitation systems. In Havana no differences in using the Otji-Toilets between different ethnos or origins seemed to be important.

One problem of off-site sanitation and as well in context of the bush and bucket system is the lack of security at night. Nine from 32 interviewed persons answering this question said that he or she is afraid using the toilet at night with no distinct difference in dependency on gender. 12 from 17 people used their cellphone light while four people took torches or candles to cope with the darkness in the facility at night. 26 of the interviewed persons did not comment on their coping with darkness. Nevertheless it might be even more dangerous to go to the bush at night. One interviewee even mentioned the advantage of using the toilet at night.

Although there is only little space for light to get inside the facility, only seven people asked were not satisfied with the brightness, while 35 out of the 43 interviewees regard it as bright enough inside the toilet during the day.

Table 3: Know how system works and preferred toilet system

		preferred_toilet		Total
		flush	Otji	
Know_system_works	Yes	28	2	30
	No	8	1	9
Total		36	3	39

Source: compiled by authors

36 from 39 people answering the question which of a few different sanitation systems they would choose preferred a flush toilet. When the residents were asked on how to improve Otji-Toilets, almost half of the 30 interviewees who made comments to this aspect said “flush”. For 13 users no data was collected. This reaction seems not to change in dependency on the knowledge of the Otji-Toilet-system. The main reasons for the 36 persons who prefer a flush toilet system is that a flush toilet is easier to clean, the waste “goes away” and no bins have to be emptied or changed (see figure 7).

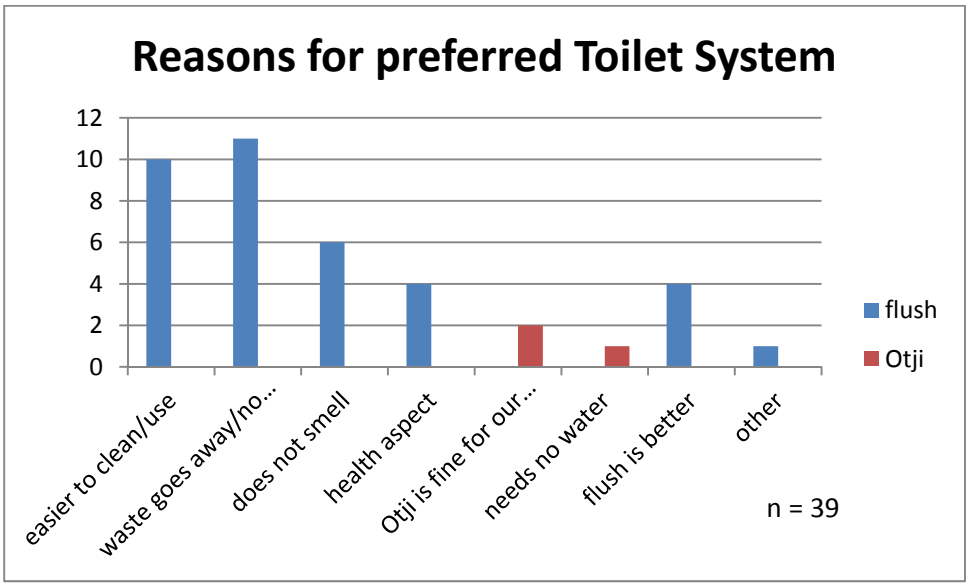

Figure 7: Preferred toilet system and reason [1]
Source: compiled by authors

Other reasons were the absence of smelling and four people associated flush toilets with healthier sanitation. In this consequence only three individuals like the Otji-Toilet more than a flush toilet, because it is more appropriate for the local conditions and needs no water.

In contrast most people said that the advantage of the Otji-Toilet is to have at least a toilet nearby. It is obvious that community members in Havana are not convinced of the Otji-Toilet being the best toilet for the local conditions, but they favor it compared to open defecation. In this context only eight persons were satisfied without the Otji-Toilet and did not consider the dry toilet as an improvement for their sanitation services. All of these interviewees also preferred a flush toilet and only one worked on his toilet by adding a toilet seat. A total of nine users out of 31 interviewees worked on their toilet to make it more comfortable or to have a protection against wind and rain (see figure 8). From the remaining 17 interviewees the data were not collected.

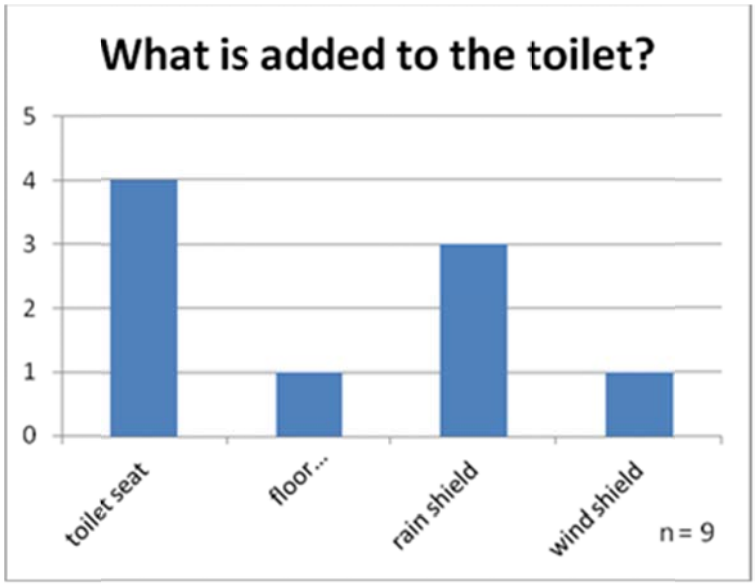

Figure 8: Improvements of the Ojit-Toilet [1]

Source: compiled by authors

Picture 2: improved toilet in Windhoek

Source: Picture taken by authors

So it is obvious that the people in Havana need to consider the Otji-Toilet as an improvement of their sanitation situation to feel responsible for their facility and to work on it to make it more comfortable and better functioning. Moreover it is essential to demonstrate the potential toilet users the advantages of the Otji-Toilet and to discuss their fears regarding dry sanitation. It is possible to change the behavior and perception of the user regarding dry sanitation systems and to make it more acceptable for them. This aspect is proved by a statement of one user, who watched the film about the Otji-Toilet, recognized that the facility is “nice” and prefers in this consequence no longer a flush toilet.

In regard to training, most interviewees in Havana cited that they were trained in using and cleaning but not trained in repairing the facility. Despite this fact, it is not clear how they were trained. With exception of three persons everyone considered the trainings as helpful.
Nevertheless a lot of people were using “Handy Andy” soap and in parts other chemicals for cleaning their toilet. This might be a problem in future, if people take account to use the dehydrated solid waste as fertilizer for their garden.
Regarding the height and space inside the superstructure of the Otji-Toilet most users marked it as sufficient and only one interviewee stated that he uses the toilet for other purposes (e.g. bathroom).

8.2.5 Natural Conditions

In general the Otji-Toilet is adequate for the natural conditions in Havana, especially in comparison with other sanitation systems. Although the ground is rocky, which makes it more difficult to dig the holes for the containment, the climate with little precipitation and much sunshine is a very good precondition for the functioning of the Otji-Toilets. Sometimes dust gets into the toilet through the gap at the back and underneath the door which might make it uncomfortable to use the toilet, but should not affect the functionality. With heavy rainfall water can get into the toilet, but this seems not to be a problem, because only eight persons mentioned this at all. The groundwater level in Havana is very deep and moreover the drinking water in Havana is delivered from water taps, which are piped (Interview CoW 2011). This means that a possible contamination of groundwater resources in Havana through infiltrating Urine from the Otji-Toilets seems not to be a probable danger for the population. Even though this might happen, the drinking water for the people living in Havana will not be affected.
Although the Otji-Toilet might also be connected to a waterborne system, this solution is utopian for Havana. Because of the hilly landscape, a sewage dam or pump station would be needed. Despite water is a scarce resource in Namibia, building such a construction would lead to rising (waste-) water costs and in consequence the prices of the connected properties would ascend. The people could not afford this kind of system and would have to move away (Interview CoW 2011).

8.3 Dry Sanitation in the Hardap Region: E-CAP Project (DRFN)

The Desert Research Foundation of Namibia (DRFN) is a non-governmental organization which was formed in 1990 in order to enhance decision-making and sustainable management in context of the Namibian environment. Throughout the conduction of many projects in the three sectors of water, energy and land management, the DRFN strives "*to ensure informed decision-making based on applied research knowledge and understanding of the environment for sustainable livelihoods and development*" (DRFN 2011).

The sanitation study at hand dealt with the DRNF – E-CAP project implemented at the Odendaal farms in Southern Namibia. These farms are situated in the Hardap Region and were formed around water points, built by the government, during apartheid. The lack of improved sanitation and livestock activity has contaminated the local ground water, which lead to the involvement of the Water-Desk at the DRFN and the implementation of the E-CAP project (*Sustainable use of Namibia's natural resources: contributing towards enhancing the capacity of future decision makers*). Therefore members of the DRFN conducted a baseline assessment on-site to improve water quality and sanitation in rural Namibian communities as well as support the development of community-integrated implementation (BOUTIN et al. 2011: ii).

This study focused on the area of Sanitation-improvement conducted in this context. Starting in April 2011, 17 Otji-Toilets were built by community-members with help of DRFN on different farms (Nico- Nord, DoringDraai, Nico, LaurenicaPos, Laurencia, Gründorn S, Gründorn N, Diamont Kop). During the project study, 16 out of 17 toilet-owners have been interviewed; one was not available at the time.

Due to the fact of the Otji-Toilets being rather new, the comparability to the other visited sites might be limited.

Picture 3 & 4: Otji-Toilets on Odendaal Farms
Source: Pictures taken by authors

8.3.1 Financing

The E-CAP project was implemented by the Desert Research Foundation of Namibia with funding from the Finnish Embassy. All the facilities were financed by the DRFN. The farm residents had to contribute one bag of cement and their labor skills.

8.3.2 Maintenance and Technical Aspects

All of the facilities the students were allowed to have a look inside (15 out of 17, in one of the 16 observed toilets the students were not allowed to look inside) were clean and seemed to be intact. In two cases out of these 15, the roof had been damaged, one of them was already repaired by members of the household and the other one was damaged only the night before the interview by strong winds. In one case the UDS pipe was broken and not yet repaired. All other toilets had nothing broken or damaged so far, which can also be lead back on the newness of the facilities.

None of the interviewed residents complained about the height of the Otji-Toilet or the space inside.

Referring to the changing of the bins, all interviewed residents stated that they know how it is to be done. In this rural area, the users themselves are responsible for changing and emptying the bins when they are full. Considering the short period of the Otji-Toilets in use, none of the bins had been full at the time of the survey. Some of the residents are thinking of using the waste as fertilizer but this decision will be made when the bins are full the first time.

Considering the smell, 14 out of 16 toilet owners answered that there is no smell, in one case the toilet smells sometimes and one of the residents answered that the Otji-Toilet always smells.

In contradiction to other visited sites, five out of 16 people asked, cited that they worked on the toilet to make it better in some way. Therefore two toilet seats were added, some people took rain and wind precautions and in one remarkable case the owner started constructing a handwashing facility annexed to the Otji-Toilet himself.

8.3.3 Participation

Before the facilities were implemented, meetings with the members of the Odendaal Farms were held in order to ensure, that Dry Sanitation and therefore Otji- Toilets are wanted by the residents and there is an understanding that this option is the best solution for the rural and dry area of the Hardap Region. The implementation itself was done by members of the DRFN, who joined the farm residents for a few weeks during construction time. The holes for the Otji-Toilets had to be digged by members of the farms.
Some residents with good construction and technical skills helped as well with the construction of their neighbours facilities.

8.3.4 Cultural Aspects

First of all there is to say, that all toilets on the Odendaal farms are in use and every household member, except for children who are too small, use the facilities. Only two out of all the 17 toilets on the Odendaalfarms were locked. These toilets assigned to residents with young children, whereas it would be dangerous for the children to e.g. fall in or play inside the facility. Therefore the interviewees locked their toilets to prevent the kids to go in.

Two of the facilities are shared with neighbours, the other 14 the students inspected are only to be used by family members or guests. In one of these cases problems regarding the cleanness of the toilet occurred.

Two of the interviewees stated their fear of scorpions or snakes inside the toilet. These declarations have been taken by many interviewed Otji-Toilet users throughout the project study and can maybe be explained by the fact, that the door does not close to the ground in order to allow fresh air to come in.

Very striking, especially in contrast to the other project sites, was the perception of the farm members towards dry sanitation. Only one out of 16 interviewed residents indicated that he/she would prefer a flush system (see figure 9). All of the others preferred Otji-Toilets. As reasons the farmers cited that the Otji-Toilet does not need water (mentioned eight times), the Otji-Toilet is fine in this area/environment (mentioned four times) and the health aspect (mentioned 1 time). As advantages the most frequently answers were the closeness of the toilets to the households as well as having facilities is better than using the bush.
The members on one of the farms own a small commercial camping site, which is visited by school classes or travelers who show interest in the area. Very remarkable in that case was, that flush toilets with septic tanks already are constructed for users of this small camping site. Nevertheless, the farmers also were included in the E-CAP project and are in favor of the Otji-Toilet. Their reasons as well are in context of the environment and the adaption of dry sanitation to the Hardap Region.

In summary, the residents in the rural Hardap Region had an entirely different approach towards dry sanitation than people questioned in urban regions.

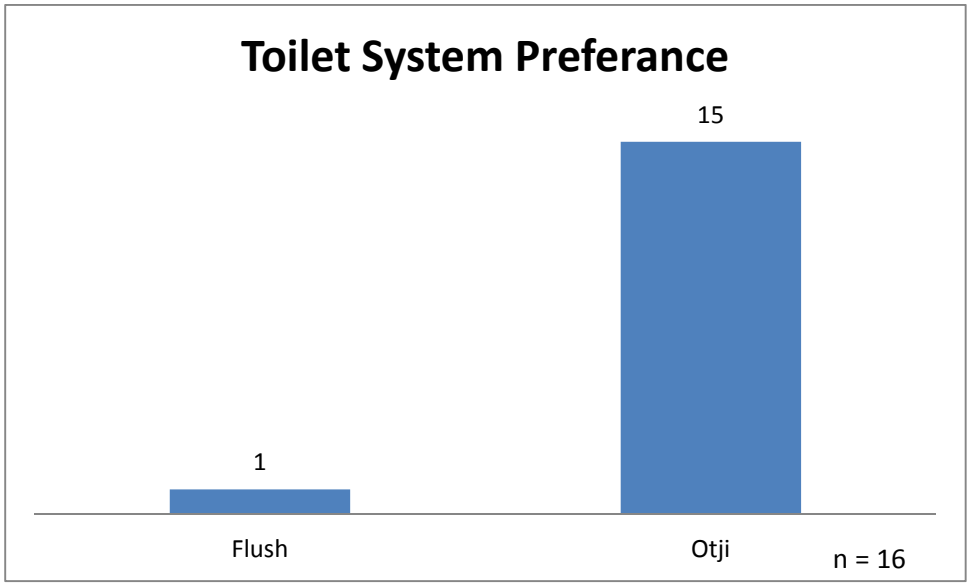

Figure 9: Preferred Toilet[1]
Source: Compiled by the authors

8.3.5 Natural Conditions

For natural conditions the strong winds which occur in this area, have to be mentioned. The roofs of two toilets already had been damaged by wind, blowing strongly the night before the interviews were taken. Also one of the interviewees closed the open space in the back wall of the Otji-Toilet with cardboard paper to prevent wind and dirt to come in.

8.4 Dry Sanitation in Aranos

The implementation of Otji-Toilets in Aranos began with the construction of two demonstration units in cooperation with the Clay House Project in 2006. Ten to fifteen community members were trained to construct the facilities. Aranos states an example, where the Council managed the continuation and extension of the project on its own and involved the trained community members in the installation of further Otji-Toilets. Currently 60 units are installed in Aranos, most of them located in the informal settlements. As particular measures to strengthen the participation of beneficiaries were not conducted, this aspect will not be concerned further in an own chapter.

During the project study 12 users were interviewed by means of the standardized questionnaire. Seven additional facilities were observed (in total: 19 facilities observed) by the utilization of the observation sheet without interviewing the beneficiaries (as four of these

seven beneficiaries were not at home when the survey took place, two interviewees were too drunken to include the answers to the evaluation and in one case a translator for the local language was missing). In Aranos the remarkable opportunity was given to interview nine beneficiaries of Otji-Toilets in the urban informal settlement as well as three beneficiaries in farms located in the rather rural area of Aranos.

8.4.1 Financing

The implementation costs were financed by the Council of Aranos, and co-financed by several programs. The Town Council pointed out during an expert interview, that when it comes to the first provision of improved sanitary infrastructure to a community, the implementation should be free of charge for beneficiaries: "(…) *otherwise people will go to the bush again*" (Interview Town Council 2011). In Aranos a service fee is taken for the removal of the solid waste. The fee is included to the costs of water, which is charged thorough a pre-paid metre system.

8.4.2 Maintenance and Technical Aspects

The removal of the solid waste is organized by the Town Council through a local contractor and takes place every three months in the urban areas. At time of the survey, no waste container was reported as full by the interviewees. One interviewee emptied the waste container by himself just before the observation took place and discharged the solids next to his house (which could be seen as problem in terms of health care measures or as indication, that beneficiaries assume responsibility for maintenance). The attempt of the Council to support beneficiaries to reuse the dried solids as fertilizer was not successful; the strategy was not exerted anymore. The users are generally responsible for hygienic conditions of the facilities.

Beneficiaries of Otji-Toilets in the rural areas of Aranos stated that the collection bins still haven't been removed since the implementation about five years ago, as they just never have been filled up completely. Relevant circumstances in rural households differ to the ones in urban informal settlements at first place in the number of persons using the toilets. As the interviewed rural households don't have neighbors in the vicinity, nobody asks them for sharing the facility. As consequence the idea of the Otji-Toilet works out very well. Moreover

the beneficiaries in the rural area feel that they are responsible on their own for the maintenance of the toilet, the feeling of ownership seems to be better incorporated. All of the observed Otji-Toilets in Aranos were in use at time of the survey. Noticeable in comparison to other examined locations was that the majority of the facilities in the urban informal settlement were shared by several neighbors of the vicinity, whereas about half of the observed facilities were not locked. Five of seven observed toilets in the urban area were classified by the interviewers not as clean as most of the toilets observed during the project study. This general impression was approved by the beneficiaries who complained about the smell of the toilets. The wish for flush toilets was express by the majority of the interviewees, only one respondent stated the preference for the Otji-Toilet as the running expenses are very low and there are no costs to cover for water consumption. As the Otji-Toilets in Aranos were implemented several years ago, the outer appearance of the facilities was surprisingly well, slight damages after heavy winds affected some roofs and ventilation pipes.

Picture 5: Cleanout in Aranos
Source: Picture taken by authors

8.4.3 Cultural Aspects and Education

Most of the beneficiaries in Aranos stated, that they didn't receive trainings for the maintenance and usage of the facility, nevertheless the system seems to be used adequately. The Town Council of Aranos stated in an in interview, that the Otji-Toilet is seen as the best solution for providing access to sanitation in informal areas and especially to households in rural areas.

8.4.4 Natural Conditions

The construction of Otji-Toilets was hindered in some cases because of a very rocky and hard soil, so that a jackhammer was used. One interviewee reported about problems related to the natural conditions on operational level: urine in the collection bin should generally percolate into the ground through the wholes of the perforated bin, this does not happen in one case, as the ground under the bin is too rocky. As consequence liquids cannot drain off and produce smell.

8.5 Dry Sanitation in Otjiwarongo

The evaluation of the sanitation systems in Otjiwarongo lasted for three days and was conducted in close cooperation with the Clay House Project (CHP). The CHP is a non-governmental organization whose aims are the promotion of environmental and social soundness and the sustainable development (CHP 2012). Past projects included the firing of roof tiles and the construction of clay houses, which had been equipped with flush toilets (Interview CHP 2011). However, the inhabitants of these newly built houses could not pay the sewage bill of the flush-toilets, so that the CHP developed a dry toilet – the Otji-Toilet. The first Otji-Toilets were built in Otjiwarongo in 2003. The majority of these toilets were installed in 2006 and 2007, but they were no longer made of clay, but now made of cement. In addition, the Otji-Toilets were no longer constructed inside the houses, but separately from the houses, because the smell that entered the homes during the night incommoded the residents. Since the year 2004, 1400 Otji-Toilets have been built in Namibia (Interview CHP 2011). Of these 1400 toilets the authors know of, 600 toilets are located in Otjiwarongo, 200 toilets in Outjo, 170 toilets in Oshikato, 58 toilets in Windhoek (Havana), 60 toilets in Aranos and some single toilets were contructed for schools and in kindergardens all over Namibia. Of

these 600 toilets in Otjiwarongo, 200 toilets have been built in formal areas; 400 toilets were constructed in informal areas (Interview CHP 2011). During the three-day evaluation in Otjiwarongo, a total of 49 households were interviewed and 49 facilities were inspected.

8.5.1 Financing

In the last years, an Otji-Toilet used to cost 6000 Nam$ (Interview CHP 2011); but the production costs have increased lately due to rising commodity prices: an Otji-Toilet now costs 8000 dollars. The applicant for the construction of the Otji-Toilet was the Town Council of Otjiwarongo; the project was funded by the European Union (EU). Due to the largely external financing by the EU, the residents of Otjiwarongo only needed to pay 250 Nam$ for the construction of their own Otji-Toilet. Since the CHP has not got sufficient support from the Namibian Government with funding and providing work visa for foreign experts, the CHP trust board was forced to stop all activities and to move into a 'stand-by' position. But a private company, initiated from the previous CHP-manager continues providing Otji-Toilets to customers. This company now is also contracted from the municipality for emptying the bins. For each emptied bin, the town council has to pay 60 Nam$, currently three times per annum (180 Nam$ annual). The owners of Otji-Toilets have to pay a service fee to the municipality of 18 Nam$ monthly (216 Nam$ annual), while households connected to the sewage system pay 46 Nam$ monthly (552 Nam$ annual) (Interview CHP 2011).

8.5.2 Maintenance

As already mentioned, the external contractor is responsible for the collection and removal of the waste. Therefore, the bins are emptied by this contractor in a cycle of four months.
Because of the increased utilization, the toilets have to be emptied more often in the future. In the beginning of the implementation of the Otji-Toilets in 2003, the bins were emptied only every sixth month. This trend shows that either the toilets are used by more household members or the toilet is used for other purposes, for instance as a dustbin. The collected waste is not reused as a fertilizer, but is dumped into a clarifier for drying. The emptied bins are cleaned by the external contractor and are reused.

Picture 6:Washing bins for reuse at CHP.
Emptied bins are cleaned in a construction for this purpose at CHP. Beneficiaries of Otji-Toilets in Otjiwarongo are provided with washed bins after the cleanout.
Source: Picture taken by authors.

The Otji-Toilets in Otjiwarongo are very clean. Out of 49 observed Otji-Toilets, 40 facilities were inspected from inside regarding their cleanness. Out of these 40 toilets, 28 were clean, 12 toilets were more or less clean and no toilet at all was dirty (please see figure 10).

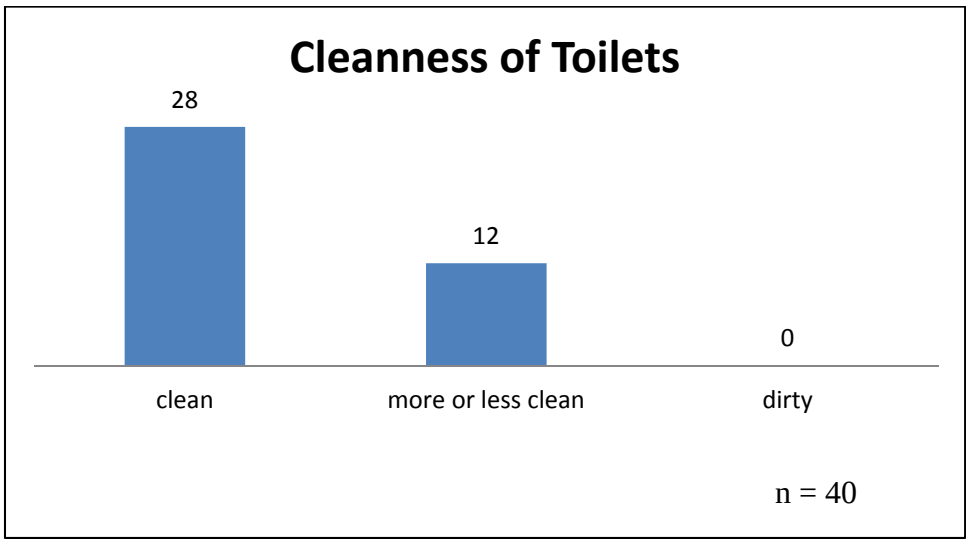

Figure 10: Cleanness of Toilets[1]
Source: Compiled by the authors

This result is surprising because many toilets had no lock and moreover, they were also knowingly shared. The assumption was that shared toilets and toilets without a lock would be less clean. In Otjiwarongo, 21 toilets were shared with neighbors and other family members, 19 toilets were not shared; only 14 toilets had a lock and 26 did not have a lock. The remaining nine toilets were not inspected regarding these two aspects. A correlation between the cleanliness and the fact that a toilet is shared shows that more toilets are clean when they are shared. Also, there is no correlation between the cleanliness and the household size.

The female members of the households are mainly responsible for the cleaning of the toilets. In 27 households women were responsible for the cleaning, in 18 households the responsibility was shared by all household members and in only one household the man was responsible for the cleaning. From the remaining three households the data were not collected. In 17 cases the toilet was cleaned every 7th day. In eight cases the toilet was cleaned every day or every 3rd day. The toilet was cleaned every 2nd day by 5 interviewees, every 14th day by two interviewees and every 4th day by one interviewee. From the remaining eight interviewees the data were not collected.

Regarding the responsibility for changing and emptying the bins, almost every interviewee knew who is responsible for changing and who is responsible for emptying the bins. Since the CHP is the inventor of the Otji-Toilet and also the external contractor for the removal of the bins, the CHP is well-known by the residents. When a toilet is full before the four-months cycle is over, people can inform the contractor and the bins will be emptied within a week, as the responsible contact person from the CHP said. However, the gathered data did not show that measure; 21 of the inspected toilets were full and 26 toilets were not full. From the remaining two interviewees the data were not collected. It has to be noticed that the circle of emptying was taking place during the evaluation in Otjiwarongo. Therefore many households were interviewed right before the bins were emptied.

The acceptance of the Otji-Toilet is partly hindered by the smell that comes out of the toilet when the sun does not shine anymore. In contrast to the overall result of the acceptance study, the inhabitants of Otjiwarongo seem to accept the Otji-Toilet very well. Only eleven interviewees said that their toilet smells; 15 interviewees said that their toilet does not smell at all. Further twelve interviewees stated that the toilets smells sometimes and nine interviewees that it only smells when the bins are full. From two interviewees the data were not collected.

The inspection of the toilets shows a clearer result. Out of 49 inspected Otji-Toilets, 41 toilets were inspected regarding the smell. Only two toilets smelled a little, one toilet smelled strongly and 38 toilets did not smell at all. Nevertheless, there remains the possibility of informing the users about the usage of ash to improve the dehydration and avoid the smell. Currently, only four people used freshly spent ash. A measure for the reduction of the smell during the night would be the installation of a solar panel, which would charge a battery during the day and enable to continue the aeration at night. But first field tests showed that the generated electricity from the solar panel was draw off by the residents and used for other purposes (Interview CHP 2011).
These results, gathered from the inspection and the interviews, show that the responsibility for the maintenance such as the changing and emptying of the bins, are well defined.

A further important sub-item is the question whether the toilet is damaged in any manner. Out of all 49 inspected toilets, 22 had some damages and 27 toilets did not show any damages at all. From these 22 toilets, one toilet was so damaged that is could not be used anymore. The other 21 toilets showed damages, but they were still functional. The detailed list of the damages is to be gathered out of figure 11.

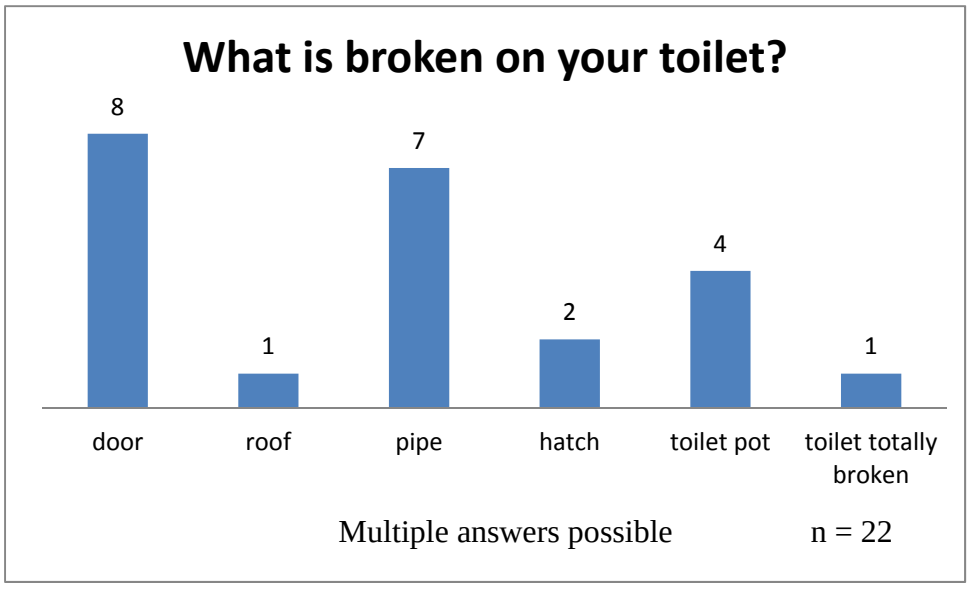

Figure 11: Damages on the toilet[1]
Source: Compiled by the authors

8.5.3 Particpation

Many users of the Otji-Toilets were participating in the whole process of implementation of the toilets. A total of 13 people said that the municipality talked to them before starting the implementation and even five people personally went to the municipality and asked for an Otji-Toilet. In four cases the toilet was already constructed when they came to Otjiwarongo while 13 people claimed not having been asked which type of toilet they would prefer before the installation of their Otji-Toilet. From the remaining 14 interviewees the data were not collected.

During the construction phase, local bricklayers were employed. Furthermore, any kind of question concerning the functioning of the Otji-Toilet was answered by the CHP. Up to today, the office of the CHP, which is located near the informal settlements, is ready to directly answer any questions arising from the use of the toilet. There is also a DVD for the inhabitants of the informal settlements available where many answers to current questions can be found (Interview CHP 2011). Since the external contractor is also responsible of the bins, they are often in these settlements and can always give advice to the users of Otji-Toilets.

8.5.4 Cultural Aspects and Education

According to the interview with the contact person of the CHP, the cultural background does not play a great importance in the acceptance of the Otji-Toilet. What really matters is education. Educated people know that a flush toilet is in many cases not practical because of the lack of water or the lack of infrastructure. The people who are aware of this trend do prefer an Otji-Toilet to another kind of sanitation system (Interview CHP 2011).

When asked what kind of toilet system they would prefer, 28 interviewees answered: a flush toilet. Another ten interviewees preferred the Otji-Toilet and four people the VIP. In seven cases the question was not asked. The cause why the flush toilet is mainly preferred is shown in figure 12.

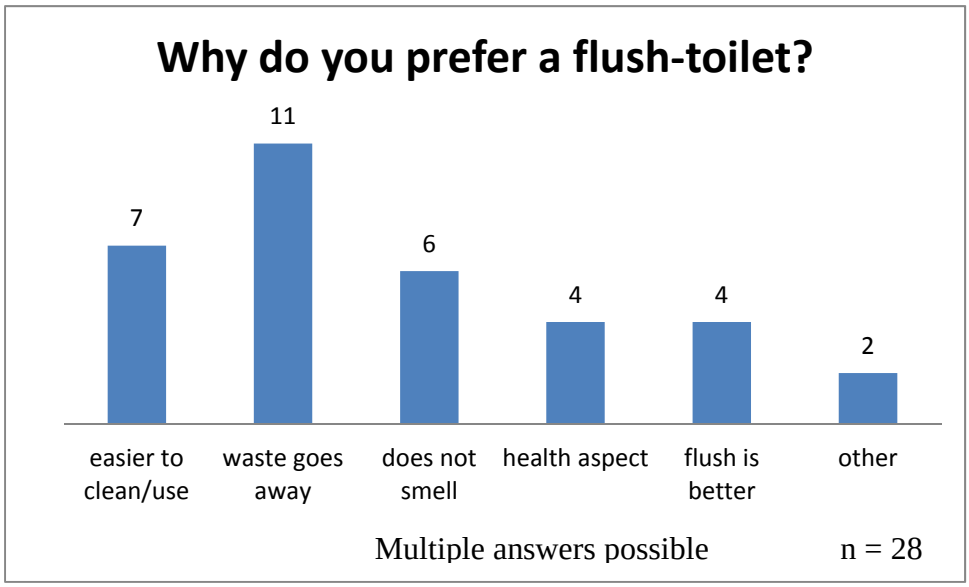

Figure 12: Cause of preferration of a flush-toilet[1]
Source: Compiled by the authors

As the figure 12 shows, most of the interviewees prefer the flush toilet because the waste goes away immediately after using the flush. This is an advantage that cannot be denied. However, the misinformation claiming that a flush toilet is better and easier to clean while a dry toilet is unhygienic can be solved thanks to proper information. There is an **obvious lack of information concerning the Otji-Toilet**. Indeed, only 20 interviewees knew how the system of the Otji-Toilet works; 22 interviewees did not know it. From seven interviewees the data were not collected. Moreover, out of all 49 interviewees, 47 were asked regarding the question, if they ever received any kind of training concerning the proper cleaning or using of the toilet. 45 interviewees gave the answer *no* and just two interviewees gave the answer *yes*.

The causes why an Otji-Toilet is preferred in some cases are manifold. Respectively two interviewees stated that the Otji-Toilet is fine for their current situation and it is cheap, and respectively one interviewee said that the Otji-Toilet needs no water, it does not smell and it is hygienic. The remaining three interviewees who also preferred an Otji-Toilet did not answer this question.
However, it is a fact that many of the interviewees are afraid of using the toilet at night. A total of 18 interviewees claimed to be afraid, mainly because of the threat of robbery and of the darkness; 22 interviewees were not afraid at all. From the remaining nine interviewees the data were not collected or they did not answer this question.

8.5.5 Natural Conditions

In general, the Otji-Toilet is adequate for the natural conditions in Otjiwarongo. The climate with little precipitation and much sunshine is a very good precondition for the functioning of the Otji-Toilet. Furthermore, the groundwater level in Otjiwarongo is between four and five metres deep, so that the danger of a contamination of groundwater through the infiltration of urine is less probable (Interview CHP 2011).

Due to heavy rainfall, water could get into the toilet and into the chamber where the bins are located. The contact person of CHP said that the flooding of the floor would not be a problem for the toilet, but a flooding of the chamber would interfere the drying-out of the feces. Therefore a new construction was designed, but cannot install for lack of financial and political support (Interview CHP 2011).

As the results show in some cases (14 times), the interviewees said that heavy rainfalls and wind affected their toilet. A total of six interviewees said that water came into the toilet (but not into the chamber) and some interviewees stated that the wind damaged the door (three times), the pipe (four times) and the roof tiles (one time) of their toilet.

8.6 Dry Sanitation in Outjo

The evaluation in Outjo followed the survey in Otjiwarongo and the conduction lasted for one day. Out of 200 implemented Otji-Toilets in Outjo, 23 users were interviewed and 23 toilets were inspected.

The Otji-Toilets were ordered from the Municipality of Outjo and were constructed by the CHP with support of a local contractor from Outjo. Whether any community members were involved in the construction, cannot be answered because no expert was available for an interview by the time of the survey. The construction of the Otji-Toilets in Outjo took place between 2007 and 2009. The complete costs were borne by the municipality, who also pays for the currently conducted repairing of damaged toilets (Interview CHP 2011)

8.6.1 Maintenance

The toilets in Outjo were as clean as in Otjiwarongo. Out of 23 inspected Otji-Toilets, 22 toiltes were inspected regarding their cleanness. Out of these 22 toilets, 15 toilets were totally clean, seven toilets were more or less clean and no toilet looked dirty. Women are mainly

responsible for the cleaning (12 cases) and in some cases the responsibiliy is shared among all household member (seven cases). The toilet was cleaned only one time by a male household member. From the remaining three houselholds the data were not collected. The cleaning cycle is similar to the cleaning cycle in Otjiwarongo. Almost every toilet is cleaned at least once a week (18 cases): Out of these 18 cases seven toilets are even cleaned every day and four toilets are cleaned every second day. Additonally to the 18 mentioned cases, two toilets are cleaned every month and from three interviewees the data were not collected. The impression of cleanliness is also reflected by the absence of smell on the toilets. The results of the inspection show that out of 23 toilets, only one toilet smelled strong and 21 toilet did not smell at all. From the remaining one toilet the data were not collected. But as in every correlation concerning the odor, there is a large discrepancy between the smell perceived by the interviewer and the sensation of the interviewee. Out of 20 interviewees who responded to this question, twelve said that their toilet smells and only three people said that their toilet does not smell, while five interview gave the answer that the toilet smells sometimes. This discrepancy can be explained by the fact that the evaluation in Outjo took place in the afternoon while the smell mainly arises in the evening or in the morning when the ventilation does not take place for lack of sunlight. Also, a coherence between the cleanliness or the odor with the installation of a lock could not be established by the results. However, it could be shown that almost all toilets that were only more or less clean were shared with neighbors or other family members. Despite the smell, the dispersal a freshly spent ashes to reduce the smell is hardly ever made in Outjo. Only three households were using the ash method, whereas 19 interviewees did not use it. From one interviewee the data were not collected. A further measure for the reduction of smell is the punctual emptying and changing of the bins. During the evaluation, the bins were already full in seven toilets while 16 toilets were only partly full. As often mentioned in this report, the punctual removal of the bins seems to be a major problem. The interviewees claimed that the responsibility for the changing and emptying of the bins was attributed to an external contractor. Out of 22 interviewees who responded to this question, 21 interviewee knew who the responsible contact person for the emptying and changing of the bins was. What kind of other duties the external constructor has, is not clear because no expert interview was conduted in Outjo.

In Outjo it was striking that some of the toilet cabins were damaged; sometimes even the wall behind the toilet pot was missing. But unfortunately, interviews with the owner of these toilets could not be conducted in most cases. Out of 23 inspected Otji-Toilets, 13 toilets were

damaged and only 10 toilets were intact. As you can see in figure 13, the same parts of the toilet as in Otjiwarongo tend to be damaged in Outjo.

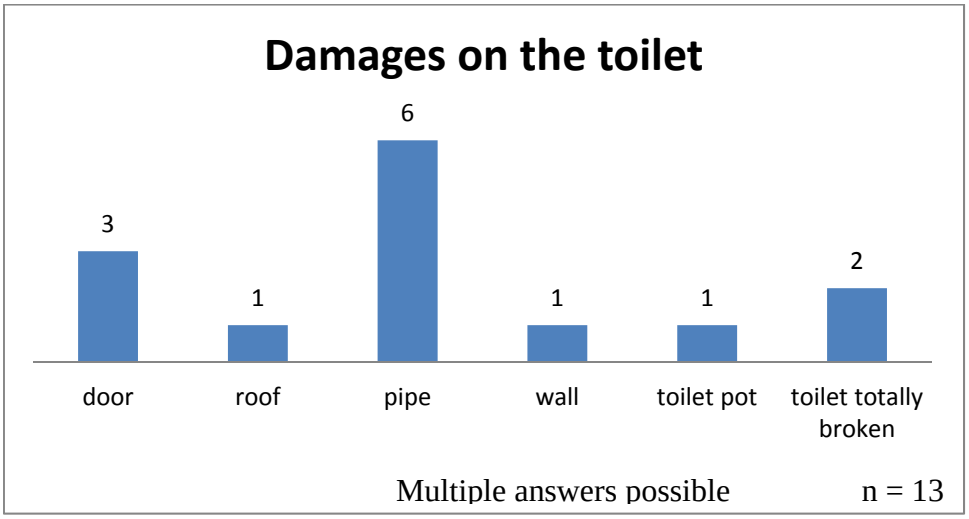

Figure 13: Damages on the toilet[1]
Source: Compiled by the authors

Upon closer inquiry, most of the interviewees could not tell how the damage happened. Sometimes the interviewees said that the damage was caused by the wind or by the emptying of the bins by the external contractor. But in many cases, it was difficult to understand how a brick wall could break down just by the force of the wind; it looked more like a willful damage. Interestingly, the expert from Otjiwarongo said that the Municipality of Outjo currently repairs the damaged Otji-Toilets and bears all expenses.

8.6.2 Participation

The Municipality of Outjo engaged the CHP with the supply of 200 Otji-Toilets. The CHP undertook the construction with support of a local contractor from Outjo. Whether the construction was conducted by support of the users of the Otji-Toilets themselves is not known. But the construction was entirely financed by the municipality according to the expert from Otjiwarongo. Moreover, the municipality will also finance upcoming necessary reparations. This financing is on the one hand positive for the user of the toilets, because they are financially disencumbered, but on the other hand a dependency upon the municipality is thereby created and the strive to take good care of one's own property is unlikely to arise. This could be the cause why proportionally many toilets are damaged in Outjo. This is also

the reason why the expert from Otjiwarongo said that owners of Otji-Toilets should pay a fractional amount of the construction, maintenance and repairing costs.
In general, the results of the evaluation show that only five people said that the municipality asked them if they wanted an Otji-Toilet before the implementation, while 18 interviewees asserted not having been asked. A similarly clear result arises from the question if the people were trained in using, cleaning and repairing the toilet. Out of 23 interviewees, five said that they were trained in using and in cleaning the toilet, 17 did not receive any training and from one interviewee the data were not collected. Only three interviewees stated they were trained in repairing the toilet as well, whereas 19 interviewees did not receive the training. From the remaining one interviewee the data were not collected as well.

8.6.3 Cultural Aspects and Education

20 out of 21 answering interviewees expressed their wish for a flush toilet when asked about their favourite toilet system. Only one interviewee was absolutely satisfied with the Otji-Toilet and mentioned as his main reason that this kind of toilet does not need any water. Further advantages of the Otji-Toilet were gathered thanks to further questions. The advantages are: it is near by the dwellings and it is an improvement to previous measures where a bucket or the bush was used. Why the flush toilet was preferred in most cases is shown in figure 14. Out of these 20 interviewees who preferred a flush toilet, 15 gave an answer regarding the question why this kind of toilet is preferred. The remaining five interviewees gave no answer.

Coherence can be found between the causes why the flush toilet is preferred and the disadvantages of the Otji-Toilets. Five interviewees said that a flush toilet does not smell and twelve interviewees said that the Otji-Toilet smells a lot. Another coherence is given between the answer "*waste goes away/ no changing or emptying of bins"* and the disadvantage that the Otji-Toilet has no flush and therefore the waste remains visible under the toilet pot. A further disadvantage arises from the assumption that the Otji-Toilet is unhealthy.

Another problem that does not arise from the construction of the Otji-Toilet but from the overall missing infrastructure is that there is no light inside the toilet cabin. This leads the people to improvise to use their toilet at night. Out of 22 interviewees answering the question,

15 used a cell phone during the night, one interviewee used a candle, another interviewee said that the flood light sufficiently illuminates his toilet and three interviewees just use their toilet in the darkness. The remaining two people do not go to the toilet at night because they are afraid. Altogether 14 interviewees – both men and women – acknowledged that they were afraid of using the toilet at night. Besides the darkness (six interviewees), the interviewees fear snakes and scorpions (six interviewees), worms and insects (one interviewee) and robberies (one interviewee).

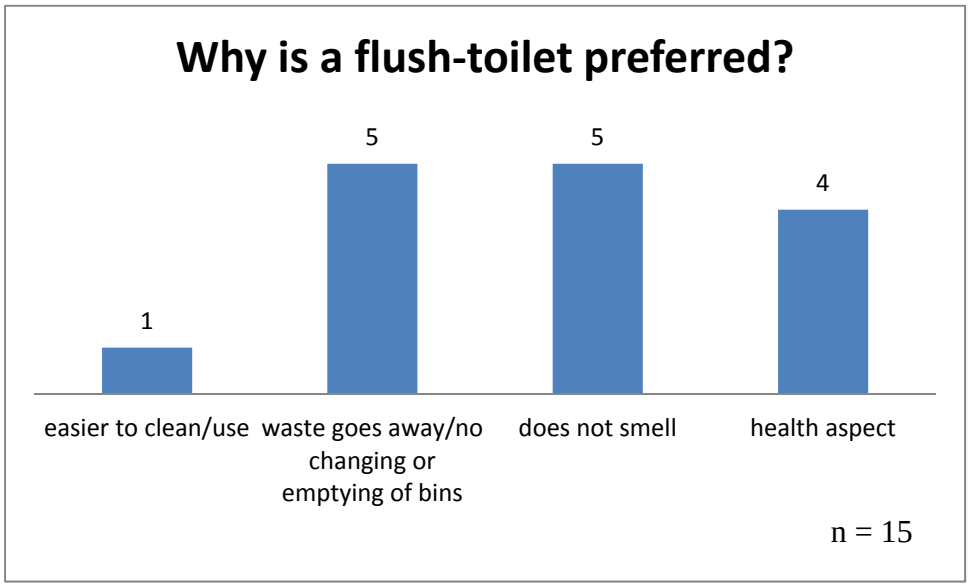

Figure 14: Why is a flush-toilet preferred?[1]
Source: Compiled by the authors

8.6.4 Natural Conditions

In general, the Otji-Toilet is adequate for the natural conditions in Outjo. The climate with little precipitation and much sunshine is a very good precondition for the functioning of the Otji-Toilets. Information about the groundwater level is not given in Outjo.

The evaluation shows that the Otji-Toilets of Outjo were affected many times by heavy rainfalls or wind, as nine out of 21 answering interviewees stated. In six cases, the water came into the toilet floor, two toilets were overflowed by heavy rainfalls and one toilet roof was damaged by a storm. Twelve interviewees said that nothing like that ever happened to their toilet.

8.7 Dry Sanitation in Gobabis

To conduct the survey also in the Town of Gobabis was recommended by different stakeholders in Namibia, as the Town Council is currently planning to implement 4000 units in informal settlements. The visit to Gobabis was not planned in advance but very worthwhile as the Town Council provided a good insight to the current situation of sanitation in the town. One Otji-Toilet was implemented in Gobabis in 2006 as a pilot project. During the survey this Oti-Toilet was evaluated. The facility was in use by one household and it was not open to the public. The beneficiaries were generally very happy with the facility which stood out for its cleanliness. One problem reported was, that the removal of the waste container was never carried out, the users don't know how to do it and the collection bin was full at time of the survey.

The Town Council of Gobabis decided to provide the informal settlement Ipacu Unit A and B with a dry sanitation system which technically works in the same way as an Otji-Toilet. Two Otji-Toilets are merged to a double unit, so that the facility provides two restrooms. The construction of several double units has already begun, at time of the project study the existent toilets were locked and still not in use. To avoid negative consequences of shared toilets, one household will be provided with one unit. Outstanding in this case is, that Gobabis decided to implement the Otji-System because it was seen as the most appropriate one in comparison to other dry systems. The price for one double unit was calculated to be 1200 Nam $ (Interview Town Council 2011). Residents of the vicinity remarked, that they are not integrated in this ongoing project and feel excluded. During the construction of the pilot project, residents were involved and trained to build the Otji-Toilets, the same persons are not being involved in the new project, although they asked to be so. The Council explained that less difficulties occur, when contractors are hired instead of local people.

The natural circumstances in Gobabis are challenging as the groundwater level is quite high. The water supply in Gobabis is organized though boreholes. Therefore "*it's absolutely crucial to have a system where you can gather feases and put them away. Washwater and Urine have to be brought away too*" (Interview Town Council 2011). The Town Council of Gobabis plans to collect the liquids separated by the urine division system of the Otji-Toilet and pipe it to a collection chamber for avoiding urine infiltration to the ground.

8.8 Dry Sanitation in Drimiopsis

After the survey in Gobabis a further stop was made in Drimiopsis where DRFN has implemented seven Otji-Toilets so far. The students had a look at two Otji-Toilets which were in good conditions. Remarkable in this case is the integration of beneficiaries to the project. In Drimiopsis DRFN organized a meeting with residents to introduce the functionality and benefits of the Otji-Toilet, afterwards seven people were trained in constructing the toilets.
If people decide for themselves that they would like to have an Otji-Toilet, they contact DRFN in Drimiopsis, and the process for the implementation of the individual Otji-Toilet will be discussed. Users participate in the construction process by digging holes for the containment of the toilet. The financing of Otji-Toilets is organized in a different way than in other observed regions and seems to be very successful resulting in a deep feeling of ownership by beneficiaries. In Drimiopsis people invest in rates according to their financial capabilities. The toilet is locked until beneficiaries have paid the full amount of around 250 N$. The facilities are subsidized by DRFN (Interview DRFN Drimiopsis 2011). To get a better impression for the entire results of the evaluation of dry sanitation systems in Namibia the next chapter will deal with the quantitative analysis of the gathered information from all regions where this project study took place.

Picture 7: Otji-Toilet in Drimiopsis
Source: Picture taken by authors

9. Quantitative Analysis

As part of the sanitation study, information that should enable a better understanding of the key factors that determine the success or the failure of dry sanitation systems were gathered thanks to a standardized questionnaire and an observation guideline. The focus was laid on the evaluation of dry sanitation facilities such as Otji-Toilets. Therefore, the users of Otji-Toilets were interviewed according to a standardized questionnaire; the interview lasted for around 15-25 minutes and was followed by an inspection of the toilets in order to determine their condition. Special attention was laid for example on whether they were in working condition, if the door was lockable and if a hand washing facility was present.

During the sanitation survey, 146 users of Otji-Toilet were interviewed and 168 Otji-Toilets were inspected (see table 4). Furthermore 14 users of Enviroloo and two users of Pit Latrines were questioned. The interviews and inspections in the seven evaluated areas are distributed as follows:

Table 4: Number of interviews and inspections of Otji-Toilets

Location	No. of Interviews	No. of observed Otji-Toilets
Havana Extension 6	43	58
Odendaal Farms	16	16
Aranos	12	19
Otjiwarongo	49	49
Outjo	23	23
Gobabis	1	1
Drimiopsis	2	2
Total	146	168

Source: compiled by the authors

At the locations Windhoek, Aranos and Odendaal Farms, translators were provided for the conduct of the interviews and the inspections. In addition, the community had been informed of the survey in advance. In Otjiwarongo, Outjo, Gobabis and Drimiopsis the accomplishment could be done without translator, because at least one family member could speak English. Since this survey had not been announced in advance, the interviews and observations were conducted in the late afternoon, as by this time, most of the users of an Otji-Toilet were back from work.

9.1 Observation Guideline

Factors gathered out of the inspection will first be in the focus of this analysis. The inspection of the toilet was usually conducted after the completion of the questionnaire. In some cases, survey and observation were performed simultaneously by two researchers. The inspection procedure can be divided into three categories: General details, cleanness and odor as well as damages of the toilets. The category “cleanliness and odor” will be set up here, even though it could also be presented in the section on the evaluation of the questionnaire. These results will be discussed here in order to enable a better understanding of the inspection section. Also, the damages of the toilets will not be discussed in this chapter but in the section on the evaluation of the questionnaire, since more background information concerning the damage has been gathered during the interview.

9.1.1 General Aspects

The first point of interest of the inspection was the determination of the Erf number and the coordinates of the location. After that, the distance between the toilet and the house was estimated. An accumulation can be seen in the specification between five and ten meters, which indicated that a total of 66% of all 168 observed toilets, are to be found in a radius of 5-10 meters to their houses. The nearest toilet to the house is situated at a distance of 1 meter; the largest distance measured between toilet and house comprised 50 meters. The fact that most of the toilets are in the immediate vicinity to the house is to be regarded as extremely positive. Thus the long foot march into the riverbeds, which is usual when the necessary sanitary facilities are not available, can be avoided and the number of assaults on children and women during the night can thereby be reduced. Similarly, the danger of being hit by a car while crossing the road to reach the riverbeds can be eliminated by the installation of the toilet near the house. The only disadvantage of the small distance between the toilet and the dwelling is, as the interviewees very often asserted, that the smell of the toilet reaches the house or to the open cooking site as soon as the sun sets.

Further unambiguous results could be found in other observations categories: 162 out of 168 observed toilets face north, which promotes the ventilation and also accelerates the drying of the feces. Only two toilets were installed facing another direction and from the remaining four toilets the data concerning their direction was not taken. Leaflets, which are placed in the toilet house and instruct the proper use of the toilet, were only in two of the toilets inspected.

In 148 toilets the leaflets were not present. The remaining 18 toilets were not observed regarding the leaflets. A similarly clear observation could also be made regarding the installation of a light: only one interviewee subsequently installed a light bulb in his toilet. It should be noted, however, that this toilet belonged to a bar or a pub and that 10 owner of bars or pubs were interviewed altogether.

A much more balanced result arises from the presence of a lock for the toilet to avoid unwanted users or to prevent children from falling into the toilet, a danger that interviewees pointed out many times. 92 of the interviewees had installed a lock, while 71 toilets had not. There are no data available from the remaining 5 toilets.

9.1.2 Cleanness and Odor

Two other important insights could be gathered from the inspection: the cleanliness of the toilet and the odor. The result of the cleanliness inspection is that from our point only five toilets were really dirty. 29 were more or less clean and 92 were clean (Figure 15).

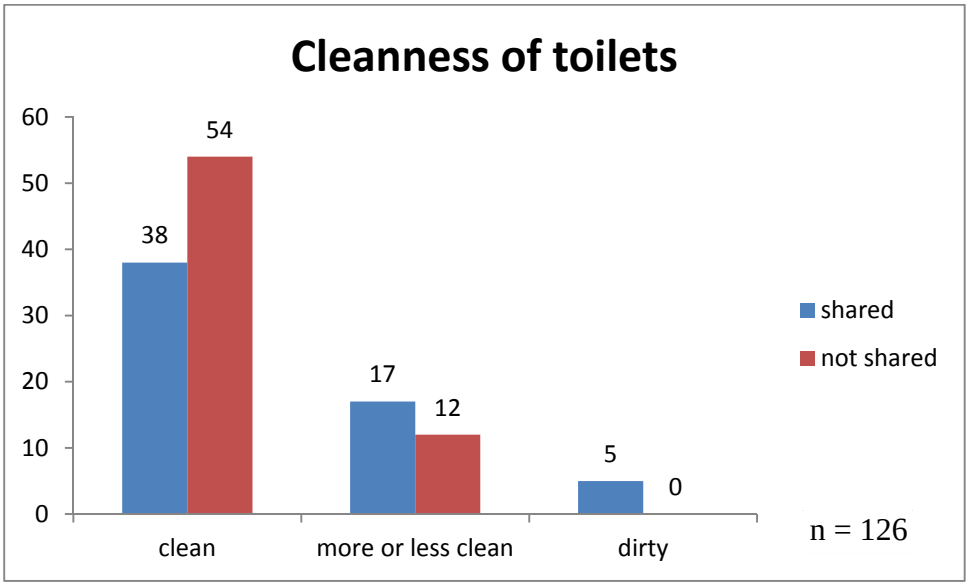

Figure 15: Cleanness of toilets[1]
Source: Compiled by the authors

An interesting result is that there is no definite correlation between the cleanliness of the toilets and whether the toilet is shared with other people. 60 of the evaluated Otji-Toilets were shared and 66 were not shared. In the figure above only the toilets were regarded, in which cases information about the cleanness and the status of shared/not shared was available. The

term shared refers not to a public toilet in this context, but to a toilet that is in charge of one household but is also used by neighbors or other family members. All 60 toilets that are not shared are clean or more or less clean; none of these toilets is dirty.

Another result can be found with respect to shared toilets: 16 toilets are more or less clean and two toilets are dirty. Certainly, the number of samples is too low to generalize the results; nevertheless, a trend similar to the one found in the evaluation report of the City of Windhoek considering Okahandja Park can be sketched. It seems that shared toilets are not an ideal solution for further implementations of toilets. If the toilets are shared with many other households, the responsibility for cleaning the toilet is not clear and this leads to a lack of cleanliness and a corresponding rejection of the toilet.

On the other hand, the installation of a lock does not seem to be a guaranty for cleanliness. 61 toilets were locked, 64 not. From the remaining 43 toilets the data regarding the lock were not collected. 44 of the non-locked toilets were completely clean, 18 were more or less clean and only two toilets were dirty. A similar result is obtained for the locked toilets. 47 of the observed toilets were clean, 12 toilets more or less and two toilets were dirty.

Another piece of information about the cleanliness of the toilets can be gathered from a correlation between the question *"Have you been trained in cleaning the toilet?"* and the actual hygienically state of the toilet. 73 people answered *yes*, 68 people *no*. From the remaining five interviewed users the data were not collected (annotation: in this case the sample size n is 146 because the question *"Have you been trained in cleaning the toilet?"* is part of the interview and not part of the Observation Guideline where n is 168). The gathered data reveals that it is not possible to assert that training necessarily leads to a cleaner toilet. One also has to be careful because it must be assumed that intensive training as to how to use and clean the toilet properly has never taken place, because many interviewees did not give an answer to the more specific question concerning what exactly they had been taught. Moreover, some experts stated, in contradiction to the statements of the Otji-Toilet owners, that a training referring to the proper cleaning of the toilets had never taken place.

Women seem to be mainly responsible for the cleanliness of the toilets in the interviewed households. 75 toilets were cleaned by women and only nine toilets by men. In 52 cases the responsibility was shared by all household members. In one case the responsibility was not clear. From the remaining nine interviewed households the data were not collected. In 70 cases the toilet is cleaned at least every 3rd day. Most households, however, clean the toilet in a cycle of seven days (123 households).

A clear result can be identified concerning the odor of the toilets that was determined during the inspection. Only 4 toilets smelled strong, 11 toilets smelled a little and 115 toilets did not smell at all (please see figure 16). The remaining 38 observed toilets were not inspected regarding the odor.

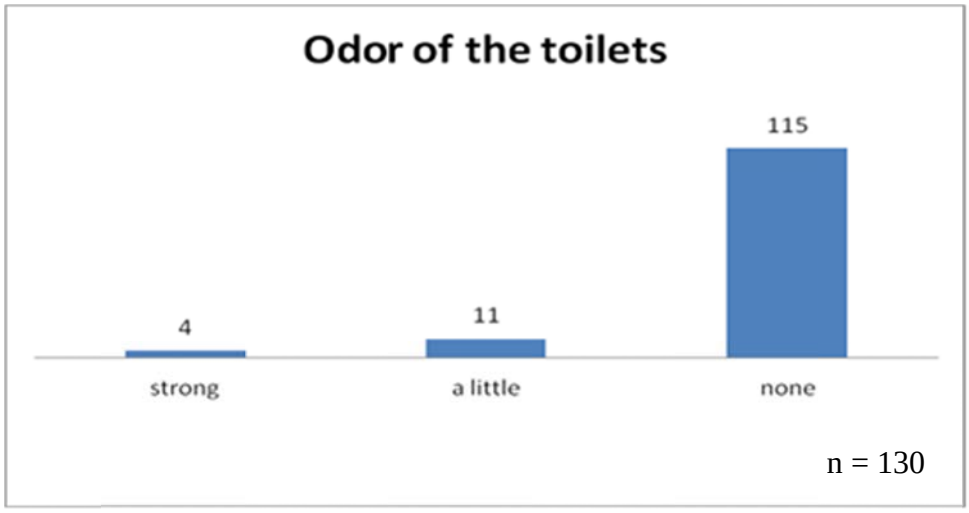

Figure 16: Odor of the toilets[1]
Source: Compiled by the authors

An interesting distinction does occur from our own subjective observation and from the statements of the interviewees. The interviewees sensed the smell of the toilet as unpleasant and even disgusting unlike our impression.

From the observation of the students, 115 toilets did not smell at all. Only eleven toilets smelled a little and four toilets smelled strongly (please see figure 16). In contrast to that, 48 of the interviewees said that their toilet smells, additional 29 said the toilet smells sometimes, 50 interviewees stated that the toilet did not smell at all and nine interviewees said the toilet only smells when the bins are full. The sample size all in all is 146 but ten interviewees did not answer to this question, meaning there are 136 answers available.

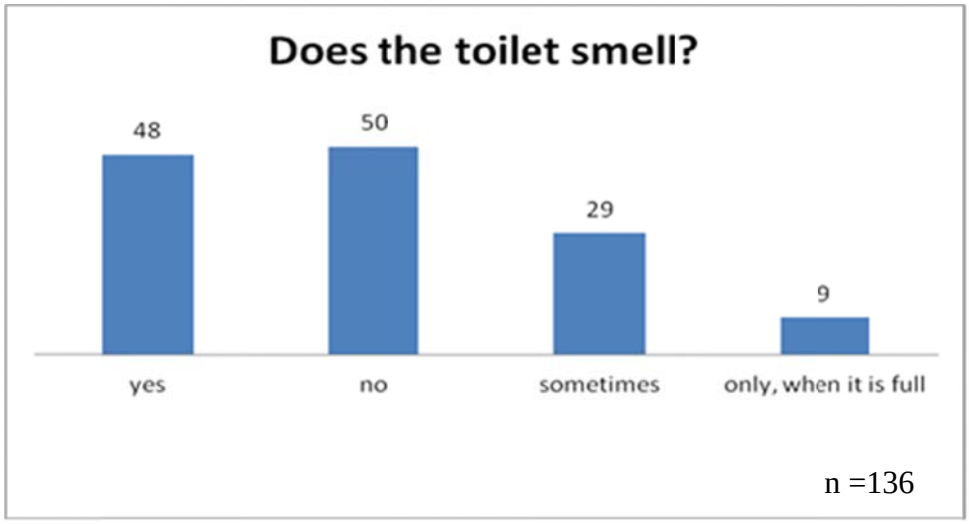

Figure 17: Does the toilet smell?
Source: Compiled by the authors

The comparison of the observation and the impression of the interviewees reveals a major discrepancy. The strong odor is mainly produced when the bins below the toilet are full, as we heard from the interviewee. An explicit result is given neither in a correlation between the fullness of a toilet and the smelling (statement interviewee) nor between the fullness and the odor (own observation). However, it is noteworthy that 52 of the inspected toilets were full and 88 toilets were not full. No data have been collected from the remaining 28 toilets.

Furthermore, odors can arise in the evening and morning hours when the ventilation is not provided by the sunlight. Since the evaluation was mainly made in the noon and in the late afternoon, no further statement referring to the odor during the inspection can be made. A simple method to minimize the smell of feces would be the dispersal of fresh ashes on the bin when it starts to smell as many interviewed experts mentioned. The method would be feasible for every budget since firewood is burned every day in the open cooking site anyway. However, only 20 households use this method. The remaining 112 households which were asked this question did not use ashes to prevent their toilet from smelling.

No matter how effective the ash method is to prevent the smell, the most important aspect remains the accurate changing and emptying of the bins. If this is not done regularly, the toilets begin to smell and the acceptance of the users for the toilets declines rapidly. Therefore the responsibilities for changing and emptying the bins have to be clear.

9.2 Analyzing Results of the Evaluation

The standardized questionnaire is distinguished into four main sub-items, which can each be distinguished into several sub-categories as well. In the following section, the results of the questionnaire will be presented according to these four sub-items:

- General aspects
- Participation and Construction
- Maintenance
- Acceptance

9.2.1 General Aspects

One of the general pieces of information that is of interest to our study relates to the gender distribution of the interviewees. The result is more or less balanced, which is surprising since the presupposition was that women are primarily responsible for the household and therefore are the primary contact for the interview. The proportion of women among the 146 interviewees was of approximately 57 %, while 43 % of the interviewees were men.

Another general aspect of the interview concerns the size of the household. In most cases the household size was very homogenous. The number of residents in a household fluctuates in approximately 70 % of all cases between two and six members. Most of the households had three family members (20 %), the maximum of members in a household were 16 members and the minimum was one member. By analyzing the questionnaires it is obvious that most of the owners of Otji-Toilets also use them. Only occasionally family members avoid the toilet, mainly because they still are toddlers and thus too small to use them. 139 out of 144 answering interviewees said that they use the toilet, whereas only five interviewees do not use the toilet. The reason for the non-use was for three interviewees that the toilet was damaged so that the toilet was no longer usable; one interviewee stated that strangers use the toilet and he therefore avoids using it for lack of cleanliness; the last interviewee gave no reason for the non-use.

9.2.2 Participation and Construction

The first question concerning the participation of the people was whether the residents were asked by the municipality during the planning phase what kind of toilet system they wanted.

According to the interview results, 59 people said *yes*, only 38 said *no*, four interviewees said that the toilet was already constructed when they moved to that location and even five people personally went to the municipality and asked for an Otji-Toilet. From the remaining 40 interviewees the data were not collected. This result is surprising because many people gave an answer contradicting their first answer to the question addressing the toilet system they would want if they could choose: most of them answered that they want a flush toilet (96 out of 133 answering interviewees). The difference between these two answers can arise from the fact that the question is too vague for the interviewee or the translator on the one hand; or from the interviewee's awareness that a flush toilet cannot be realized because of certain impediments and his according acceptance of the installation of Otji-Toilets on the other hand.

Another important aspect that heightens the chances of a successful implementation of toilets is a clear definition of **property rights**. As mentioned in this report, a public toilet system such as in Okahandja Park is doomed to fail because nobody feels responsible for it. It is essential to give the responsibility for each toilet to a household in order to ameliorate its cleanliness, acceptance and use. Similarly, the participation of the people in the planning phase is a key point not to be underestimated.

Still another important aspect of the construction phase is the adequate dimension of the toilet facility. The size of the toilet facility seems to be acceptable for most of the interviewees. 117 interviewees said that the height of the facility is ok, whereas only 19 interviewees were not satisfied. From the remaining 10 interviewees the data were not collected. 101 interviewees were satisfied with the space as well, whereas 37 interviewees were not satisfied with the space. From the remaining eight interviewees the data were not collected. As we already know, there is usually no light in the Otji-Toilets; this is related to the lack of necessary electric infrastructure in these urban und rural areas. Nevertheless, most of the interviewees need to use the toilet at night. From 113 answering interviewees, 57 use their cell phone as source of light; 21 interviewees use torches or candles, 16 interviewees avoid to go to toilet at night and 12 interviewees just use the toilet in the dark. Six interviewees said that thanks to the floodlight they have enough light during the night and only one interviewee installed a light on his own, as already mentioned in this report.

A further issue is the lack of hand-washing facilities in the toilet. The Otji-Toilet is a kind of dry toilet and does not provide any hand-washing facility; moreover, the next water point is usually far away from it. Thus, one interesting question was whether the interviewees have a

possibility to wash their hands in a proper way to avoid possible infections originating in unhygienic conditions. From 133 answering interviewees, 106 interviewees give the answer that they have a bowl filled with water inside their houses that they use for washing their hand after using the toilet. Nine interviewees said they have a bowl inside their toilet and six interviewees claimed having a hand-washing facility such as a water tap in the near of their house. The remaining 12 interviewees said that they do not wash their hands.

To guarantee the health of the dry toilet users some improvements regarding the installation of hand-washing facilities are necessary (see LUTCHMINARAYAN 2007 for further information on sanitation, safe water and hygiene behavior).

9.2.3 Maintenance

The sub-item maintenance can be distinguished into two further sub-categories. First of all: the emptying and the changing of the bins, then the repairing of damages in or on the toilet.

As already mentioned, the regular emptying and changing of the bins is a key point for the maintenance and for the acceptance of dry toilets – and therefore also for further implementations of such sanitation systems. This is the reason why the responsibilities of everyone have to be very clear. Unfortunately, this does not seem to be done right now in every case, since, out of 140 inspected toilets, 52 bins were full at the time of the inspection, whereas 88 bins were not full. Here it has to be noted, that in some cities the cleanout was ongoing during the survey.

As one can gather from the analysis, most of the interviewees know who is responsible for changing and emptying the bins (108 out of 122 answering interviewees). However, the bins should be changed or emptied as soon as a notification comes in when it actually does come in. This can be illustrated with two examples: In Aranos the municipality is responsible for emptying the bins; in Otjiwarongo an external company conducts the emptying. In both cases the emptying is done in an exemplary manner. It would also be an idea to train the users in changing the bins and to give the responsibility for this task to the dry toilet users themselves. Also there would be the possibility of job creation for local cleaning agencies. Altogether, the community members should be assigned a greater responsibility for their toilets in order to heighten their acceptance. Only 18 out of 110 answering interviewees said that there is a responsible person within the community who is checking the toilets. From these 18 interviewees, seven interviewees came from the Odendaal Farms, five interviewees from

Havana, four came from Aranos and respectively one interviewee came from Drimiopsis and Outjo. A responsible contact person within the community would certainly make sense, because problems such as a full bin or a broken door could be solved more quickly. The statement that the bins have to be emptied every six months is based on a householdsize of four to five persons (Interview CHP 2011). In many cases, however, more people use the Otji-Toilet. Therefore, in some cases, it would be judicious to reduce the emptying cycle according to the actual use of the toilet.

The fact that the acceptance of the Otji-Toilet is in a close correlation with the arising odor, a phenomenon amplified by the non-punctual emptying the bins. That will be clearly illustrated and amplified by the figure 18, where the aspects, why a flush-toilet is preferred, are shown.

99 out of 137 answering interviewees preferred a flush toilet (please see figure 20). When asked why most interviewees prefer a flush toilet, the majority answered that the flush toilet would not smell and also that it would avoid the emptying of the bins. A detailed statement of the preferred toilets systems and thus of the acceptance of the Otji-Toilet will follow in the next chapter.

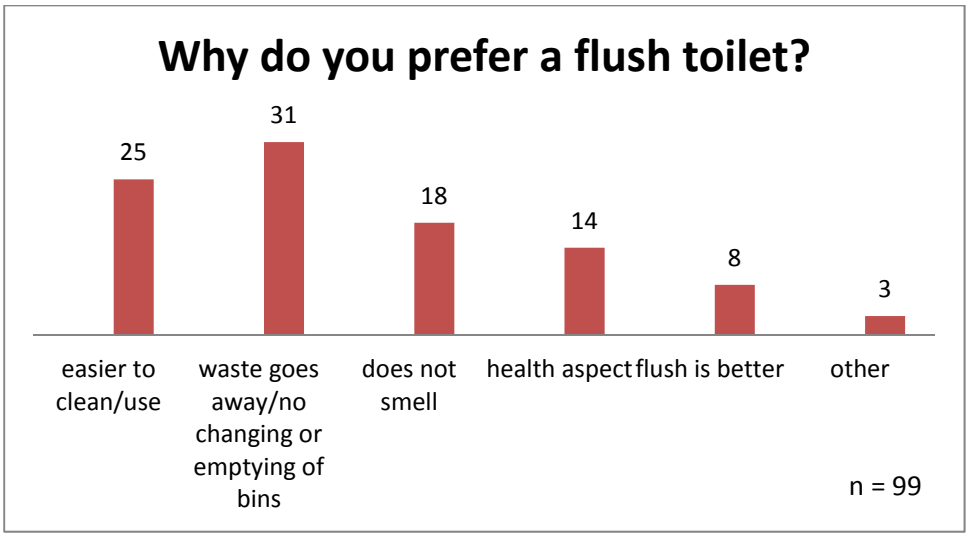

Figure 18: Why do you prefer a flush toilet?[1]
Source: Compiled by the authors

The answers to the question whether the toilet had ever been damaged provide an interesting result. Of a total of 144 answering interviewees, 53 persons said that their toilet is damaged; 91 toilets were not damaged and three toilets lack data. After evaluating the results, the pipe that promotes the ventilation and the drying of the feces seems to be to the weakest point of toilets. Besides the pipe, the door was also damaged in some cases; but overall and in spite of

these minor damages, the toilets were still usable and made a good impression. A detailed listing of the damaged parts can be gathered out of figure 19.

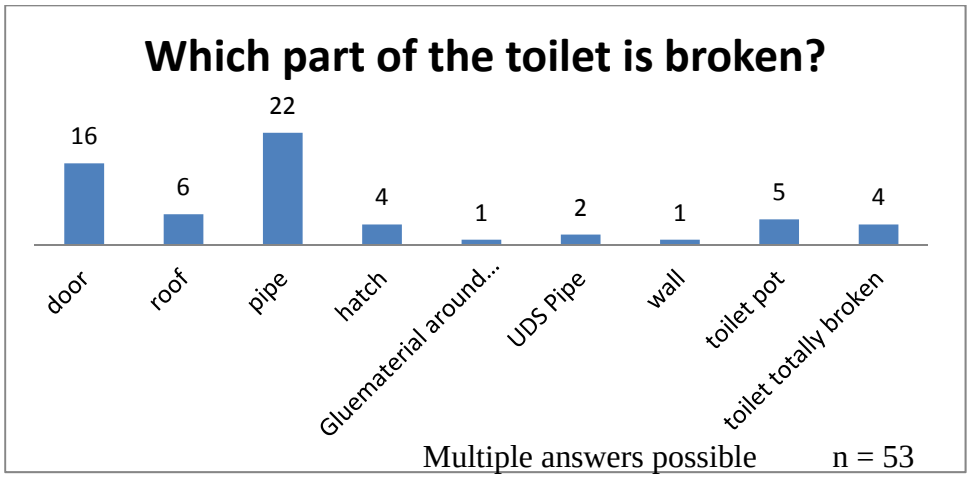

Figure 19: Which part of the toilet is broken? [1]
Source: Compiled by the authors

9.2.4 Acceptance

As mentioned several times in this report, the satisfaction with and acceptance of the toilet is a key factor for the successful implementation of dry sanitation. Therefore, it is crucial to contact the people during the planning phase already and explain the reasons why it is impossible to install a flush toilet to them. Furthermore, the function of a dry toilet system should be explained and it should be pointed out that there is no risk of contamination by any disease through the use of an Otji-Toilet.

As the results indicate, such an educational action has not yet been conducted often enough or the users have forgotten it. Out of a total of 139 answering interviewees, 84 said that they knew how the system of the Otji-Toilet works; 55 interviewees did not know how the system works. However, the interviewees were frequently asked questions regarding particular functions of the toilet, for example regarding the function of the pipe. Many interviewees that claimed to know how the toilet functions could not answer this control question. Unfortunately this control questions was not a permanent content of the questionnaire so that no profound statement can be done with the little data collected.

A basic question in the questionnaire regarded the kind of toilet system the interviewees would prefer. As you can see in figure 20, 99 interviewees said that they would like a flush toilet; 33 interviewee prefer an Otji-Toilet, four a Ventilated Improved Pit Latrine (VIP) and one interviewee another kind of toilet. From the remaining ten interviewees the data were not collected.

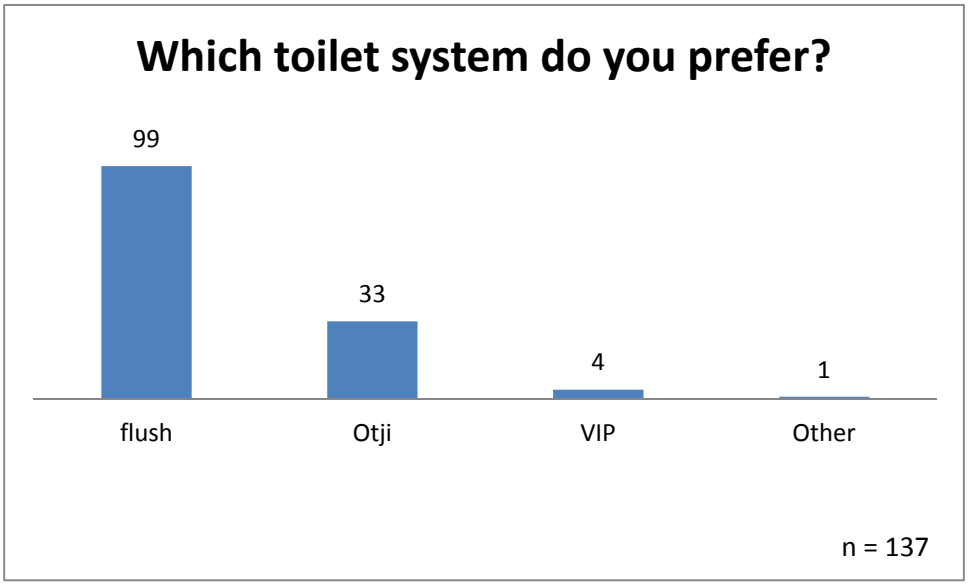

Figure 20: Why do you prefer an Otji-Toilet[1]
Source: compiled by the authors

As mentioned in the chapter "Maintenance," the main reason why the interviewees prefered a flush toilet was the idea that a flush does not smell, that there are no bins to be changed or emptied and the assumption that a flush toilet is easier to clean. The strenght of the Otji-Toilets from the point of the interviewees are the following, which you can withdraw from figure 21. The Otji-Toilet is highly regarded among the interviewees because of several factors. 15 interviewees valued that no water is used thanks to the use of the Otji- Toilet. This consideration is very wise given the climatic conditions in Namibia. However, this answer does not only rely on environmental awareness, but also on economic factors. The use of Otji-Toilets does indeed not influence the water bill of the users. Furthermore, this assumption coincides with the second main reason for the choice of the Otji-Toilet: nine Interviewees said that this toilet is fine for their present situation.

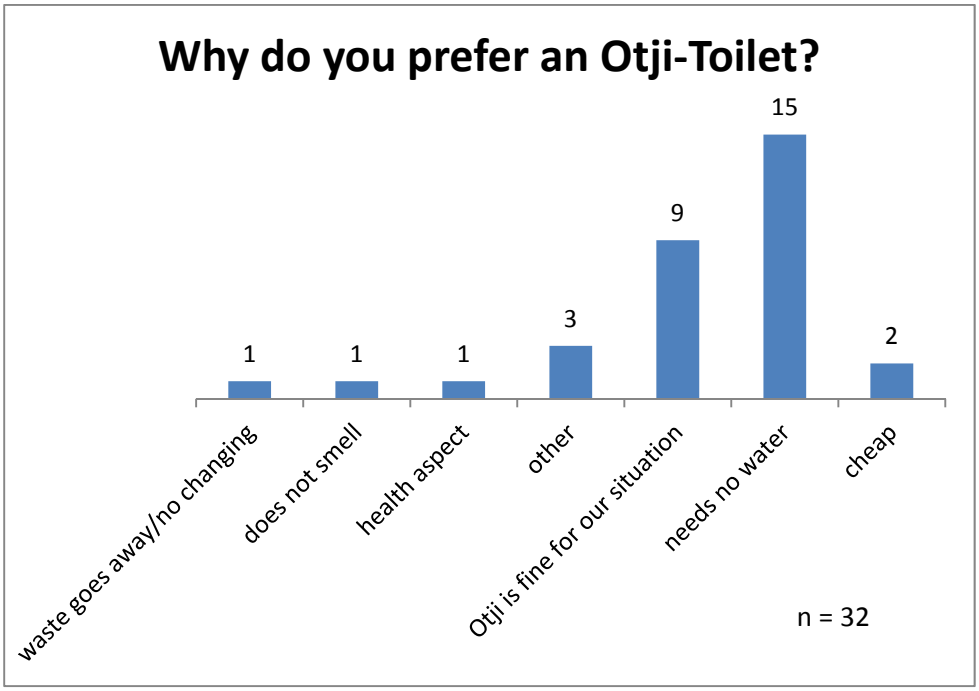

Figure 21: Why do you prefer an Otji-Toilet[1]
Source: compiled by the authors

These statements to the question "*Why do you prefer an Otji-Toilet"* are consistent with the answers to another question, where the interviewees stated any kinds of advantages of the Otji-Toilet. Of a total of 108 answers, 33 interviewees said that the Otji-Toilet is a significant improvement to their former situation where they had to use the bush and / or the bucket system. Another 31 interviewees stated that the closeness of the toilet to their homes is a great advantage; six interviewees even claimed that the Otji-Toilet would not smell at all and for another six interviewees the Otji-Toilet represents an improvement of their security when they have to use the toilets at night. The statement that water can be saved by the Otji-Toilet was stated four times in a total. The remaining 28 answers are subdivided into the category *"other"*.

Of course, the interviewees were not only asked about the advantages of the Otji-Toilet, but also about its drawbacks. The drawbacks mentioned by the interviewees have been described many times before in this report. As can be gathered from figure 22, 46 out of 114 answering interviewees named the smell of the toilet as its greatest disadvantage. Nine interviewees stated that no one empties the bins and respectively eight interviewees stated that the toilet is unhealthy and that the Otji-Toilet has no flush.

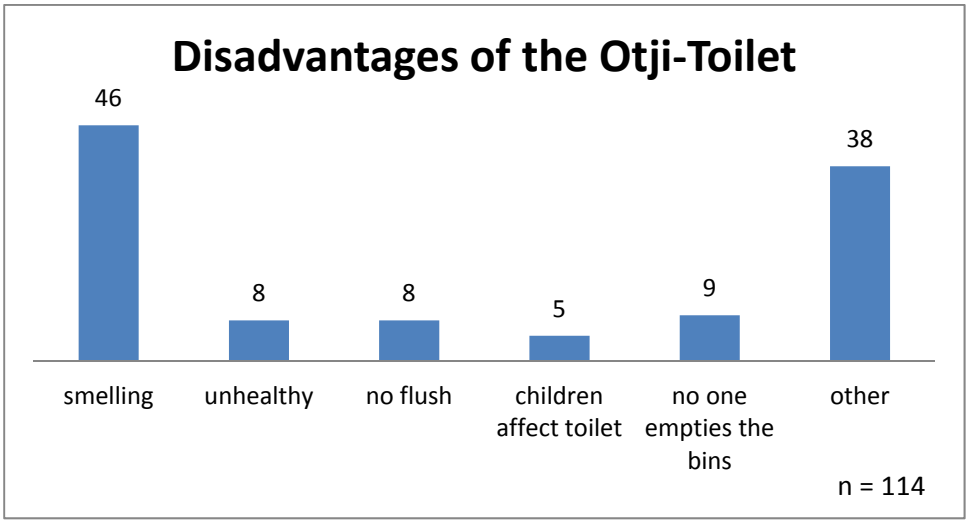

Figure 22: Disadvantages of the Otji-Toilet[1]
Source: compiled by the authors

In total, it should be noted that the number of the disadvantages exceeds the number of the advantages, but that problems mentioned could be solved. The smell in the evening and in the morning is a fact that cannot be denied. However, several basic measures could reduce the smell: First of all the toilets must be kept clean, but this does not seem to be a problem as you can see in figure 15. A further essential measure for reducing the smell is the punctual changing and emptying of the bins. A further measure is the dumping off ashes into the bin.
A major component concerning further implementations of dry toilets must be the information about the Otji-Toilet. Misinformation, such as the transmission of diseases through the use of the toilet or the prejudice that the toilet could be unhealthy, should be counteracted by appropriate measures.

10. Summarizing Results regarding the DAC-Criteria

In the following chapter a summary with regard to the DAC criteria as theoretical framework for this study will complete this report.

10.1 Relevance

The implemented dry sanitation systems which were part of this study are in general directly contributing to the success and realization of the Sanitation Strategy. The objectives of the different sanitation projects and of the implementation of Otji-Toilets in the project area are consistent with the overall approach of the sanitation sector of Namibia. Nevertheless there is still research required to get in particular information about the unintended impacts of the implementation of dry sanitation services.

From the current state of knowledge there is no alternative to realize the Sanitation Strategy disregarding the implementation of dry sanitation systems (especially Otji-Toilets) on a large scale in Namibia.

10.2 Efficiency

The Otji-Toilet is in a perspective of cost-benefit analysis very efficient. The cost of an Otji-Toilet varies currently between 6000 and 8000 $N for an Otji-Toilet with Urine Diversion system. As the material for the Otji-Toilet is mainly available in Namibia itself transport costs are reduced and there is no need for customs duty, especially in comparison to the EnviroLoo. Furthermore the Otji-Toilet does not need a lot of worker in construction and maintenance. In comparison to a flush toilet there is no sewage system necessary and no pipes have to be installed. Especially the running costs of a dry sanitation system are less than with wet systems because no water is needed. Although digging the holes for the containment of the Otji-Toilet can be hindered by rocky underground there is even no big machinery required. This means that the Otji-Toilet can be easily constructed at any place without requiring a lot of technic with high investment costs or high qualified manpower. In addition unqualified workers can be trained with relatively low efforts in constructing and maintaining the toilets, so that new jobs are created and the users get more independent from external expertise.

10.3 Effectiveness

Dry sanitation and in particular the delivery of one Otji-Toilet per household is an appropriate approach in Namibia to provide the population with functioning improved toilet systems. But currently there is a huge gap between the vision of the sanitation strategy to provide "A healthy environment and improved quality of life for 66% of the (Namibian) population having adequate sanitation services with a high level of hygiene by 2015" (Namibian Sanitation Strategy 2009: 7). It is very unlikely that this goal will be reached. To realize the goal of providing acceptable, affordable and sustainable sanitation services it is essential to get more political support. As already mentioned the Otji-Toilet is relatively cheap. Nevertheless the implementation has to be subsidized by the Namibian government or by other institutions like the EU or NGO´s to make it affordable for the people in the informal settlements.

Although the Otji-Toilet is an adequate sanitation system to provide access to appropriate sanitation in Namibia most users prefer a flush toilet. In this context it can be concluded that dry sanitation is more acceptable for the users than going to the bush, while the favored system is wet sanitation.

In this consequence the most important factors influencing the achievements of the objectives of the sanitation strategy and policy are the political support, the maintenance of the toilets and the sensitization for dry sanitation systems.

Regarding the effectiveness of dry sanitation to improve the hygienic conditions with 91 % of the interviewee in this study much more people said that they were washing their hands after using the toilet with a bowl, bin or tap at home than in the baseline study by the Red Cross Society of Namibia in the Kunene Region with 20 % washing their hands after toilet (MAWF 2009b: 28). This discrepancy can be explained with a higher sensitivity for hygiene by people using a dry toilet through trainings and having the possibility to wash the hands nearby. While dry toilets are in general near the house of the user, the activity of hand washing can get easily routine because the people can immediately wash their hands with a bowl at home after using the toilet. People going to the bush don´t have direct access to a hand wash facility after using the bush so that it is more difficult to get this activity in routine.

10.4 Impact

The impact of the implemented dry sanitation systems is first of all the interviewed people have a toilet. The obvious advantages are that the people don´t have to go so far to the bush anymore and that more security is assured. Impacts on health, economic, social relationship were not part of this study and cannot be assessed. Nevertheless it can be mentioned that the implementation of the studied Otji-Toilets did not lead to a reuse of human excrements and waste as fertilizer in general. To realize the concept of ecological sanitation there are more efforts in education for the user necessary. The advantages of using human waste as fertilizer for plants or a garden have to be pointed out and the fears regarding health risk and the concerns about getting in touch with the waste have to be taken seriously and discussed with the users (for further information regarding this aspect see www.susana.org).

10.5 Sustainability

From the perspective of sustainability dry sanitation systems are very appropriate for Namibia. As dry sanitation helps to save the limited water resources it can close the nutrient cycle for an ecological production of food on a small scale as well. In particular the Otji-Toilet can be considered as a sustainable toilet system because the local production of the essential material for construction induces less energy consumption for transport and less CO2-emission in general. Despite this aspect there is even more no sewage system needed. This fact implies less energy consumption and little effects on the water cycle too. However the possibility of groundwater contamination through infiltrating urine needs to be studied on the long run.

From the financial perspective there is much more to be done for a sustainable implementation of dry sanitation. Dry Toilets like the Otji-Toilets as well as wet sanitation are too expensive for most people living in the informal settlements. This is why a financial concept with subsidization has to be developed which guarantees all people in Namibia access to improved sanitation.

11. Conclusion

Dry sanitation systems are very appropriate to give more Namibian people access to improved sanitation. This project study has shown that especially the Otji-Toilet works quite well in Namibia and contributes to an improvement of the local living conditions.

Despite the fact that the evaluated dry sanitation systems in Namibia work quite well, more efforts could be done to realize the complete concept of ECOSAN, which implies the recycling of resources as natural fertilizer.

The most important factors for the success of dry sanitation in Namibia are the political support and the maintenance. Furthermore an adequate instrument for financing the implementation of dry sanitation on a large scale has to be developed.

Apart from a reliable organization of the maintenance of the dry toilet it is essential that the users are sensitized for the advantages of dry sanitation systems and that their concerns regarding dry sanitation are taken serious. The users have to be integrated in the implementation phase and should be involved in the planning and construction process.

As the feeling of ownership of beneficiaries towards the dry toilets seems to be a key factor contributing to the success of dry sanitation systems in Namibia, further research is necessary to get a deeper understanding about the role of ownership in this context. A substantial question which should be addressed in future studies is, if the feeling of ownership is deepened, when beneficiaries of dry toilets give a financial contribution or buy subsidized facilities.

Although most interviewed people preferred a flush toilet, the financial capacities of the people without access to improved sanitation and the natural conditions in Namibia with limited water resources do not allow an implementation of wet sanitation systems on a large scale. Dry sanitation systems and in particular the Otji-Toilet are cost-efficient, adapted to the natural conditions in Namibia, easy to use and to produce and can contribute to an economic development which also integrates the poorest people in Namibia.

References

ALLGEMEINE ZEITUNG (2003): Meteorologen erwarten „normale“ Regenzeit. Internet: http://www.az.com.na/lokales/meteorologen-erwarten-normale-and-quot-regenzeit.5986.php (02.02.2012)

ALLGEMEINE ZEITUNG (2004): Kleine Regenzeit hat begonnen. Internet: http://www.az.com.na/lokales/kleine-regenzeit-hat-begonnen.8989.php (02.02.2012)

ALLGEMEINE ZEITUNG (2011): Erste Tropfen und Regenmeldungen. Internet: http://www.az.com.na/lokales/erste-tropfen-und-regenmeldungen.135063.php (02.02.2012)

BERNARD, H. R. (2000): Social Research Methods. Quantitative and Qualitative Approaches. London.

BETSCHART, T. (2011): Implementierung von sanitären Maßnahmen im Kontext der Entwicklungszusammenarbeit in Lusaka Sambia. Lusaka.

BOUTIN, V., C. BUTLER, S. KESSELI and M.C. MCCORRY (2011): Improving Water Quality and Sanitation in Rural Namibian Communities. A Baseline Assessment on Odendaal Farms and Development of Community-Integrated Implementation.

BROCK-UTNE, B. (1997): The Language Question in Namibian Schools. In: International Review of Education 42: 241-265.

CENTRAL BUREAU OF STATISTICS (2011): Population Projections. Internet: http://www.cbs.gov.na/Atlas/population_projections/html/CH%2000-Preface.php (17.11.2011)

CENTRAL INTELLIGENCE AGENCY (2011): World Factbook. Internet: https://www.cia.gov/library/publications/the-world-factbook/geos/wa.html (17.11.2011)

CITY OF WINDHOEK (2011): Windhoek your 2013 destination. Internet: http://www.iwahq.org/contentsuite/upload/iwa/all/IWA%20Windhoek%20Reuse%202013%20Bid-download.pdf (18.11.2011)

CLAY HOUSE PROJECT (CHP) (2007): The Otji Toilet. Different Designs – One System. Otjiwarongo.

CLAY HOUSE PROJECT (CHP) (2011): The CHP Dry Toilet Solutions. Internet: http://home.arcor.de/clayhouse/toilet/toilet.htm (22.11.2011)

CLAY HOUSE PROJECT (CHP) (2012): The Clay House Project. Internet: http://home.arcor.de/clayhouse/ (02.02.2012)

DEPARTMENT OF WATER AFFAIRS & FORESTRY (2010): Code of Practice: Volume 8. Dry Sanitation Systems. General Guidelines.

DRFN (2011): History. Internet: http://www.drfn.org.na/about/history/ (31.10.2011)

ENVIRO OPTIONS (Pty) Ltd (2011): Concept. How it works. Internet: http://www.enviro-loo.com/index.php?option=com_content&task=view&id=15&Itemid=30# (22.11.2011)

GAGNON, A., N. KIDANE and S. LAPOINTE (2005): Improvement of Sanitation in 5 Rand. Okahandja.

HILL, T. and R. WESTBROOK (1997): SWOT analysis: It's time for a product recall. Elsevier Science Ltd. Great Britain, Long Range Planning Vol. 30 (1): 46-53.

HOFMANN, E. (2010): Zum Monatsende sieben Milliarden. In: Allgemeine Zeitung. Internet: http://www.az.com.na/lokales/zum-monatsende-sieben-milliarden.136802.php. (02.02.2012)

KELLE, U. and S. KLUGE (2010): Vom Einzelfall zum Typus. Fallvergleich und Fallkontrastierung in der qualitativen Sozialforschung. In: BOHNSACK et al (2010) (edit.): Qualitative Sozialforschung. Wiesbaden.

KLEEMANN, F. (2011): Otji-Toilets for peri-urban informal households. Omaruru.

LAMNEK, S. (2005)[4]: Qualitative Sozialforschung. Basel.

LEGAL ASSISTANCE CENTRE (2005): Our land we farm. Internet: http://www.lac.org.na/projects/lead/Pdf/landwefarm.pdf (18.11.2011)

Lutchminarayan, R. D. (2007): Sanitation, water and hygiene in eThekwini Municipality, Durban, South Africa.

MALAN, J.S. (1998): Die Völker Namibias. Göttingen. Windhoek.

MARITZ, N. and M. A. WIENECKE (2006): The Design of the Habitat Research & Development Centre (HRDC). Windhoek.

MINISTRY OF AGRICULTURE, WATER AND FORESTRY OF NAMIBIA (2008): Water Supply and Sanitation Policy. Windhoek.

MINISTRY OF AGRICULTURE, WATER AND FORESTRY OF NAMIBIA (2009a): Namibia National Sanitation Strategy 2010/11 – 2014/15.

MINISTRY OF AGRICULTURE, WATER AND FORESTRY OF NAMIBIA (2009b): Namibia Sanitation Situational Analysis Report (2009).

NAMIBIAN WEATHER (2011): Namibian Weather. Internet: http://weather.namsearch.com/wxtempdetail.php (17.11.2011)

NATIONAL PLANNING COMMISSION SECRETARIAT (2001): Namibian 2001Population and Housing Census. URL: http://www.npc.gov.na/census/index.htm (02.02.2012)

NATIONAL PLANNING COMMISSION (2003): Final Report Namibia. Internet: http://www.npc.gov.na/publications/census_data/Final_Report_Namibia.pdf (23.07.2011)

OECD (1991): The DAC Principles for the Evaluation of Development Assistance.

RAITHEL, J. (2006): Quantitative Forschung: Ein Praxiskurs. Wiesbaden

REUBER, P.and C. PFAFFENBACH(2005): Methoden der empirischen Humangeographie.

SCHNELL, R., P.B. HILL and E. ESSER (2008): Methoden der empirischen Sozialforschung. München.

STAUFFER, B. and D. SPUHLER, (2011): Pit Latrine. In: Sustainable Sanitation and Water Management Toolbox. Internet: http://www.sswm.info/category/implementation-tools/water-use/hardware/toilet-systems/pit-latrine (22.11.2011)

STOCKHOLM ENVIRONMENT INSTITUTE (2009): The EcoSanRes Programme. Internet: http://www.sei-international.org/publications?pid=1516 (02.02.2012).

UHLENDAHL, T., D. ZIEGELMAYER., A. WIENECKE, A., MAWISA, M. L. and P. PISANI (2010): Water consumption at household level in Windhoek, Namibia.

SUSANA (2011): Sustainable Sanitation Alliance. Internet: http://www.susana.org/ (02.02.2012)

UNIVERSITY OF COLOGNE (2002): Digital Atlas of Namibia. Internet: http://www.uni-koeln.de/sfb389/e/e1/download/atlas_namibia/e1_download_climate_e.htm#annual_rainfall (18.11.2011)

UNDP (2011): Goal 7: Ensure environmental sustainability. Internet: http://www.undp.org/mdg/goal7.shtml (21.12.2011)

WHO (2011): Types of drinking water sources and sanitation. Internet: http://www.wssinfo.org/definitions-methods/watsan-categories/ (01.11.2011)

WIENECKE, A. (2006): Sanitation in Namibia. HRDC (ed.) Windhoek.

WIENECKE, A. (2007): The HRDC and Alternative Sanitation Systems in an Arid Country, Paper for the Strategic Management of Wastewater and Sanitation Conference. HRDC (ed.) Windhoek.

WIENECKE, A. (2008): Study Tour to Aranos, Gibeon and Mariental 13-15 May 2008. HRDC (ed.) Windhoek.

WITZEL, A. (1982): Verfahren der qualitativen Sozialforschung. Überblick und Alternativen. Frankfurt am Main.

Annex 1: Questionnaire

Questionnaire ID:	Project Name:	Household No:	Time:
Location:	Date:	System:	Gender:

1. General Aspects

1.1 Do you use this toilet? ☐ Yes ☐ No

1.2 Who owns the toilet? _____

1.3 How many persons live in your household? ____ (Number)

and how many of these are small children? ___ (Number)

1.4 Does everyone in your household use the toilet? ☐ Yes ☐ No

If not, why not? _____

1.5 Did you pay for the construction of the toilet? ☐ Yes ☐ No

If yes, how much?_____ (Nam Dollar)

1.6 How far do you have to walk to the toilet? ____ m

2. Planning and Training

2.1 Have you been trained in... ... using the toilet ☐ Yes ☐ No

... cleaning the toilet ☐ Yes ☐ No

... repairing the toilet ☐ Yes ☐ No

2.2 Were these trainings helpful? ☐ Yes ☐ No

2.3 Before construction, did they ask what you wanted? ☐ Yes ☐ No

If yes, in which way: _____

2.4 Do you know how the whole toilet system works? ☐ Yes ☐ No

3. Constructing

3.1 Are you able to construct the toilet by yourself?
- ☐ Yes, with guidelines/instruction manual
- ☐ Yes, with instruction from experts
- ☐ No

3.2 Have there been problems during construction? ☐ Yes,_____ ☐ No

3.3 Did you work on the toilet to make it better? ☐ Yes ☐ No

If yes, in which way? _____

3.4 Is the toilet high enough? ☐ Yes ☐ No

3.5 Is there enough space inside the toilet? ☐ Yes ☐ No

3.6 Is the toilet used for other purposes? ☐ Yes ☐ No

3.7 Is there enough light inside during daytime? ☐ Yes ☐ No

3.8 How do you cope without light at night? _____

4. Usage of facilities

4.1 Is your toilet shared with other persons? ☐ Yes ☐ No

If yes, who _____

4.2 Do you explain guests how to use the toilet? ☐ Yes ☐ No

4.3 Did you have problems? ☐ Yes ☐ No

If yes, what kind of problems?_____

4.4 How do you wash your hands?_____

4.5 Are there problems that someone throws wrong things into this toilet? ☐ Yes ☐ No

If yes, what _____

5. Maintainance & Repairing

5.1 Is someone in your community responsible for checking the toilet? ☐ Yes ☐ No ☐ No idea

5.2 Has anything of the toilet ever been broken? ☐ Yes ☐ No

If yes, what ?_____

If yes, who repaired it? ☐ Household ☐ Nobody ☐ External

5.3 Do children affect the toilet when they play? ☐ Yes ☐ No

5.4 Did somebody ever destroy something on the toilet? ☐ Yes ☐ No

If yes, in which way? _____

6. Cleaning

6.1 Who cleans the toilet?

- ☐ One member of the household (☐m/☐f)
- ☐ Employees
- ☐ Everyone in the household is responsible
- ☐ Community is responsible
- ☐ Responsibility not organised

6.2 What are you using for cleaning the toilet?

☐ Brush/scrubber/Cloth ☐ Water ☐ soap ☐ handy andy

6.3 How often is the toilet cleaned? ☐ every ____ days

6.4 Is your toilet clean enough for using?

- ☐ Yes
- ☐ More or less
- ☐ No

7. Cleanout **no system incl. Containers ☐**

7.1 Do you know who is responsible for changing the bins? ☐ Yes ☐ No

If yes, who_____

7.2 Can you change the bins on your own? ☐ Yes ☐ No

7.3 Is one bin full at the moment? ☐ Yes ☐ No

If yes, how much time did it take? _____ months

7.4 Has it been changed already? ☐ Yes ☐ No

7.5 Who changed it? Household ☐ nobody ☐ external ☐

7.6 Do you know who is responsible for emptying the bins? ☐ Yes ☐ No

If yes, who? _____

7.7 How much are you paying for emptying the bins? _____ Nam$/time

7.8 Do you put ash inside the toilet to prevent smell? ☐ Yes ☐ No

On farms:

7.9 Do you use the waste as fertilizer? ☐ Yes ☐ No

7.10 If not, in which way is it disposed/used? _____

7.11 Concerning UDS: What happens to the liquids? _____

8. Acceptance

8.1 Before the toilet was constructed, were you happy without it? ☐ Yes ☐ No

8.2 Which are the advantages and/or disadvantages of the toilet? _____

_____

8.3 Is the toilet easy to use? ☐ Yes ☐ No

8.4 Does it smell? ☐ Yes ☐ No

8.5 Are you afraid using the toilet at night (rape, robbery)? ☐ Yes ☐ No

If yes, in which way?_____

9. Environmental conditions

9.1 Did rains or flooding ever affect the toilet? ☐ Yes ☐ No

If yes, in what way? _____

9.2 Is it too hot ☐ or too cold ☐ inside the toilet? ☐ Yes ☐ No

10. Desires for Improvement

10.1 Do you have any ideas for improvement of the toilet (technical, physical, ….)?

_____

10 .2 Which toilet system do you prefer?

☐ Flush ☐ Otji ☐ VIP ☐ Pit latrine ☐ Bush/Bucket

☐ Other_____

Why? _____

10.3 For what purpose is that pipe? (→ UDS)_____

Comments:

Annex 2: Framework Expert Interviews (general issues)

1. Introduction

Responses will be treated confidential, findings will be presented anonym.

Is it ok to record the interview?

1. Personal Background of interviewee

1.1 Which function do you assign related to the sanitation sector?

2. General Aspects of dry sanitation in Namibia:

2.1 Referring to your experience, what are prominent challenges related to DSS?

2.2 Which are the advantages and disadvantages of dry sanitation systems in Namibia?

2.3 Which dry sanitation system is most adequate for Namibia?

2.4 Which factors are essential for the long term success of dry sanitation systems in Namibia?

2.5 Do you know, if the facilities were used for not intended purposes?

3. Preliminary Research Issues:

3.1 Natural Conditions:

Does Namibia has specific natural conditions which make dry sanitation systems favorable in this country?

3.2 Cultural aspects:

Which role do cultural aspects play for the functioning of dry sanitation?

3.3 Technical and maintenance aspects:

Which problems occur relating the construction and maintenance of dry sanitation systems?

What is the best way to provide handwashing facilities linked to dry toilets?

3.4 Financial aspects:

Which financing instruments are most appropriate for the implementation and cleanout of DSS?

Who should have the property rights of the facility?

3.5 Management aspects:

3.5.1 Keyfactors which definitely must be considered during the planning phase?

3.5.2 Who should be responsible for the construction, maintenance and cleanout of the facilities?

3.5.3 How should the participation of the users be organized?

3.5.4 How many people should use one facility in maximum?

4. Impacts

4.1 Are dry sanitation systems creating new jobs? (e.g. Cleanout service, construction service)

4.2 What are the risks of using dry sanitation systems in Namibia?

4.3 Are there any differences between the functioning of dry sanitation between urban and rural areas?

Annex 3: Framework Expert Interview (focus on projects)

1. Introduction

Responses will be treated confidential, findings will be presented anonym.

Is it ok to record the interview?

2. Personal Background of interviewee

2.1 Which function do you assign related to the sanitation sector?

2.2 Are you involved in any dry sanitation projects?

2.2.1 What is the intension of the project?

2.2.2 How many toilets were implemented in this project?

2.2.3 Where have these facilities been implemented?

2.2.4 Which institutions/project partners were involved?

In the following part of the interview we will mainly focus on the different phases of implementation of the sanitation systems. Later on we are interested in your general experience concerning dry sanitation systems in Namibia.

3. Project Information

3.1 General Aspects

3.1.1 Property rights: _____

3.1.2 Project financed by: _____

3.1.3 How much were the cost for implementation of one facility?_____ (Nam$)

3.2 Planning & Training

3.2.1 How many people are supposed to use one facility?

3.2.2 Have users been involved during the planning phase?

3.2.3 Did you conduct workshops with the users concerning sanitation systems?

3.2.4 Have the users been trained in...

... using the facilities	☐ Yes	☐ No
... cleaning the facilities	☐ Yes	☐ No
... repairing the facilities	☐ Yes	☐ No

3.3 Constructing

3.3.1 Have members of the community/household been involved in the construction process?

3.3.2 Are hand washing facilities constructed? ☐ Yes ☐ No

3.3.3 Were there any problems referring to the construction of the facilities?

3.3.4 Who financed the construction?

3.3.4 Which materials were used for construction of the facilities? _____

3.4 Usage of the facilities

3.4.1 Do the users have to pay for using the facility? ☐ Yes ☐ No

If yes, how much? _____ (Nam$/time period/ System)

3.5 Maintenance

3.5.1 Who is responsible for maintaining the facilities? _____

3.6 Cleanout **no system incl. Containers ☐**

3.6.1 Who is responsible for the cleanout of the facilities?_____

3.6.2 Who is paying for the cleanout service?_____

3.6.3 How much are the costs for cleanout service? _____ ($N)

3.6.4 How much time does it take to fill up one of the containers? _____ months

3.6.5 For how long are the excrements dried out? _____ Months

3.6.6 Which tools are used for the removal of the dried matter? _____

4. General Aspects of dry sanitation in Namibia:

4.1 Referring to your experience, what are prominent challenges related to DSS?

4.2 Which are the advantages and disadvantages of DSS in Namibia?

4.3 Which dry sanitation system is most adequate for Namibia?

4.4 Which factors are essential for the long term success of DSS in Namibia?

4.5 Do you know, if the facilities were used for not intended purposes?

5. Preliminary Research Issues:

5.1 Natural Conditions: Does Namibia has specific natural conditions which make dry sanitation systems favorable in this country?

5.2 Cultural aspects: Which role do cultural aspects play for the functioning of dry san?

5.3 Technical and maintenance aspects: Which problems occur relating the construction and maintenance of dry sanitation systems? What is the best way to provide handwashing facilities linked to dry toilets?

5.4 Financial aspects: Which financing instruments are most appropriate for the implementation and cleanout of dry sanitation systems? Who should have the property rights of the facility?

5.5 Management aspects:

5.5.1 Keyfactors which definitely must be considered during the planning phase?

5.5.2 Who should be responsible for the construction, maintenance and cleanout of the facilities?

5.5.3 How should the participation of the users be organized?

5.5.4 How many people should use one facility in maximum?

6. Impacts

6.1 Are dry sanitation systems creating new jobs? (e.g. Cleanout service, construction service)

6.2 What are the risks of using dry sanitation systems in Namibia?

6.3 Are there any differences between the functioning of dry san. between urban and rural areas?

Comments:

Annex 4: Observation Guideline

Date:
Observer:

Project Title:
Year of Implementation:
Number of implemented toilets:
Number of working toilets:
System:

Number of the toilet:
Location / Coordinates:

Interview possible?
Toilet not in use on a long run? (Why?)
Owner presently not available (Why?)

General Details

- Distance toilet to house (in m):
- Handwashing (tap or bin):
- Toilet with lock?
- Leaflet inside the toilet?
- Container facing north?
- Water supply (pipe or borehole):
- Distance borehole to toilet (in m):
- Illumination installed?

Cleanness
(1 = clean, 2 = more or less clean, 3 = dirty)
Water bucket inside the toilet:

Odour
(1 = strong, 2 = more or less, 3 = no odour)

Damages of the toilet

- Missing / damaged material (roof, door, wall, toilet):
- Ventilation system: 1. Missing, 2. Damaged
- Toilet seat installed?
- Toilet full?

Reasons for damages

- Vandalism
- Wind/ rain / flooding
- Technical problems
- Cleanout