CUVEwaters integrated water resources management

Participatory empirical research on water and sanitation demand in central northern Namibia: A method for technology development with a user perspective

Jutta Deffner and Clarence Mazambani

CuveWaters Papers, No. 7

Imprint

Prepared by
Institute for Social-Ecological Research (ISOE)

General Editor
CuveWaters research co-operation
www.cuvewaters.net

CuveWaters Papers present results from ongoing research work in the project 'Integrated Water Resources Management in Central Northern Namibia, Cuvelai-Etosha Basin – CuveWaters'. The joint project is funded within the programme "Integrated Water Resources Management (IWRM) including the Necessary Technology and Know-How Transfer" of the Federal Ministry of Education and Research (BMBF).

Distribution
Institute for Social-Ecological Research (ISOE)
Hamburger Allee 45
60486 Frankfurt/Main, Germany
Download: www.cuvewaters.net

Frankfurt/Main, September 2010

The Research Partners

Institute for Social-Ecological Research (ISOE)
Dr. Thomas Kluge (Project Head)
Hamburger Allee 45, 60486 Frankfurt/Main, Germany
Tel. ++49 (0) 69 707 6919-0
E-mail: cuvewaters@isoe.de

Technische Universität Darmstadt
Chair of Water Supply and Groundwater Protection
Prof. Dr. Wilhelm Urban
Chair of Wastewater Treatment Technologies
Prof. Dr. Peter Cornel
Petersenstrasse 13, 64287 Darmstadt, Germany
Tel. ++49 (0) 6151 16 2748
E-mail: w.urban@iwar.tu-darmstadt.de
E-mail: p.cornel@iwar.tu-darmstadt.de

Namibian Partners:
Desert Research Foundation of Namibia (DRFN)
German Technical Cooperation (GTZ)
Ministry of Agriculture, Water and Forestry (MAWF)
And other Namibian ministries, institutions and organisations

Contact in Namibia: Water Desk Coordinator (DRFN)
Tel. ++264 (0) 61 377 500

SPONSORED BY THE
Federal Ministry of Education and Research

Table of Contents

Abstract

Improvements in water infrastructure in developing countries are of major importance for achieving access to clean water. CuveWaters, a research based IWRM project, currently underway in Namibia, is testing different technical options to de-centralise water supply and upgrade sanitation. The Cuvelai Basin is affected by highly variable precipitation, mostly saline groundwater and a lack of perennial rivers. Water management is characterised by strong dependency on a water pipeline. Finding ways to improve the situation calls for a good grasp of the local situation regarding water utilisation patterns. Technologically sophisticated concepts can easily clash with users' socio-cultural needs and everyday behaviour as well as their understanding of planning and maintenance. A demand-responsive approach has therefore been developed. It combines a qualitative socio-empirical perspective with participatory planning. This paper discusses method development, empirical application and results. The approaches aim is to support mutual learning as a basis for a sustainable change process.

Acknowledgements

The authors wish to thank their colleagues Mary Seely and Konrad Goetz for the fruitful comments and discussions. We also want to thank Komeine Nantanga, Alex Moses, Dasius Nelumbu, Patrik Klintenberg, Petra Moser-Nørgaard, Thomas Kluge, Steffen Niemann, Marius Mohr and Manuel Sturm for their discussion on and improvement of the empirical work, all the community members participating in the empirical assessments for their frank contributions, time and patience during the workshops, and Nickey Marais and Sabine Kielinzcuk for the preparation of the drawings and architectural models.

1 Introduction[1]

'If you really want to know how things are, just try to change them' (Kurt Lewin, 1958)

Integrated water resources management (IWRM) in semi-arid regions such as central northern Namibia aims to improve people's living conditions and livelihoods by focussing on water supply and management. A holistic interpretation of management involves individuals not only in their roles as representatives of political or administrational organisations and institutions, but also as everyday players, namely users of water in households, families, neighbourhoods and communities within their social networks. In applying the Dublin principles of IWRM (GWP, 2000) to the social-ecological problems of water management, it is crucial to guarantee the participation of those individuals in the research and implementation process. In our view many technology oriented development projects lack such participation especially where it is needed to understand private water use, sanitation and the existing patterns of water supply and water use in private households. Participatory approaches are often aimed at integrating the user perspective but this is not always obtained with adequate empirical methods. Therefore the objective of this paper is to show the development and application of a demand-responsive approach for community participation for implementing new technological options within an IWRM process. The specific emphasis lies on private water users as core beneficiaries of the implementations. The approach wants to identify the most appropriate sustainable technologies for water and sanitation management under the local conditions of the model area. With this focus CuveWaters conducted participatory empirical assessments of the user perspectives on supply, demand and management of water and sanitation in 2007 and 2008. The empirical work on water and sanitation at user level was not just a question of gathering data from informants but a shared process of investigation, learning and information exchange with the community.

This paper has also the aim to give a critical review of the used method after the first phase of application. Further we want to give outlines for adaptations in the projects' context and a wider frame.

2 Model area and focus of research

2.1 Central Northern Namibia as study area

The Iishana sub-basin, part of the Cuvelai-Etosha Basin in central northern Namibia, is the model area for the research-based IWRM project CuveWaters. The project focuses on introducing into the region alternative means of water and sanitation supply, waste water treatment technologies and sanitation practices. Purpose is to improve the livelihoods of the inhabitants and reduce the dependency on only one water source. Among other technology options of the project, it is intended that demonstration plants for rainwater harvesting in a rural/peri-urban context and along with sanitation upgrading and waste water treatment in urban informal settlements are being tested.

[1] Comments by Dr. Mary Seely and Konrad Goetz are gratefully acknowledged.

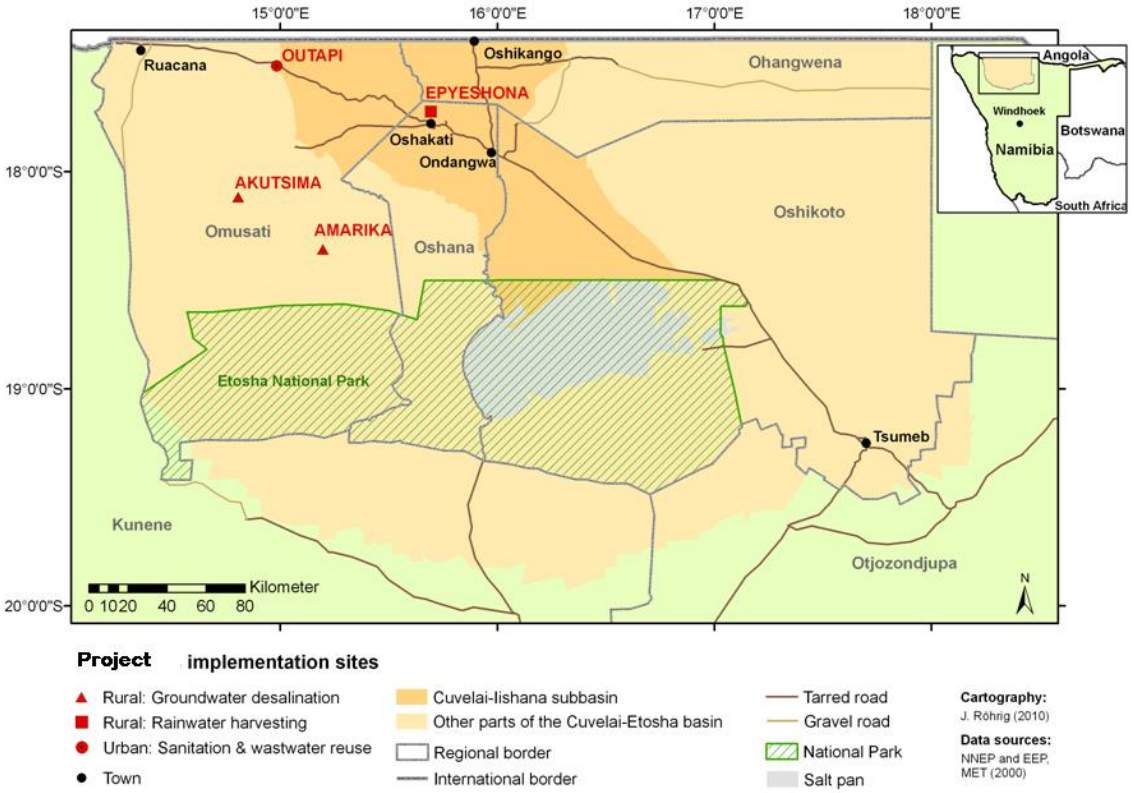

Figure 1: Map of the Cuvelai-Iishana sub-basin in central northern Namibia, showing Epyeshona village and Outapi town.

The Namibian central north is one of the most densely populated areas in Namibia, with rapid urbanisation (Mendelsohn and El Obeid, 2001) and migration towards the water grid (Klintenberg, 2005). Fresh water is provided by a water pipeline which originates from the Angolan-Namibian border river Kunene. Endogenous water resources in rural areas comprise water shallow temporal rivers and lakes during the rainy season (oshanas) and hand-dug wells (omifimas). The region is exposed to very variable rainfall during the months November to April (between 300 and 600 mm per year) (Mendelsohn et al., 2000, 9; Niemann, 2000, 72) and is subject to a level of evaporation which is five to six times higher than the rainfall.

The situation within the last years shows the variability in its extremes: in 2007 rainfall was very low, the region was flooded while in February and March 2008 and 2009 and, due to ongoing high rainfall, declared to be under a state of emergency. One consequence of the flooding – in addition to making people homeless – was the increase of diseases such as diarrhoea, cholera and tuberculosis due to poor sanitary conditions.[2]

Groundwater resources are scarce, mostly saline and not potable.[3] People in the rural areas mainly live on farming livestock such as cattle and goats, and growing pearl millet (mahangu), their staple food. People in urban or peri-urban settlements still remain in contact with their villages and tend to be employees or run small-scale businesses and market stands. But un- and underemployment is very common and so the financial resources of households are often very restricted.

2 For example see articles in Allgemeine Zeitung 3.4.2008 or New Era 3.4.2008.

3 More information about the climatic & geologic water situation e.g. Mendelsohn, 2000; Kluge et al., 2006.

Ongoing population growth, further urbanisation and the possible effects of an upswing in Angola's economy may well lead to more severe water stress for the region's inhabitants and livestock. In addition the effects of climate change are likely to increase to the overall water scarcity.

2.2 Model sites and project setup

The project CuveWaters is working on different model sites. To enhance a multi-resource mix in water supply, the project's aim is to implement adapted technologies in three different site types: rural, without water grid; peri-urban, with water grid and urban, with water grid but no adequate sanitation. At the rural sites decentralised solar-thermal groundwater desalination for improving water supply for human consumption and subsurface water storage for improving water supply for cattle will be piloted. At the peri-urban site rain water harvesting techniques for gardening will be introduced. The urban sites are settlements in different stages of formalisation. Water supply and sanitation facilities will be piloted here. This paper deals with the empirical research in urban (Outapi) and peri-urban (Epyeshona) settlements.

The project is divided in three phases. The initial phase (2007-2009), of which we report here, aimed to prepare and adapt the different technology options to local circumstances. During the implementation phase (2009-2012) the technical facilities will be constructed, tested over two years and their use will be monitored. Afterwards the diffusion phase aims to adapt and further disseminate the technologies in the region and Southern Africa.

For the peri-urban model site the village of Epyeshona was chosen in accordance to the local water supply intermediate called DWSSC.[4] It is a village located approximately 10 kilometres north of Oshakati (see fig. 1). The village consists of about 80 households, with an estimated 640 residents. The settlement is formed in the typical traditional style: homesteads with wood palisade fencing, huts made of wood, brick or corrugated iron with a mixture of zinc or thatched roofs, a kraal, and granaries and millet fields in close vicinity to the homesteads. There is always a distance between the homesteads. The village in general is surrounded by plain semi-arid grasslands for herding cattle and water-filled oshanas during the wet season. The village has three communal water points nearby. The longest distance from a household to a water point is about one kilometre. During the last years, approximately 80% of the households in the village were able to afford the installation of private taps. Additional water sources are the nearby oshanas during the rainy season, hand-dug wells and an excavated earth dam approximately 2.5 kilometres away. There is no advanced sanitation in the village.

Evululuko, an urban informal settlement in Oshakati was first chosen as model site as it was in a current formalisation and transition process. The impacts of the flooding during the rain season in beginning of 2008 made it necessary to look for an additional model site which was found in Outapi (100 km west of Oshakati, 70 km to the Angolan border). Outapi has about 4'600 inhabitants (Outapi Town Council information). In Outapi three settlements were selected in consultation with the town council. These were namely 1) Shack dweller Federation, 2) Tobias Hainyeko and 3) Onhimbu. Shack Dweller Federation is a self build formalised neighbourhood of low income earners built from 2004 on. Since 2008 62 houses were built with around 200 inhabitants. The houses fulfil a standard plan of half/full brick houses with kitchen, bathroom and varying numbers of bedrooms. The houses are not connected to water pipes or sewage lines. The water has to be collected from water points of neighbouring informal settlements. The inhabitants of Shack Dwellers earn a living by tailoring and selling grilled meat, fruits and snacks. Tobias Hainyeko is an informal settlement with around 145 households and about 900 inhabi-

[4] DWSSC: Directorate of Water Supply Sanitation Coordination

tants. The number of households is growing. The houses are mainly zinc huts, sometimes brick with zinc roofs. There are two pre-paid water points in the area and one private tap. There are several public latrines and six eco sanitation toilets in the neighbourhood, but only two of the latrines were working. People use the bush frequently. The inhabitants are mainly underemployed and live from selling grilled meat, fruits and snacks. The third settlement, Onhimbu, is an older but also informal part of Outapi. It is estimated that about 600 to 1000 persons live there. The settlement is inhabited by traders from Angola selling goods on the local open market and local inhabitants who run small businesses. The area is serviced by 5 communal pre-paid water meters and 15 private taps. There are only a few private latrines in the area and some of them are non-functional, so the majority of the inhabitants use the bush. Some households have electricity.

Figure 2: Typical street and small house garden in an urban informal settlement

Figure 3: Traditional homestead in Eyeshona village

2.3 Research questions

The main questions for adequate technology adaptation and implementation are:

- How the residents perceive the new technologies in sanitation and water supply?
- How do the new technologies have to be designed to fit best the needs of the users?

Therefore a fundamental aim of the research team was to gain a holistic understanding of people's livelihoods and living circumstances in the pilot sites. For that understanding an empirical basis had to be gained to what kind of infrastructure the households have access to and how the payment for water services compares to payment for other services. Further the local residents' everyday patterns of water utilisation and sanitation were of interest.

3 Method development and approach

3.1 Challenges of combining qualitative and participatory methods

Two perspectives led the choice of empirical methods: On the one hand it was the need to understand everyday routines and the social reality of water issues faced by urban and rural inhabitants with scarce resources. On the other hand it was the necessity to integrate principles of participatory methods in the research process in order to meet one core of the Dublin principles laid down for IWRM processes in 1992 (GWP 2000).[5] The methodological rethinking of the empirical procedure therefore focussed on a combination of qualitative social-empirical and participatory planning methods. At the beginning of the process, the compatibility of these methods were discussed by the research team. We identified three main areas of substantial deviation from the typical qualitative research design as very often conducted in the European context:

First, the co-existence of qualitative exploration and participation: the approach should include community participation from the very first empirical steps. Participation was seen to be absolutely crucial for technology implementation. In qualitative research designs, however, participatory approaches are usually separated from an open and interpretative investigation to develop hypotheses. Second the willingness to pay: The above-mentioned research questions imply a qualitative approach. Examining people's willingness to pay for new water services is often investigated with standardised, preference-analytical methods such as choice experiments (conjoint) (e.g. Stoveland and Bassey, 2000; Cookson, 2003). They require a clear picture of possible pricing, which was not yet the case at this stage of the project. Third 'hard facts': this aspect was about how to subsequently work with data that was derived from this interpretative method but from a non-representative sample of people.[6]

---

[5] The four Dublin principles formulated at the UN Conference on Environment and Development are to treat fresh water as finite resource, to be water management participatory on all levels, to consider the women's key role in managing and safeguarding water and to see water as an economical good.

[6] For instance, people would be asked how much water they use on average for different purposes and they would give approximate amounts in litres, or in terms of containers which can be converted into litres.

3.2 Qualitative research focus in development studies

Qualitative social science research methods can be adapted to different situations. They provide iteration and the exploration of everyday routines, and address the interviewees as everyday experts in an interactive situation. The main functions of our approach are:

- The interviewees are allowed to respond in their everyday language and in an open, preferably natural conversation atmosphere. This way, social reality is described in the words of everyday actors, and not in categories defined by the researcher, as is the case with standardised survey methods.
- Furthermore, the gathering of empirical data takes place in an everyday context and not under laboratory-like conditions. This means that responses can at all times be interpreted within the context and situation.
- A creation of interaction within a trustful atmosphere aims to stimulate questions and discussion. Not only cognitive but also emotional statements are accepted to account for the symbolic dimension of socio-technical systems.

Qualitative investigations are often carried out in development and health studies (e.g. Thomas et al. 1999, Patton 1990), to accompany other studies or surveys (e.g. Denzin/Lincoln 1994, Stadler et al., 2008).

3.3 Participatory methods in a socio-empirical context

Participatory assessment and planning methods (PLA) enjoy internationally widespread use (Chambers 1994). During the last 20 years European administrations have recognised the need for participatory methods in urban and environmental planning, transport and zone planning, tenant participation or vision development (e.g. Davidoff 1965, Arnstein 1969, Bischoff et al. 1995).

When it comes to understanding participatory learning and planning in international development projects, the role of participatory methods is to involve community members, enable them to undertake situation analyses and develop goals for the improvement of their livelihoods. Examples of investigations are stakeholder processes (Brown et al., 2002, Poolman, 2006), community mappings and planning. In Namibia this is visible in the nationwide Participatory Poverty Assessments (PPA) conducted for the Namibian government (e.g. Uibis Site Report, 2005/2006; SIAPAC, 2006). In recent years, participatory planning methods have been frequently used in water resources management in particular (e.g. Lammerink et al., 1999; Poolman, 2006).

The amount of effort put into PLA/PPA methods in relation to the return gleaned from them is a subject of frequent debate (Lammerink 1999). There is also general criticism of the effects and results of such appraisals (an overview is given in Brown et al., 2002). Another open question is how to deal with criteria such as validity and reliability.

But experience shows the information and data derived from such methods to be of considerable relevance, providing insights into people's everyday patterns and socio-economic situation.

3.4 Demand-responsive approach and study design

3.4.1 Describing the demand-responsive approach for community participation

In the initial phase of the IWRM project the demand-responsive approach consisted of three steps. The first step was the appraisal/assessment of living conditions: Main objective of this

step is to gain a mutual understanding and transparency of problems (focused on water issues) in the community. The second step was the recapitulation of assessment and introduction of new technology options: Main objective was to discuss options and gain first impressions of perception and acceptance. The community re-plans the proposed options and makes recommendations for their further development. The third step starts again with a recapitulation of the discussion and proceeds with updated information on the options. Main objective is the discussion of management, operation, acceptance and transparency issues.

All further steps belong already to the implementation phase of the project. In follow up workshops the more detailed institutional issues will be decided jointly (community/ project). Also the monitoring and evaluation process and capacity development measures during the implementation will be introduced to the community. Figure 4 shows the steps of the demand-responsive approach.

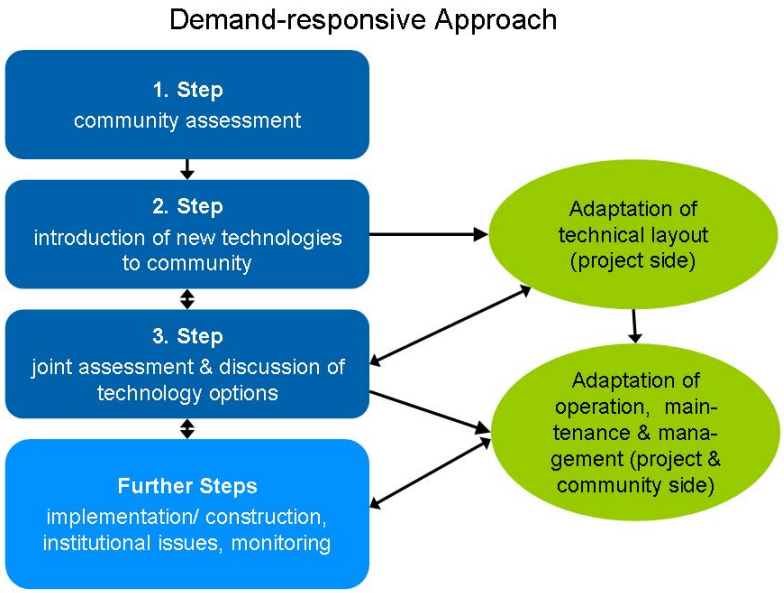

Figure 4: Demand-responsive approach in its steps

The first step started with initial community workshops in each location, applying a set of tools which is shown in an overview (see table). After analysing the first workshop results the research team jointly decided how the second series of empirical workshops would be conducted. Additional tools were developed to obtain and clarify information from the communities (recapitulation function) and to explain more clearly and discuss the new technology options with the participants. The focus of the second series of workshops was on finding out the level of acceptance and understanding of the technical options, along with concerns and needs for further adaptation and capacity development (see table). The first and second workshops were three months apart.

Table: Set of empirical tools and methods used for the first two steps (assessment and technology presentation)

Tools for Situation Assessment		**Method**
1. Area Mapping (Village/neighbourhood mapping) Inventory: water services/resources, sanitation facilities, other infrastructure		Group exercise with big paper sheets, mapping with different materials
2. Uses and Quantity of Water Water uses, amounts used, conservation techniques		Facilitated collection on big paper sheets, group discussion
3. Water Quality for Consumption Evaluation of water quality, reasons of perception of water quality, knowledge of purification process		Facilitated work with individual assessments (stickers), written statements on cards, group discussion
4. Types and Uses of Sanitation Facilities (urban) Existing types of sanitation facilities, opinions, preferences		Facilitated work on big paper sheet, group discussion
5. Payment for Water Services and other Costs For which water services do people pay, how much, relation to other living costs		Facilitated work on big paper sheet, preference to pay with individual assessment (stickers), group discussion
6. No Water for 24 hours Water resources used if there is no water? Prioritisation of water for different purposes		Facilitated work on big paper sheet
Excursion through area (urban)		Excursion with some participants showing the surroundings
7. Own ideas for improvement Which ideas of their own do people have to improve water supply, water quality, water use and sanitation?		Group discussion for agreement on main problems, individually written statements on cards, clustering by facilitator
8. Opinions on proposed options and possibilities		
Individual Water Supply and Sewage System (urban): Overall opinions, discussion about advantages, disadvantages, possible problems **Washing House** (urban): Overall opinions, discussion about advantages, disadvantages, possible problems	**Rain Water Harvesting Techniques** (rural): Actual practice of rain water harvesting, experiences, attitudes, opinions, advantages, possible problems	Poster drawing of technology options, individual cards with opinions, question and answer session group, discussion

Tools for Technology Discussion		**Method**
1. Review of first workshop results and validation of information (urban + rural)		Facilitated group discussion
2. Opinions of participants on the single elements of the washing house (urban)	**2. Opinions of participants on the single elements of the roof rainwater harvesting (rural)**	Presentation of architectural model, question and answer session with engineer, group discussion Group work for drawings of an optimised washing house
3. Opinions of participants on wastewater treatment (urban):	**3. Opinions of participants on the single elements of the rainwater ground catchment (rural)**	
4. Distance from washing house to households (urban) Preferable distance from washing house	**4. Excursion walk** (rural) Set up and possibilities of rural homesteads	Facilitated excursion, group shows possible areas, guided by participants
	5. Excursion walk (distance from ground catchment to households) (rural): Preferable distance	
5. Payment for services provided by the washing house (urban) Obtain idea of the costs for using the services provided by the washing house		Facilitated discussion about basis of calculation, individual cards with frequency of utilisation of services
6. Willingness to use products from the wastewater treatment (urban) To determine the people's willingness to use recycled water and biogas		Individually written statements on cards, clustering by facilitator, discussion
7. Institutional framework of the washing house (urban) Institutional issues: sustainability, maintenance, repair, security, payment organisation, cleaning; ideas of responsibilities of washing house	**6. Institutional framework for rainwater ground catchment** (communal/ group of private owners/etc) (rural): institutional issues: sustainability, maintenance, repair, security, responsibilities	Facilitated group discussion
8. Institutional framework for the wastewater treatment (urban) (See 7)		
9. Garden survey (urban) Samples of garden, grown fruit/vegetables, importance of gardening		Excursions in groups covering transects, guided by participants

3.4.2 Study design

Adapting the approach to the situation at hand partly involves adjustment of empirical methods to the circumstances of an informal settlement or traditional rural village. The demands of bilingual field work and working with people who are possibly illiterate means, that the rules of representative examination cannot be applied as standard.

Via an iterative and discursive process in the research team we arrived at the following integration of participatory and qualitative approaches: input from Namibian colleagues relating to their experiences of PPA in Namibia included information on a mix of instruments (tools) and suggestions for different forms of facilitation and interaction within workshop groups. In addition they conducted pre-tests in Namibian locations[7] and supervised appropriate visualisation of the technical details of water supply options. Furthermore – as local practitioners – they conducted the facilitation of the workshops. The German colleagues provided input concerning qualitative method requirements, advised on operationalisation and differentiation of research questions and their focus, and made sure that the technical-engineering questions (TUD/IGB[8]) of the project were reflected.

Workshop participants were invited by the chairperson of the CDC (community development committee) or WPC (water point committee) to ensure a good access to the communities. The participants needed to be knowledgeable and representative in age and gender of their community. The requisite information included not only the technical side of the water system, but also cultural questions and everyday patterns of the users involved. Most of the participants took part in all empirical phases. In each location approximately 20 to 40 community members participated.

The workshops were recorded and documented on paper, flipcharts and photos. The participants were able to use their local language (Oshiwambo). English translators were present for the German team members. Most of the participants were literate.

4 Results and discussion

In the following we will highlight results and interpretations of the participatory workshops. The aim is to evaluate if the tools led to a shared understanding of the routines in water use, perceptions of the current situation and the newly discussed technologies as we raised the issues identified in the research questions. The discussion includes the following aspects:

- Understanding the inhabitants perception and history of the neighbourhood
- Rationale of water utilisation
- Needs concerning sanitation
- Challenges of investigating perceptions and acceptance of new technology options
- Benefit of the assessment for the communities

Overall the choice of workshops as instrument for the empirical work was favourable in two respects. Firstly as a working environment to which the participants were accustomed due to their meetings in the CDC or WPC. Secondly, as it embedded the participants in their social setting of neighbours, relatives etc., it did not create an artificial situation.

---

[7] Two pre-tests: indoor pre-test with employees of the research institute and in an informal neighbourhood of Katutura, Windhoek, Namibia.

[8] TUD: Technical University Darmstadt, Water Supply and Groundwater Protection; IGB: Fraunhofer Institute for Interfacial Engineering and Biotechnology

4.1 Understanding the inhabitants perception and history of the neighbourhoods

The area mapping served to find out how the participants live in and perceive their neighbourhood. The mapping combined cognitive geography and PLA methods. The focus was on water sources and sanitation facilities but included other infrastructure and facilities, such as markets, schools and bars. The community mapping produced an overview of where services and opportunities are situated and who uses and knows them. The map also elicited further information on the settlements history. For example, why many of the communal taps are out of order or closed (due to non-payment), the fact that the few functioning ones have very restricted opening hours, and how many people generally use one specific communal tap. While mapping, participants explained that private taps are often used by more than one household. It became clear, that a community garden started by the non-governmental organisation (NGO) in the 1990ies was abandoned because of pests but also because the management and institutional frame was not adjusted to the user needs. Also it provided the research team with an overview of people's common understanding of the settlement. Even though the exercise was not designed to provide a complete inventory survey of technical water infrastructure (taps, toilets, pipes), it turned out that for the participants it was an opportunity to learn about the development of their location.

4.2 Rationale of water utilisation

Discussion of water consumption and quality included several steps. The participants were asked to write down and discuss their opinions on various water sources and to rank those. There were no general differences between rural and urban water utilisation. Based on estimations provided by the participants it was possible to calculate an approximate household water consumption, which ranged on average from 35 litres per day and person (urban; n=20 persons) to 39 litres per day and person (rural; n=30 persons).

It was clear at both sites (urban and rural) that the main acknowledged source of water is tap water. But the mix of water resources varies, depending on the season, expenses and due dates for these expenses (e.g. ploughing, school fees) and the socio-economic situation of the family. Although all participants clearly expressed their awareness that private taps offer the healthiest water quality, they frequently admitted to using less purified water. Here the benefit of the method is very clear: these differentiations would and could not have been recorded properly if a standardised survey had been the method. During further questioning on this topic more and more people revealed that they regularly use water from the canal or earth dams for laundry and body hygiene to save money. The discussion also emphasised well known gender aspects of water use. Women have the most responsibilities for housework and therefore for using and managing water and its cost.

Surprising perceptions concerning water quality also demonstrated another positive aspect of the method: on the urban site the communal tap was perceived to provide water of a much poorer quality than that of the private taps. We discovered that none of the disadvantages referred directly to the water itself. They encompassed broader deficiencies of communal taps such as payment modalities, queues and the water price being judged as high. Another surprising result from the discussions was that rainwater quality was ranked just below the one from private taps, even though it is not yet widely used.

A central weak point of gathering data on water quantity was that people had to estimate the amounts of water they use for different purposes. Generally speaking, and this is an internationally known fact from qualitative and quantitative surveys, people do not know how much water they consume, even if they know how much they pay for it. This emphasises the mostly non

valid data in standardised surveys on that topic. Another weak point was that the participants wanted to give an average amount of water used in all households (as a sort of community agreement) and not the water amounts used in the single households. Also the listed water uses turned out to include uses which were relevant to only very few people/households. Examples are water for flushing toilets or making ice cubes for selling. In retrospect, it would have been more effective to simply let the participants individually estimate the amounts of water used without first listing uses included in these estimates.

These findings show that symbolic perceptions clearly influence the rational assessment of a resource.

4.3 Finding the hidden needs concerning sanitation

It was clear that all urban settlements suffer from insufficient and inadequate sanitation. The participants at the several sites had different views on whose responsibility the situation is. Where shared VIP toilets are provided (Evululuko, Tobias Hainyeko and Onhimbu settlement) it is seen as the municipalities duty. In Shack Dwellers it is seen as a private issue. During the assessment of the sanitation situation explicit or implicit reasons as to why the situation is not adequate were revealed: Private flush toilets would be preferred everywhere, but because of water consumption and sewage installation costs the majority of the participants was aware that they are far too expensive. Even VIP toilets are expensive, compared to pit latrines, and incur follow-up costs when the tank needs to be emptied.

In Evululuko for example previously existing knowledge on how to build functional and durable toilets faded away among the residents. It was a big problem for the community to sustain the knowledge on construction techniques for the VIP toilets (ventilated improved pit latrine) introduced in the 1990s by the NGO Oshakati Housing and Sanitation Improvement Project (OHSIP). The individuals who were trained eight years ago moved away or deceased. Security also evolved as a concern. Sanitation facilities located on the plot are preferred, because leaving the plot during the night is perceived as dangerous, especially for women (and probably children). Using even a simple sheltered pit latrine or a 'flying toilet'[9] on the plot is preferred to leaving the plot for a shared VIP toilet. In addition, the shared VIP toilets are often misused and not cleaned or maintained regularly. That situation all in all contributes to the fact that using the bush (which is the open space in the settlements) to defecate and urinate is very common.

By using more than one tool to explore the perspective of the community members towards sanitation, the usefulness of the qualitative approach becomes obvious: sanitation is a very intimate topic to talk about. Only by offering more than one setting (discussion, ranking and excursion) was it possible to collect and discuss the different interconnected issues and viewpoints.

4.4 Challenges in investigating perceptions and acceptance of new technology options

The tools to present and discuss the new technology options introduced by the project were used mainly during the second assessment workshop series and deepened in the follow-up meetings. To give a picture of the options being considered we describe them briefly at the beginning of each site discussion (see also Deffner et al., 2008).

[9] A flying toilet is a simple plastic bag which is used during nights and disposed in the bush afterwards.

4.4.1 Urban site

Three options for improvement of the sanitation situation were introduced via poster drawings (fig. 5) and architectural models (fig. 6). The concept was modified between the workshops and derived finally in a concept for each settlement in Outapi:

- (1) For neighbourhoods which already have some sort of zoning plan the individual connection to water pipes and a vacuum sewage system is preferable (Shack Dwellers).
- (2) For neighbourhoods in a medium formalised status (Tobias Hainyeko) small washing houses, so called cluster wash houses to be shared by three to four families, could be a solution.
- (3) For neighbourhoods in a dynamic transition status with a high fluctuation of residents, a bigger washing house serving around 250 inhabitants could be an efficient upgrading (Onhimbu).

At Shack Dwellers settlement a water supply system to each plot is necessary to provide water for taps and toilets in the already prepared bathrooms. A vacuum sewer collects the waste water and leads it to a decentralised treatment plant. For the user households the vacuum sewer system offers the same advantages as a normal individual sewage system. The advantage is that water consumption costs and costs for excavation works are lower.

As intermediate solutions two variations of shared sanitation facilities, called washing houses, were proposed. In Tobias Hainyeko settlement cluster washing houses for three to five households could offer a toilet, shower, tap and laundry place in close vicinity to the user households. In Onhimbu a bigger washing house for about 250 users was proposed in analogous design to the public toilet facilities at the open market in Outapi. In addition the washing house could offer showers and laundry places.

The waste water treatment plant processes sewage water into bio gas and purified water instead of dumping the sewage in the commonly used oxidation ponds, where the water evaporates while a deep sludge accumulates on the bottom of the pond over the years. The purified water is rich in nutrients and can be used for gardening/farming.

Figure 5: Poster used to explain the water purification process and the alternatives of sanitation infrastructure in a settlement (drawing by Marais, 2007)

In Shack Dwellers settlement the main concern was that there is no water supply yet and no agreement between the municipality and the Shack Dwellers Federation who will build (and pay) water pipes. The members were very eager to build the water pipes themselves so that they would be prepared for the new system. The participants in Tobias Hainyeko discussed among themselves that individual water supply and sanitation would be the most preferable solution. But neither the condition of the houses and huts nor the economic status of the households allows realisation. The shared use of the cluster wash units was seen as the next best improvement, despite its compromises. In Onhimbu understandably the users too – if costs would play no role – would prefer private bathrooms. Because of the situation of high fluctuation of residents in this settlement the workshop participants pointed out that the main benefit is for traders and other persons who do not live constantly in Onhimbu.

During the discussion with the participants the research team wanted to reach an understanding of the possibility of stepwise upgrading. In the project viewpoint the washing house can be an upgrade with a medium-term perspective (e.g. for 10 years). It can be seen as a transitional solution open for development. This was difficult to communicate to the participants, because people's period of residence in the urban area is often shorter so that they do not know whether they will still be living there or not.

The presentation of the architectural models (e.g. fig. 6) showing the basic functions of the washing house was very successful and highly appreciated by the participants. The groups eagerly modified and completed the design during the sketching exercise (see table). This provided very useful information, especially on the privacy and safety needs of the users, and for further design and management of the house. Especially the current situation of women is perceived as being so bad that any improvement should begin here.

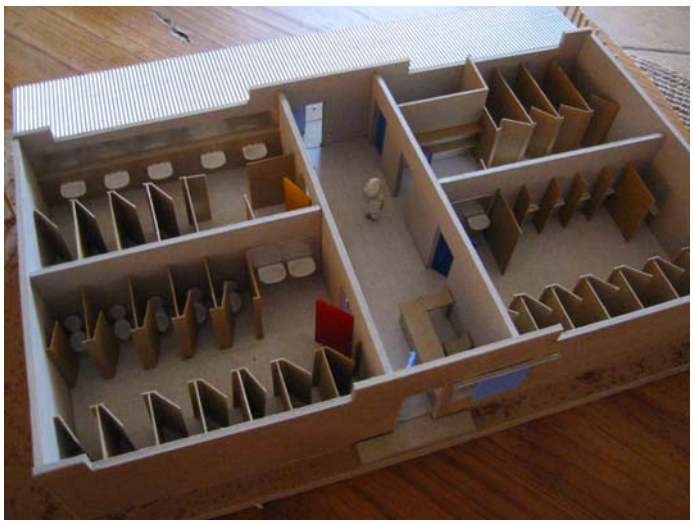

Figure 6: Architectural model of the washing house (assembled by Kielinczuk)

Overall, the costs of the services provided in the washing house was the main issue with regard to the potential number of users and the distance people would walk to use the services. In this respect, the discussions during these tools closed the 'loop' of understanding and showed the difficulty of investigating willingness to pay. For example laundry is currently judged as being 'for free' for many inhabitants in informal settlements. They do their washing at the water canal even if it is far to walk. The willingness to pay for improved laundry facilities is very low.

A fruitful tool was the cost exercise: frequencies of using the services were provided by the participants based on average water cost. It became obvious that taking a shower would be the most popular service after fetching tap water. Using the toilet was, on average, only the third highest use. That refers again to safety: using the washing house during the night is perceived to be too dangerous.

In the discussions about payment, metering techniques and management of the washing house it became obvious that the technical development process was not yet detailed enough to propose good options for discussion. On the other hand, more detailed technical planning was not yet possible because of missing data, e.g. how many people would use the washing house. This contradiction was addressed through estimations.

This experience led to the development of implementation issues for all sites afterwards. They address ownership, user needs and expectations, technical capacity of staff, maintenance, institutional arrangement and security, upfront and long-term costs and, if needed, energy requirements and easiness of relocation of the facilities.

There was no clearly expressed acceptance of using the recycled water from the waste water treatment plant for fertilisation. Very few people have experience with small gardens so that the benefits and duties of gardening with additional water for irrigation were not apparent. From the project's side it was clearly emphasised that the recycled water will not be potable. Nevertheless, some people said that they would use the water for human consumption. Unmistakable information and social marketing strategies about potentials and risks will be important during the implementation phase.

4.4.2 Rural site

The rainwater harvesting options proposed in the rural community were roof and ground catchment techniques (fig. 7 and 8). The ground catchment system is comprised of e.g. a cemented inclined surface with a mostly sub-surface water reservoir to hold and protect the rainwater. The two techniques incur an initial outlay for gutters, ferro-cement or brick tanks and the preparation of the surface and tank outlet or pumps. There are no high running costs after installation. To make a meaningful contribution to the livelihoods of the community, it is most efficient to use the harvested rainwater for gardening (small scale subsistence and for selling products on the market) and not as substitute for other water uses.

Figure 7: Architectural model roof rain water harvesting (assembled by Kielinzcuk 2007)

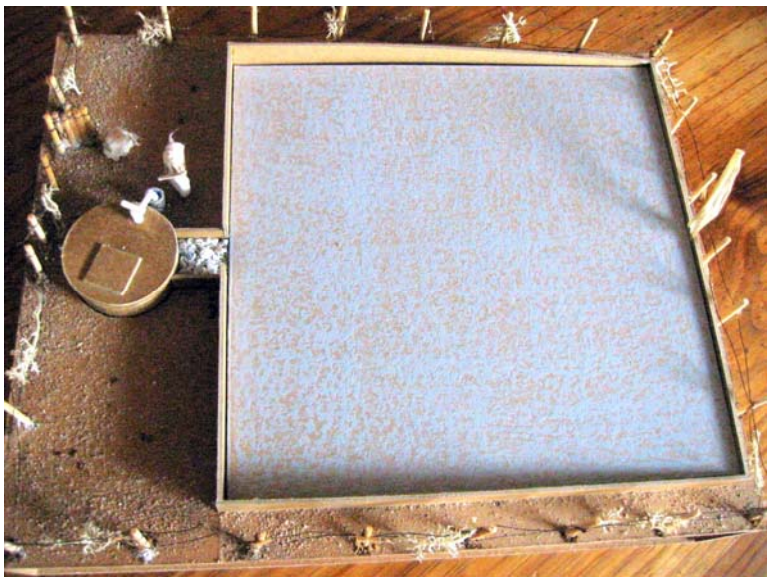

Figure 8: Architectural model ground catchment (assembled by Kielinzcuk 2007) (optional figure)

The community showed a very positive reaction and high interest for the rainwater harvesting technologies and the possibility to get engaged with gardening. During the workshops they worked out potential user households and the area where the communal ground catchment could be located. Besides this, it became clear that another concern of the participants was water for livestock. The community expected the project team to help solve this problem even though water for livestock lies not in the focus of the project at this site. The high initial outlay for starting rain water harvesting represents one of the main obstacles for the community members. The communication not only of the advantages but also of financing plans and possible funding sources must be included in further implementation efforts.

4.5 Benefits of the assessments for the community

The participants were very engaged and there was an open discussion on almost all topics. For the most part, group members neither avoided broaching intimate topics in general nor disregarded single opinions. The exceptions were topics such as the amount of money spent on alcohol in households or very personal questions on the frequency of body hygiene needs.

The first assessment generated insights on how the participants assess their situation and their access to water infrastructure. The problems identified during the first assessment on the rural and the urban sites referred mainly to the management of and payment for water services. It helped people clarify their expectations vis-à-vis the municipality (urban) and DWSSC respectively NamWater (rural). A frequent problem was the suboptimal communication and information flow between the municipal administration and the CDC. Most participants held the view that it is the municipalities' task to fix taps and toilets or to eliminate possible debts which lead to the closure of taps. The overall workshop process, but especially the 'own ideas for improvement'-tool, thus made communication problems explicit to the CDC and other community members. It also emphasised that the idea of an informed choice is only possible through conducting community workshops. On the other hand the political power of associations and CDC is in fact very small. Although sensitive and eager to participate in the project, they have no direct influence on basic decisions of the municipality to introduce the water supply and sanitation.

The rural group developed partial solutions for what they could do or would need to solve their problems in managing the water point. One example was their suggestion that a bike and an umbrella for faster and shaded work would help to reduce the burden on the water point cashier.

The communities expressed their appreciation of the information they received during the workshops. They also expressed their willingness to contribute to the construction with manpower. It was clear that they realised the economic options resulting from a possible implementation regarding job opportunities connected with the technical facilities and their construction. They also saw the chances to sell products being produced with the help of the new water sources. On the other hand it remains unclear as to what implications or degree of sensitivity the new or refreshed knowledge on everyday routines is going to develop concerning efficient water use. We believe that the community members learned about their own community on different levels, i.e. about the different health aspects of water purification, water quality, sanitation facilities, and rain water harvesting. The introduction and discussion of new technologies and the excursions provided insight into new perspectives and possibilities enabling informed choices.

5 Conclusions

The participatory investigations highlight crucial aspects of cooperation and communication between users, the community, administrations, and the project.

5.1 Perception of water management in the two model communities

Starting with the neighbourhood mapping the method served well for exploring the everyday routines of the water users and the prominence of social, socio-economic and cultural routines. An example is the interdependency of family feasts, seasonal water availability and money allocation (e.g. rain season → Christmas time→ due date of school fees). With the tools on water consumption and quality it was possible to identify symbolic assessments of water and access to it such as the example of ‘water quality’ of Evululuko’s communal vs. private taps show: the communal tap water is evaluated with ‘low quality’ because of poor tap water management and costs, not the water quality itself.

The participants found it difficult to develop a long-term perspective on their water management, related costs and the interdependence of water quality and their health situation. It was partially difficult to lead a fruitful discussion on payment due to the absence of alternatives for payment and water metering at the planned washing houses. In next steps empirical tests of different price alternatives could help identify the best accepted ones. Therefore during implementation we have to monitor the sensitiveness of the willingness to pay is connected to the consciousness of especially health benefits of using purified water. In addition we also have to observe how users perceive having more variety in their diet by having a small vegetable garden and having access to better sanitation conditions. The visibility of advantages for the families’ health situation is in our view a core point for social marketing in the implementation phase. General message will be to show that higher costs of the purified water or the use of the washing house etc. enhance their livelihoods in long-term.

Despite some limitations of the approach used, one general benefit is that the ambivalent situation of the water users becomes explicit: The charges for water services still do not enjoy a high level of acceptance as it was already shown by the Namibian Water Awareness Campaign (NAWAC, 2005). This not only results from poverty but is a consequence of free water services in pre-independence Namibia and the partially contradictory statements of local and regional politicians on the issue today. The details of this ambivalence can be set out as follows: The

understanding of water users that 'cheap' water incurs direct and indirect health costs is limited. To the community members the cost of water services is more important than water quality. It would therefore be important to follow up on the extent to which free water sources are used.

The deficits of sanitation do not only concern poor infrastructure. The empirical work made explicit that the management of the existing facilities is also poor. There is a weak awareness among users of how management could contribute to a better sanitation situation.

5.2 Methodological implications

Summing up the methodological implications of the experiences with the demand-responsive approach we conclude: The iterating planning and adaption during the workshop series helped to re-ask or re-discuss unclear topics. The focus on everyday life and routines made it possible to reconstruct social interconnections, e.g. the allocation of financial resources in certain cycles. The demand-responsive approach in this shaping process did not only prove the pure acceptance of new technology options but helped to enable the communities to participate and cooperate in the process of design and construction.

Some few tools resulted in repetitive answers, with little variation within the empirical instrument. For further participatory assessments some more experimental, interactive tools could be used to test the participants' opinions and to explore possible contradictions. The series of workshops effectively pinpointed the tools' limitations and served to refine methods for the participatory monitoring in the implementation process which now has started. For the communities it was difficult to understand the difference between research project (iteration and adaptation in a process) and development project with one clear aim, which is the implementation of improvements. Here again the workshop setting allowed discussion of those issues in contrast to e.g. a standardised survey.

5.3 Future implications

So what brings IWRM concepts to life on a private user's level? The demand-responsive approach did help to identify viable ways of improving the basic supply of clean tap water, offering a multiple resource mix for potable and non-potable water, and upgrading sanitation in informal settlements. Our basic concern is, that implementation in development projects often pays only little attention in advance to socio-cultural and institutional framings of new technologies. Here the demand-responsive approach offers stepwise tools to overcome such limitations.

The "fundament" for the construction and implementation of the new technologies is laid out: For the project team the needs of the users in an everyday context are visible as well as the "needs" in the realm of institutional and capacity development. Through such empirical work direct conclusions can be drawn on the acceptance of the new water sources, e.g. rain water. Also the communities came to mutual decisions, e.g. on how to share and manage the new facilities.

Therefore an in-depth analysis as described with the demand-responsive approach is necessary before a new technology is finally designed and constructed in place. In an iterative process users and stakeholders have to be part of the shaping of the technologies. Not till then can the implementation start.

The implications for policy-making are further that for mainstreaming a multiple resources mix on a national and international level a stronger demand-responsive approach is needed. This

includes a consecutive steering by social marketing for efficient water consumption and hygiene in such IWRM projects.

References

Arnstein, S. (1969), A Ladder of Citizen Participation, American Institute of Planners Journal, July, 216

Bischoff, A., Selle, K., Sinning, H. (1995), Informieren, Beteiligen, Kooperieren. Kommunikation in Planungsprozessen. Eine Übersicht zu Formen, Verfahren, Methoden und Techniken. Dortmund: Dortmunder Vertrieb für Bau- und Planungsliteratur

Brown, D., Howes, N., Hussein, K., Longley, C., Swindell, K. (2002), Participatory methodologies and participatory practices: Assessing PRA use in the Gambia (Paper No. 124 of the Agricultural Research & Extension Network AgREN), London, Overseas Development Institute

Chambers, R. (1994), The Origins and Practice of Participatory Rural Appraisal, World Development, 22(7), 953–969

Cookson, R. (2003), Willingness to pay methods in health care: a sceptical view, Health economics, 12, 891–894

Davidoff, P. (1965), Advocacy and Pluralism in Planning, Journal of the American Institute of Planning, November 1965, XXXI

Deffner, J., Mazambani, C., Klintenberg, P., Nantanga, K., Moser-Norgaard, P., Seely, M. (2008), Selected results from socio-ecological participatory situation assessments in two sites in Central Northern Namibia (CuveWaters Paper No 3. Prepared by: DRFN/ISOE) Frankfurt, Institute for Social-Ecological Research

Denzin, N.K., Lincoln, S.Y. Eds. (1994), Handbook of Qualitative research. Thousands Oaks, London, New Dehli, Sage

Global Water Partnership (GWP) (2000), Integrated Water Resources Management. TAC Background Paper Nr 4, Stockholm

Klintenberg, P., Christiansson, C. (2005), Improved access to water: an enemy in disguise? Drainage basin management – Hard and soft solutions in regional development (Report of the Stockholm International Water Institute), Stockholm, 267–268

Kluge, T., Liehr, S., Lux, A., Niemann, S., Brunner, K. (2006), IWRM in Northern Namibia – Cuvelai Delta (Final Report of a Preliminary Study, unpublished), Frankfurt, Institute for Social-Ecological Research

Lammerink, M.P. (1999), A detailed look at the PAD approach, PLA Notes (IIED), 35, 34–41

Lammerink, M.P. / Bolt, E., de Jong, D., Schouten, T. (1999), Strengthening community water management, PLA Notes (IIED), 35, 21–28

Mendelsohn, J., El Obeid, S., Roberts, C. (2000), A Profile of North-central Namibia, Windhoek

Namibia Water Awareness Campaign (NAWAC) (2005), What is behind the tap? Perceptions on affordability and willingness to pay for water services, Research Document, Windhoek

Niemann, S. (2000), Wasserversorgung und Wasserverwendung in Namibia. Nutzungstraditionen als Grundlage eines nachhaltigen Ressourcenverbrauches im ehemaligen Ovamboland. Hamburger Beiträge zur Afrika-Kunde, Hamburg

Patton, M.Q. (1990), Qualitative Evaluation and Research Methods. Newbury Park CA, Sage

Poolman, M.I., van de Giesen, N.C. (2006), Participation: Rhetoric and Reality. The Importance of Understanding Stakeholders Based on a Case Study in Upper East Ghana, International Journal of Water Resources Development, 4, 561–573

SIAPAC, National Planning Commission (2006), Draft Regional Poverty Profile Oshana Region (Prepared by: SIAPAC)

Stadler, J.J., Delany, S. & Mntambo, M. (2008), Women's perceptions and experiences of HIV prevention trials in Soweto, South Africa, Social Science and Medicine 66, 189–200

Stoveland S., Bassey, B.U. (2000), Status of water supply and sanitation in 37 small towns in Nigeria (Paper presented at the donor conference in Abuja), Kristiansand, Stoveland Consult

Strauss, A., Corbin, J. (1990), Basics of Qualitative Research: Grounded Theory Procedures and Techniques, Sage

Thomas A. Chataway J., Wuyts,M. (1999), Finding out fast: Investigative skills for policy and development. London, Thousand Oaks, New Delhi, Sage

Uibis, Gibeon constituency (2006), Uibis Site Report. Participatory Poverty Assessment for the Hardap Region (Prepared by: DRFN), Windhoek