MASTER

Prepaid water in Namibia
the impact of prepaid household water meters on the inhabitants and the municipality of Otjiwarongo

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Prepaid water in Namibia: The impact of prepaid household water meters on the inhabitants and the municipality of Otjiwarongo.

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Adri van Iersel: Brabant Water
When I heard from my supervisors about their contact with Brabant Water, who had a project on prepaid water meters in Namibia, I immediately knew I wanted to be on this project. Luckily they both agreed to let me go to Namibia for a research project. This led to this thesis, which is written for the fulfilment of the Master Innovation Sciences at the University of Technology in Eindhoven.

The three months I spent in Namibia were amazing. Every day I heard or saw new information on the topic and discovered more about Namibia, prepaid water meters and myself. It was great to talk to so many inhabitants and to see how they live over there. Also, I made some friends who showed me around, taking me to places where you would never go as a tourist. This complemented the tourist attractions I visited, which were also great, as Namibia is a very beautiful country. I learned a lot about doing research, poverty, Namibia, prepaid water meters and about myself. It was an experience I will never forget.

This thesis and this experience would not have been the same without the help of many people. First of all, I would like to thank my first supervisor Annelies Balkema. She helped me a lot during the whole process. She was very involved, came up with good ideas and solutions if I was stuck, made a lot of time for me to talk about the thesis and giving feedback, and she gave me the freedom to make my own decisions. Furthermore, my second supervisor, Henny Romijn, always motivated me with her great enthusiasm and helped me on some specific areas of the research. Also, I really want to thank Brabant Water for giving me this opportunity. I would like to thank Adri van Iersel in particular, as he arranged the contact and was of great help if I had questions.

Besides my supervisors, I also received a lot of help from people in Namibia. I would like to thank the municipality of Otjiwarongo for taking such good care of me, giving me a real warm welcome and providing a lot of information to me. A special thanks for Naudé Slabbert, for providing so much information and help. Also a big thanks to Almuth Goereses, as she helped a lot with arranging interviews and also was a great friend. Finally, a big thanks to Deon for being a great friend and helping me with the survey.

Finally, I would like to thank my friends and family. My family always supported me and made me laugh and relax in the weekends and on holidays. I also have many great friends, who made studying so much more fun. Especially Frans van Herwijnen, Willem Giesbers and Tanja Manders made sure working at the university was never boring. A special thanks goes to Frans, my good friend and fellow traveller. It was great that we could go to Namibia together. My experiences there would not have been the same without him: it was so much fun to travel and live together with him in Otjiwarongo, and it was also nice to discuss the research and all other topics that came to mind with him. Last but not least I would like to thank my boyfriend Yoush van Vlimmeren, who supported my decision to go to Namibia for three months, was great in discussions about the research, in cheering me up and gave me all the help and support I needed.

I hope you will enjoy reading this thesis,

Lisanne Saes
Eindhoven, February 2012
Namibia is a very dry country in Africa, where almost half the people live below the poverty line of US$1.25 a day. This is why supplying water at an affordable price is a challenge. Collecting payments is a challenge as well: with conventional water meters there were many unpaid bills and a total debt of over N$20 million (€2 million) (Municipality Otjiwarongo, c) The municipality of Otjiwarongo is one of the cities that started installing prepaid water meters on standpipes years ago, making people pay before use. Now, since a few years the municipality of Otjiwarongo also installed prepaid household water meters. This research wants to evaluate the choice for this intervention for both the users as the responsible institution. The research question is:

“What is the impact of prepaid household water meters in Otjiwarongo on the effectiveness and the efficiency of the municipality’s water supply and on the quality of life of inhabitants, and how can public participation contribute to improve the quality of life?”

There are two areas of the city where the municipality is installing prepaid household connections, both with different goals. The first is Orwetoveni where lower- and middle income households live. Conventional water meters are replaced for prepaid water meters in order to force people to pay, preventing more debts and recovering debts at the same time (as the municipality struggles with collecting money for services and from debts). The other area is the informal settlements where the poorest people live. Prepaid household water meters are used in this area to enable people to get a household connection, instead of using the (prepaid) public standpipes.

METHODOLOGY

First of all, the goals of the municipality were structured and evaluated, after which is seen in how far they reach their goals with the prepaid water meters: the effectiveness. Furthermore, it was researched how effective the prepaid water meter is in reaching this result, with the help of a cost-benefit analysis.

The impact on the quality of life is indicated by looking which features influence the quality of life and measure these factors. For formulating the factors which influence the quality of life the Millennium Development Goals were used: MDG 1, which looks at eradicating hunger; MDG 4 and 6, that look at improving health; and MDG 7 that is focused on giving people access to clean drinking water were selected, as changes in the water supply can influence the achievements of these goals. Additional literature was used to make the relation between the prepaid water meters and the goals more specific.

Furthermore, theory of Douthwaite was used to show how public participation plays a role in the implementation of this innovation, showing the importance of an increasing role for the users (the inhabitants) during the process of implementation.

DATA COLLECTION

First, a literature review was conducted. After this, three months of fieldwork in Otjiwarongo resulted in many observations, 100 surveys, 18 semi-structured interviews with inhabitants, more than 10 interviews with the municipality, and an interview with the water supplier Namwater. Furthermore, financial data over the past three years and a detailed map of the city were received from the municipality.

ANALYSIS AND CONCLUSIONS

The struggle between cost recovery and affordability is clearly present in Otjiwarongo. As the municipality has difficulties with collecting money for all services, they increased the water price to N$16/m³ (€1.60/m³) to
cover for other services as well. This, as well as the already high water price of N$8/m³ (€0.80/m³) that has to be paid to Namwater, causes their water price to be very high compared to other African countries. On top of this prepaid water meter users have to pay an even higher water price of N$25.64/m³ (€2.56/m³) to cover for the extra costs of this meter. Together this raises the price to a level that is unaffordable for many inhabitants: the poorest half of the inhabitants often already have problems with affording the minimum needed amount of 20 liters per person per day, and the recommended amount of 100 liters a day is far from affordable for this half of the population.

As many people are financially not able to pay off debt, to pay for services, to cover for the costs of a prepaid water meter or to pay more for water (on average they are already spending more than 10% of their income on water (part 6.3.3 and 7.3.3), while spending more than 5% of your income on water is already seen as being unaffordable(McPhail, 1993)), the investment of prepaid water meters cannot be earned back in these cases: no money can be recovered from people that do not have any. As the municipality invests in a prepaid water meter but does not receive any extra income from this, this is neither effective nor efficient. However, for people that can pay it but did not do this with a conventional water meter it could be efficient. For household connections in the informal settlement a national subsidy for installing the prepaid household water meters was needed as costs are not recovered in another way.

Many prepaid water users in the first area, Orwetoveni, are using less water than before to be able to afford water and debt payoff. This will harm their hygiene and health and has a negative effect on their quality of life. A positive point mentioned by them, however, is that they do claim to have more control over their water use (as they notice how often they have to buy more water, instead of getting high bills at the end of the month: part 6.6. For the second group, prepaid household meter users in the informal settlements, the results are more positive, as they do not have to walk to the standpipe anymore, saving them time and effort. However, normally when people get a household meter their water use more than doubles. This desirable effect was not found in this case, as high prices were still seen as a barrier for using more water. Furthermore, besides the amount of water used also the water quality is a health risk, as water quality often decreases when storing it in a bucket or jerry can. Prepaid water meters do not solve this problem.

Finally the public participation was researched. Although there is room for improvement, the municipality already gives the inhabitants most information and also complaints or question often end up at the municipality. So, the municipality sees the problems, but they do not always know how to act on it, how to solve it. From the model of Douthwaite follows that the users (inhabitants) should be more involved as the project develops. This means that by now, as they are in the stage of expanding the market, the goals should meet. However, this is not the case. The reason that the municipality still can expand without this is that it is a forced innovation, not a voluntary one. The discrepancy between cost recovery for the municipality and affordability again turns out to be the problem and this cannot be solved by only increasing public participation.

**RECOMMENDATIONS FOR AN IMPROVED WATER SUPPLY IN OTJIWARONGO**

First of all water has to be made more affordable for poor and vulnerable inhabitants. At the moment water is too expensive for them to afford minimum needed amounts of water. This harms their health and quality of life, and as a consequence also brings extra costs for healthcare to the country. Also, although people in the informal settlements with a prepaid household water meter benefit from this, the benefits of the household meter could be much bigger if the water would be more affordable. Then, the water use could really increase and not only time would be saved, but more diseases would be prevented as well.

Furthermore, installing prepaid water meters in Orwetoveni at households who cannot afford to pay their bills harms all parties involved while no one benefits: the municipality makes the investment without earning it
back, and the household either loses its water connection or starts paying, but has not enough money left for water and food. Therefore prepaid water meters are not a solution for poor and vulnerable people, like pensioners, and another solution has to be found for them. Therefore it is recommended to perform a study to lower the prices; by carefully looking at the income and expenditures of the municipality, discuss with Namwater if they can help lowering the price and asking help from the national government, as a better water supply would help them score better on the MDG focused on reducing child mortality and would save them costs on health care.

Also, it would be useful to state more specific goals, which can be measured and controlled. This way policy decisions can be evaluated more easily and the best solution can be chosen. Decisions could also be supported by these goals, making it clear to everyone where the decisions come from. Making the system and the prices more transparent to the inhabitants is also a part of this.
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<tr>
<td>CBA</td>
<td>Cost Benefit Analysis</td>
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<tr>
<td>CESR</td>
<td>Center for Economic and Social Rights</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>HDI</td>
<td>Human Development Index</td>
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<tr>
<td>IBT</td>
<td>Increasing Block Tariff</td>
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<td>IWA</td>
<td>International Water Association</td>
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<td>MAWF</td>
<td>Ministry of Agriculture, Water and Forestry</td>
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<td>MDG</td>
<td>Millennium Development Goal</td>
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<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
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<tr>
<td>NPV</td>
<td>Net Present Value</td>
</tr>
<tr>
<td>N$</td>
<td>Namibian dollar</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>SE</td>
<td>Strategic Executive</td>
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<tr>
<td>SWAPO</td>
<td>South West Africa People’s Organisation</td>
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<tr>
<td>TOT</td>
<td>Transfer of Technology</td>
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<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
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<tr>
<td>US$</td>
<td>United States dollar</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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1. INTRODUCTION

The focus of this research will be on prepaid water meters, whereby people have to pay before use. Many cities in sub-Saharan Africa as well as in other areas have started implementing this technology with the purpose of cost-recovery on their water supply. This technology, being a policy decision and therefore forced on the inhabitants is interesting from a theoretical perspective, since it is in between innovation theories and policy evaluations. Also, the impact from this technology on the municipalities and on the inhabitants is not clear yet.

In Namibia the prepaid water meter has been implemented in several cities already, like Windhoek, Swakopmund and Rehoboth. But where it used to be only applied at standpipes (public water access points) it is now expanding to prepaid household meters. The city Otjiwarongo tries to explore the possibilities of the prepaid water meter, being an example for other cities. The research will therefore focus on prepaid water meters in Otjiwarongo.

The municipality of Otjiwarongo signed a Memorandum of Understanding with Brabant Water NV, a public drinking water company in the Netherlands. Both parties agreed to share their knowledge, and Brabant Water would help the municipality with education and training of their personnel. Brabant Water also helped with this research, by providing knowledge to the writer and with financial support for the research.

An introduction to Namibia and to Otjiwarongo will first be given. After this, a problem definition will be given, which will lead to a research objective and a research question. Then, a research justification will be given, followed by the research boundaries. The definitions used will be discussed after this. And finally, an outline of the report will be given.

1.1. INTRODUCTION TO NAMIBIA

Namibia is a country in sub-Saharan Africa, located on the west coast, just above South-Africa (Figure 1-1). It has 2.3 million inhabitants (World Bank, 2010) and covers an area of 824,292 square kilometers (Nationsencyclopedia, n.d.), which is almost 20 times as big as the Netherlands. Thus, the population density of Namibia is extremely low, at less than three people per square kilometer. There are many different cultures in Namibia: over 60% of the population is either Ovambo or Kavango people, other groups are the Herero, Damara, Nama, Bushmen and the Caprivians. They all have their own language, but English is the official language of Namibia.
Namibia is a middle-income country, with a GDP of 12.2 billion US dollars (World Bank, 2010), approximately €8.8 billion\(^1\). The GDP per capita in US dollars is $5,330 (€3,838). Also, the annual growth rate of the GDP is 4.8%. However, the inequality in Namibia is very high. With a gini coefficient\(^2\) of 0.74, Namibia has the highest income inequality in the world (Nationmaster, n.d.). Thus, even though the country is relatively rich and has a good economic growth compared to most other African countries, most of the inhabitants of Namibia live in poverty. Almost half of the population lives below the international poverty line of US$1.25 (€0.90) per day (UNICEF, n.d.)\(^3\).

Namibia gained independence in 1990. From 1884 it was a German colony, after which it became under the South African rule (Namibia was called South-West Africa back then). After gaining independence a multiparty democracy was introduced, which is still in place. However, traces of their colonial and Apartheid past can still be seen.\(^4\)

Furthermore, Namibia is the most arid country south of the Sahara. Rainfall varies from an annual average of less than 50 mm in the Namib Desert to 600 mm in the Caprivi Strip in the north east of the country (Figure 1-2).

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1 Using an exchange rate of 0.72 (1 US$ = € 0.72). Calculated as the average exchange rate of 2011, from the monthly exchange rate averages (x-rates.com, 2011, a).

2 The gini coefficient is an index measuring the income inequality in a country. A perfect equal distribution of incomes would give a gini coefficient of 1. A complete inequal distribution gives a value of 0. At this moment, the best gini coefficient is from Denmark: 0.25. The average gini coefficient worldwide is 0.40

3 From another source follows that 35% lives below the poverty line of 1US$ a day (€0.72) and 56% lives below the poverty line of 2US$ a day (€1.44) (UNDP, 2005).

4 For example, in Otjiwarongo all white people still live in the city centre. Some black people also live in the city centre. But in the poorer areas and in the informal settlements everyone is black.
1.2. INTRODUCTION TO OTJIWARONGO

Otjiwarongo is a city of approximately 40,000 inhabitants (Otjiwarongo Municipality, n.d.) and is strategically located on a node of highways (Figure 1-3). Its location makes Otjiwarongo unique, because it is accessible from the North, East, South and West. According to Mr. Liebenberg, Senior Executive financial department, the best business opportunities for Otjiwarongo are in its location.

Otjiwarongo was established in 1892 by the Herero, making it one of the oldest towns in the country. In Herero language the word ‘Otjiwarongo’ means the beautiful place with the inference that cattle could get fat grazing in this area. This name is still appropriate, since Otjiwarongo has one of the biggest cattle-breeding companies in Namibia. In 1900 the first Germans settled in Namibia, and in 1906 some Ovambo and Damara
tribes came to Otjiwarongo. The diversity of Otjiwarongo is not limited to its people and cultures; it is also surrounded by different sceneries.

Even though there are only 40,000 people in Otjiwarongo, it is one of the biggest cities of Namibia (but smaller than Windhoek, Swakopmund and Walvisbay). It is also the capital of Otjozondjupa and the biggest business center for the Otjozondjupa Region. The most spoken languages in Otjiwarongo are Afrikaans and English. Other languages are German, Otjiherero, Damara-nama and Oshiwambo.

The municipality does not receive any structural financial support from the national government, because the national government only supports smaller towns. However, they can apply for money for special projects, like water supply and sanitation. Also, the unemployment rate of Otjiwarongo is estimated to be as high as 45 percent (Namibian, 27-04-2010).

The city Otjiwarongo can roughly be divided in three areas: Otjiwarongo (the city centre, high-income), Orwetoveni (low- and middle-income) and the informal settlements (very low-income). An overview of these three areas can be seen in Figure 4.

Figure 1-4: Otjiwarongo divided in three areas. Source: from maps.google.com.

1.3. PROBLEM DEFINITION

The municipality buys water from water company Namwater, which they sell again to the inhabitants. Namwater is the only water company in Namibia, and was founded to make the water supply cost effective. Before Namwater, the national government was providing water, making a lot of losses on it every year. Namwater so far succeeded in being cost effective. They are still government owned and have to get permission from Water Affairs every year for every water source they want to use and for the water price.

Cities can also choose to get their own water instead of buying it from Namwater. The municipality of Otjiwarongo, however, does not consider this an option for them, because the boreholes are too far away from the city, and costs for transportation would be very high (interview Naudé Slabbert, ).
The problem of the municipality is that many inhabitants are not paying, while they still have to pay Namwater. Therefore, they decided to install prepaid water meters in houses that regularly did not pay and had many debts (in Orwetoveni), making people have to pay before use. They already used prepaid water meters for some years on standpipes in the informal settlement. Now they want to expand the usage.

Short after this decision, the council of Otjiwarongo decided that standpipes, which are used in the whole informal settlements, are not good enough for people and everyone should get their own water connection. Because the municipality was afraid that money collection from this group would be hard, the prepaid water meter was claimed to be the only option.

Thus, the problem of people not paying for water in one area (Orwetoveni), and wanting to give people household connections in another area (informal settlements) will potentially solved by implementing prepaid water meters. The question now is if this is a good solution and what the side effects are. The municipality expects this solution to benefit them, but this was not carefully researched. Effects on the inhabitants are not being measured at all.

1.4. RESEARCH OBJECTIVE

The research objective is to identify what the impact from prepaid water meters on the municipality and its inhabitants is. More specifically the goal is to see in how far the municipality succeeds in improving the cash flow through prepaid water meters and in giving people household connections, and what the impact from the prepaid water meter is on the quality of life of the inhabitants.

It has been proven that public participation is very useful when implementing new technologies. Therefore, a second objective is to investigate the role for public participation: where is public participation present and how does this benefit the municipality and the inhabitants. And even more important, where is public participation lacking and how does this harm the municipality and the inhabitants.

1.5. RESEARCH QUESTION

Following from the problem definition and the research objective the research question is:

“What is the impact of prepaid household water meters in Otjiwarongo on the effectiveness and the efficiency of the municipality’s water supply and on the quality of life of inhabitants, and how can public participation contribute to improve the quality of life?”

There are two situations in which the municipality is installing prepaid household water meters. One is for people who used a conventional water meter before and is meant to make them pay before use. The other is for people in the informal settlements who used standpipes before and is meant to safe them the time and effort of walking to the standpipes for water.

From this follow five subquestions which will be given and explained next.

Subquestion 1: How did the effectiveness and efficiency of the municipality’s water supply change after the implementation of prepaid water meters for new uses?

This subquestion looks from the perspective of the municipality Otjiwarongo. First, it will be seen in how far they reached their goals, the effectiveness. Second, the amount of resources used for this will be investigated, looking how efficient the municipality is in reaching their goals.
Subquestion 2: How does the implementation of household prepaid water meters in Orwetoveni influence the quality of life?

Looking from the user’s perspective, the question is how the prepaid water meter affected their lives. In Orwetoveni one of the ‘new uses’ of the prepaid water meter has been implemented, where the conventional meters in several households have been replaced by prepaid water meters.

Subquestion 3: How does the implementation of household prepaid water meters in the informal settlements influence the quality of life?

This question is again from the user’s perspective, but now focusing on the other ‘new use’ of the prepaid water meter, i.e. household prepaid meters in the informal settlements, where people used standpipes before.

Subquestion 4: What forms of public participation are being used?

Before looking at the role public participation could play in helping both the inhabitants and the municipality, it should be clear what forms of public participation are already being used. Answering this subquestion will show which forms of communication between the municipality and the inhabitants are being used.

Subquestion 5: How could enhanced public participation help in avoiding and solving problems of the inhabitants and the municipality?

Zooming in on the communication between the municipality and the inhabitants and looking at literature on public participation, this subquestion will search for ways to improve public participation. It will look at the problems with prepaid water meters and with the water supply that are now present, and how public participation could help in avoiding or solving these problems.

1.6. RESEARCH JUSTIFICATION

The research has to be relevant both for society and for science. The societal relevance and the scientific relevance will be discussed here.

1.6.1. SOCIETAL RELEVANCE

This research will show how good a solution prepaid water meters are for debt recovery and for enabling household water connections. Research on prepaid water meters for standpipes has already been done, which is why the focus of this research will be on new uses of the prepaid water meter. The benefits and the disadvantages of the household prepaid water meter will be shown for different actors. The inhabitants, which are the users of the prepaid household meters, are obviously important actors. However, only looking at the inhabitants would not make clear what the consequences for the municipality are, leaving out the feasibility. Therefore, the perspective from the municipality will be included, looking at the feasibility of prepaid household meters. Then, looking at public participation and how this could improve helps working toward solutions for the city. By not only looking at the problems but also working towards solutions this research will be very relevant for Otjiwarongo. Moreover, since other cities in Namibia and even in other countries are expected to be in a similar situation, they might also benefit from this research.
1.6.2. SCIENTIFIC RELEVANCE

One important discussion in literature where this thesis will contribute to is the discrepancy of making water affordable for everyone and recover the costs at the same time. This study will show how they deal with this in Otjiwarongo, Namibia. Since water is very scarce in Namibia it is important that people value the water enough and do not waste it. At the same time there is a lot of poverty and water is a basic need and a basic right, so it should be available for everyone at an affordable price. It will be shown in this report if and how the city of Otjiwarongo could achieve both at the same time.

Moreover, this research will contribute to the literature on public participation, more specifically public participation in developing countries. It will add information on what the role for public participation is for forced instead of voluntary innovations. The prepaid household water meter is the ‘innovation’ in this case. But instead of convincing people to use it, like with most innovations, people are being forced to use it. The role for public participation will partly be the same, because if people are not convinced of the prepaid household water meter they will try to avoid or sabotage it instead of cooperating. But there are also differences, which will be shown in this research.

Furthermore, a combination of some Millennium Development Goals will be used to measure the quality of life (more information on this can be found in part 3.4). This research will show in how far the Millennium Development Goals are a good way of measuring the quality of life related to water.

1.7. RESEARCH BOUNDARIES

First of all, the research will be done for one selected city: Otjiwarongo. Where possible, comparisons with other cities will be made. But the interviews with inhabitants and the observations are limited to Otjiwarongo. However, many cities in Namibia and in other countries are facing problems with wanting cost-recovery on the one hand, and well-being for their inhabitants on the other hand. To a certain level, conclusions of this report can be expanded to other cities, which will be discussed in the conclusion.

Secondly, this research will only focus on new uses of the prepaid water meter, which are the prepaid household water connections, leaving out the prepaid standpipes. The reason that prepaid standpipes are excluded from this research is that the municipality of Otjiwarongo implemented prepaid standpipes already more than 5 years ago, making it hard for inhabitants to recall the situation before. Other reasons are that research on prepaid standpipes has already been done (McClune 2004; Dawson, 2010; Kumwenda, 2006; Coalition Against Water Privatisation, et al 2004; Anti Privatisation Forum, 2006), and the main constraints are therefore known, and this way more focus can be put on the prepaid household water meters. But even though the prepaid standpipe will not be compared to conventional standpipes, they will be compared to prepaid household connection. Therefore, information from prepaid standpipe users will still be collected and some insight on the problems with these meters will be given.

1.8. DEFINITIONS USED

From the research questions follow four important concepts that will shortly be discussed: Impact, effectiveness, efficiency, and quality of life.

**Impact:** With ‘impact’ only the short-term impact is meant, since the impact on the long term cannot be measured yet. What actually is being measured is the ‘output’. The ‘output’, following definitions from Grau (2008) measures the products, goods and services resulting from the intervention. The term ‘impact’
was still chosen, because the writer felt that the term ‘output’ might be misleading, being more associated with monetary output than with societal output. Also, the goal of this research is to see what changes already happened due to the prepaid water meter, to try and foresee what the (long-term) impact could be. Concluding, when talking about ‘impact’ the short-term impact on the intervention is meant, focusing on changes that occurred within 3 years after the implementation.

**Effectiveness:** This looks at how effective goals are being reached, i.e. in how far they are being reached. More information on this can be found in Chapter 3.

**Efficiency:** This looks at the amount of resources, including money, time and effort, that were put into the project. More information on this can be found in Chapter 3.

**Quality of life:** The quality of life is seen as the conditions under which people are living. In this research where water supply is the main point of focus, especially the health and water use of people are important factors of their quality of life. Again, in Chapter 3 this will be discussed in more detail.

### 1.9. STRUCTURE OF REPORT

The structure of the report will be the following. First, a more comprehensive description of the prepaid water meters in Otjiwarongo will be given, showing the kind of prepaid water meters they use and the decisions they made. Then, the research framework will be shown, followed by the data collection. After this the analysis starts. The first part of the analysis looks at the impact of prepaid household water meters for the municipality, including the effectiveness and the efficiency. The second part of the analysis looks at the impact on the inhabitants, first the inhabitants in Orwetoveni and then the inhabitants in the informal settlements. Then, the third part of the analysis is focused on public participation. The last chapter will present the conclusion and recommendations.
2. PREPAID WATER METERS IN OTJIWARONGO

This chapter will provide some background information on prepaid water meters in Otjiwarongo. It will start with looking at how prepaid meters work and comparing different types of prepaid water. Then, the different uses of the prepaid water meters will be discussed. After that, Otjiwarongo’s policy on prepaid water meters will be shown. And finally some other experiences with prepaid water meters will be summarized.

2.1. TYPES OF PREPAID WATER METERS USED IN OTJIWARONGO

The municipality of Otjiwarongo has used three different brands of prepaid water meters already. Before showing which types of prepaid meters they are using, a short introduction on how prepaid water meters work will be given.

2.1.1. HOW PREPAID WATER METERS WORK

A prepaid water meter is designed to only ‘open’ and let water go through if the user has paid. When the tag is put into the meter (Figure 2-1), the credit on the tag is read and, if there is sufficient credit on the account, water can be supplied. So, one part of the prepaid meter is a mechanical part: a valve that opens and closes. Furthermore, there is an electronic part (Figure 2-2). This part reads the tag, processes the credits on the tag, opens and closes the valve and shows the credits on the display of the meter. The electronic part is powered by a battery that needs replacement when it runs out. Finally, there is a cover keeping all these parts together.

The main problems with the mechanical parts are the wear and tear of the valve due to intensive usage, the offset of minerals from the water on it or extreme weather conditions, and the vulnerability to vandalism. Problems with the electronics are mainly the regular running out of the battery and malfunctioning of the display. But also malfunction or short-circuiting of electronics after being in contact with water occurs.

2.1.2. DIFFERENT TYPES OF WATER METERS

The municipality of Otjiwarongo uses prepaid water meters for three different cases:

- On standpipes: all standpipes have prepaid water meters. There used to be 30 standpipes, but his number was increased to 53 between 2004 and 2007 (Naudé Slabbert, Strategic Executive: Infrastructure & Technical Services, interview 17-06-2011, Appendix B8).
- For household meters in Orwetoveni (blue part in Figure 1-4): Around 2100 households in Orwetoveni have prepaid water meters. The rest of the people (the majority) have conventional water meters,
where they pay at the end of every month (Burgert Liebenberg, Strategic Executive: Finance, interview 17-06-2011, Appendix B7).

- For household meters in the informal settlements (red part in Figure 1-4): 50 households in the informal settlements have prepaid water meters. All others (over 12.000 people) are using the standpipes (which, as said before, are also prepaid) (Hilda Jesaja, mayor of Otjiwarongo, interview 05-07-2011, Appendix B10).

There is a difference between the way in which standpipe meters and household meters are operated. Standpipe prepaid meters only function when the tag is inserted in the meter. Once the tag is inserted the valve opens and water starts running out. Taking the tag out closes the valve and therefore stops the water flow. The remaining credit remains on the tag. On the other hand, household meters transfer the credit to the meter. Once the credit is on the meter the tap can be opened and closed, until the meter runs out of credit. Furthermore, there are small differences between the kind of tags used on different brands of prepaid water meters and how the tag should be inserted in the meter in order to work.

The municipality of Otjiwarongo has tried different types of prepaid water meters already. They started with putting Water Master prepaid meters on standpipes, which they did already before 2004. Then, between 2004 and 2007 they replaced these prepaid meters on the standpipes for the Microplan Tagmeter. In 2008 they started installing prepaid water meters in households in Orwetoveni, again these were the meter from Microplan Tagmeter. In 2010 the municipality decided to start installing household connections in the informal areas, also from Microplan Tagmeter. But in 2011 they started testing a new meter, the Kent meter, which should replace the Microplan Tagmeter in Orwetoveni. The standpipes will keep the Microplan Tagmeter, and the new household connections in the informal settlements will get the old Microplan Tagmeter that were replaced from households in Orwetoveni, to keep the costs lower and not throwing these relatively new meters away (Mr. Slabbert, Strategic Executive: Infrastructure & Technical Services, Appendix B1, B2). An overview of these developments and prepaid meters used is provided in Table 2-1.

<table>
<thead>
<tr>
<th>Standpipes</th>
<th>Before 2004</th>
<th>Water Master prepaid meters.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household meters Orwetoveni</td>
<td>Before 2008</td>
<td>All conventional meters.</td>
</tr>
<tr>
<td></td>
<td>After 2008</td>
<td>Around 2100 replaced by Microplan Tagmeter prepaid meters.</td>
</tr>
<tr>
<td></td>
<td>After 2011</td>
<td>Microplan Tagmeters prepaid meters will be replaced by Kent prepaid meters, and Kent meters will replace more conventional water meters.</td>
</tr>
<tr>
<td>Household meters informal settlements</td>
<td>2010</td>
<td>New Microplan Tagmeters prepaid meters installed in 50 houses.</td>
</tr>
<tr>
<td></td>
<td>After 2011</td>
<td>Old Microplan Tagmeter prepaid meters will be installed in approximately 2000 households.</td>
</tr>
</tbody>
</table>

The reason they got rid of the Water Master prepaid meter is that it had many technical malfunctions. One reason for going from the Microplan Tagmeter to the Kent meter is that they had issues with the local supplier, which makes ordering spares or new meters harder. Also, with the Microplan Tagmeter one tag can be used on every meter, instead of being allocated to one specific meter. This is considered a problem for the municipality, which will be explained in more detail in chapter 5. With the Kent meter it can be arranged that a
The municipality of Otjiwarongo is not the only one trying out different prepaid water meters. In Windhoek, for example, they have used five different prepaid water meters on the standpipes already, including also the Microplan Tagmeter and the Kent meter. They are also phasing out the Microplan Tagmeter and have the Kent meter already in use. At the same time, they also have the Efteq Teqnovo v2 in use, which is cheaper than the Kent Meter, but also has more technical problems (Mr. Brinkman, Head Engineer, Waste water ad Bulkwater, Windhoek municipality, interview 01-07-2011, Appendix B9).

2.2. POLICY ON PREPAID WATER METERS

Insights in the relevant policies of the municipality will be given in this chapter. First, the costs inhabitants pay for prepaid water meters will be given. Then, costs for repairing the meters will be discussed. And finally, the process of charging the tags will be explained. The information discussed in this part is obtained from interviews with the Senior Executives of the municipality Otjiwarongo.

2.2.1. COSTS FOR PREPAID WATER METERS FOR INHABITANTS

First of all, the costs of the standpipe prepaid water meters are covered by the municipality; inhabitants are obviously not paying for this.

For the prepaid household meters in Orwetoveni the paying system is more complicated. People with the biggest debts are forced to take prepaid water meters. They do not have to pay for this. If people have debts, but are not forced to take the prepaid meters because the debts are not that high, they can choose for a prepaid water meter at a subsidized rate. It is hard to set this price though, because the municipality does not want to encourage people to make higher debts in order to get the prepaid water meter for free (Mr. Liebenberg, Strategic Executive Finance, interview 17-06-2011, appendix B7). People without debts wanting a prepaid water meter have to pay the full costs, which is N$3,300 (€330)7.

Furthermore, people in the informal settlements wanting a prepaid household water meter can get this at a subsidized rate. They have to pay N$1,000 (€100) for this. For the first 50 meters the subsidy was still higher and therefore the cost for inhabitants was lower: N$500 (€50) (Hilda Jesaja, mayor of Otjiwarongo, interview 05-07-2011, Appendix B10).

Finally, all prepaid users have to buy a tag. They pay full costs for this: N$150 (€15) (Chris and Jackson, Technicians prepaid water meters, interview 06-06-2011, Appendix B3).

2.2.2. REPAIRING THE METERS

The municipality always tries to fix broken water meters within a day. There is one employee (Jackson) 24/7 available for receiving calls about broken meters and to fix them. His phone number is written on every

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6 A connection fee has to paid though. But since these people in Orwetoveni already had a conventional water meter for which they paid the connection fee, they do not have to pay for this again.

7 The price in euro’s will be given for every price mentioned. The exchange rate for the euro and the Namibian dollar, which is coupled with the South African Rand, is not always the same, but was in 2011 around 1-10. From: x-rates (2011, b).
standpipe (Figure 2-3) so people in the informal settlements know his number. In Orwetoveni people also seem to know who to contact if the meter is broken.

![Figure 2-3: Standpipe](image)

In the informal settlements the municipality fixes the prepaid water meters for free. They can, of course, not ask the around 250 users of every standpipe all to chip in if it needs to be fixed, and it is impossible to find out who broke the meter. In practice, it turns out that for the standpipes it often takes longer to get fixed. More information on this will be in part 7.3.2.

For the household prepaid water meters, both the ones in Orwetoveni and the ones in the informal settlements, the municipality fixes the meters for free if it is not the fault of the user that the meter is broken (for example if there are problems with the electronic part). However, if it is the fault of the user that some parts are broken, they have to pay the full amount themselves.

As for the tags, the system is the same. If they break because it is your own fault, you have to pay for it yourself; otherwise the municipality replaces it for free. The tags do not break often, but if they break it is mostly peoples own fault.

### 2.2.3. PUTTING CREDIT ON THE TAGS

There are two municipal offices where credit can be put on the tags: Orwetoveni office and the Satellite office. Orwetoveni office is located in the center of Orwetoveni and is open on working days during office hours. But they do close before 5, because they also need time for the administration at the end of the day. The Satellite office is also in Orwetoveni, but closer to the informal settlements. It is also open during office hours, but also on Saturday morning.

People bring their tag and a certain amount of cash to the office. Every amount can be put on the tag, in theory even N$1 (€0.10). The receptionist takes the tag and puts it in the scanner. Ms. de Klerk, working at this office tells she can then see if the customer has his own tap or uses a standpipe. In the first case she checks if

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8 And yes, even in this area everyone has a cellphone.

9 Jackson received a lot of phone calls and filled in forms at the Orwetoveni office every day (he showed it himself). Also, none of the people interviewed had problems with reaching Jackson or had a broken meter because they did not know where to get it fixed.
the person already paid for his debts of the months or not. If not, a part of the cash will go to debt pay off instead of new credit for water (Ingrid de Klerk, Supervisor of Orwetoveni office, interview 08-06-2011, Appendix B4). Then, the money is put away in a cash desk, the customer gets his tag back, the change (if any), and a receipt. The receipt shows how much money has been put on the tag, how much of this goes to debt pay off and how much water can be used. This takes around 2 minutes in total (Observations Orwetoveni office, 08-06-2011).
3. THEORY AND METHOD

In this chapter a discussion of the theory that helps to identify which data should be collected for answering the research question will be discussed. It starts with the basics of performing an impact analysis and an overview of the concepts we want to measure. After this the different concepts of this overview will be discussed, each leading to indicators or ways to measure this specific part. Finally, a conceptual model will be presented, showing the theories used for each concept and the relation between the concepts.

3.1. INTRODUCTION

The focus of this research is on the implementation of prepaid water meters in Otjiwarongo. Since the decision on the prepaid water meter was made by the municipality in order to achieve their goals, it was a policy decision. Therefore, literature on policy evaluation will first be discussed. However, since the prepaid water meter is also an innovation, innovation and learning theory will also be of importance. The prepaid water meter is also expected to have an important impact on the quality of life of the inhabitants. The role of water in the quality of life will be discussed later in this chapter. After discussing policy evaluations and innovation theory, an overview of the concepts that will be measured in this research will be given. Theories relating to those concepts will be discussed in the paragraphs after this one.

3.1.1. POLICY EVALUATION

Although the evaluation of policies happened for centuries, what is being evaluated and how it is evaluated changed over the years. In the sixties it was relatively simple, mostly looking at the economic factors. A common way of evaluating policies was to perform a cost benefit analysis. In the seventies this was expanded by including social and technical costs. And one decade later it became even more elaborate, including also broader societal effects (like the environment) (Gaillard & Bouwman, 2001). By allocating values to the social, technical and societal costs, they can be included in a cost benefit analysis and they can be compared to monetary costs. In this research no values will be attached to the non-monetary costs, but they will be included in the research. In other words, the perspective of this research will be broader than only looking at monetary costs and benefits, including also social and other costs and benefits. But they will not be compared to each other, by putting monetary values to the latter.

Besides these differences in what is included in the evaluation, differences in when and what to measure exist as well. The evaluation could be done before the new policy has started, trying to predict the feasibility of the project. It could also be used as a monitoring tool, during the implementation of the policy, to adjust it when needed and to check the progress. Another possibility is to evaluate after one or more phases of the policy implementation is completed, in which case the consequences for the target group or for the society as a whole will be determined (Gaillard & Bouwman, 2001). In this research the prepaid water meters are already implemented in many houses. Therefore, the last case applies to this research, determining the consequences for the target group.

3.1.2. INNOVATION THEORY

Innovation theories differ mostly by the roles they attribute to different actors in different stages of the innovation process. The transfer-of-technology (TOT) model looks at innovation in a linear way. According to this model scientists have a big role, determining research priorities and developing the technology before they introduce the technology to its potential users (Chambers & Jiggins, 1987). The model has been adapted and extended, e.g. in some cases putting feedback loops in this linear model. However, scientists still have a big say in most stages of the innovation process.
Later on, participation by the local population, the users, became more important, as well as continuous mutual learning by all stakeholders (Korten, 1980; Douthwaite, Keatinge, & Park, 2002; Uphoff, Esman, & Krishna, 1998). In a conceptual model of the innovation process Douthwaite (2002) shows how stakeholder participation changes during the innovation process (Figure 3-1).

![Figure 3-1: Participation during different phases of the Innovation Process. Source: Douthwaite (2002).](image-url)

In the beginning the users (in the model called ‘key stakeholders’) only have a small role, but they are being consulted already. After this the role of the users grows and that of the R&D team becomes smaller. The users learn from their own and from each other’s experiences and actions, adapting the innovation to their needs. It is only after this learning and adaption process that diffusion of the product takes place.

From this we learn that participation of the users of the innovation is very important. Therefore, this will be included in the research.

### 3.1.3. OVERVIEW OF CONCEPTS TO BE MEASURED

Taking these different ways of looking at the implementation of the prepaid water meter in mind, we go back looking at the subquestions of the research. From the subquestions several concepts that need to be measured appear: the effectiveness and efficiency of the water supply of the municipality; the impact on the quality of life of different inhabitants; and the role for public participation. In Figure 3-2 these concepts are put in an overview, including how they relate to each other.
Figure 3-2: Concepts to be measured, following from the research questions.

On the left of the model the water supply (done by the municipality) and the water use (of the inhabitants) are shown. The green box surrounding the water supply represents the municipality, and the red box represents the inhabitants. The water supply is changed, by putting in prepaid water meters. This affects the water use of inhabitants, which in turn has an impact on their quality of life. At the same time, it has an impact on the effectiveness of the municipality, i.e. in how far they reach their goals. It will also be researched how efficient they do this. Since the main task of a municipality is to take care of its inhabitants, it is expected that their goals are formulated in a way that positively influences the quality of life. In other words, the final goal of the municipality should be to improve the quality of life of its inhabitants. The other goals should lead to this goal.

Finally, the curved arrows on the side represent the interaction between the municipality and the inhabitants. In line with Douthwaite et al (2002) the interaction between the municipality and the inhabitants and the participation of the inhabitants is important to get the whole system working.

In the following paragraphs these concepts will be discussed one by one, starting with the municipality.

3.2. MUNICIPALITY EFFECTIVENESS

The effectiveness looks in how far the municipality succeeds in reaching their goals. However, goals are not always clearly formulated before the start of the project. Gaillard et al (2001) shows how the goals can be reconstructed afterwards. In order to do this he makes a hierarchy of goals. At the top of this hierarchy the more abstract goals appear, like wealth. Further down in the tree of goals more concrete goals appear, like improving education. Going from the broader goals to more concrete goals the results are some very specific goals. If these goals are specific enough they can be measured, and it can be seen how effective the municipality is in reaching these goals. Also, from the hierarchy it can be seen which broader goals are not being translated into more specific goals and are overlooked by the municipality.

3.3. MUNICIPALITY EFFICIENCY

The efficiency looks at how efficient goals can be reached, i.e. what the means are for achieving the goals in monetary terms, resources and effort. Thus, after the goals have been reconstructed and it has been measured in how far the goals have been reached, it will be researched how much this has cost for the municipality. Did they reach the goals in an efficient way, or could they reach the goals more efficiently?
The costs of the prepaid water meters will therefore be analyzed and a cost-benefit-analysis (CBA) will show what the benefits have to be to cover for the costs.

3.4. QUALITY OF LIFE

The Millennium Development Goals (MDG’s) will be used as a measurement for changes in the quality of life for the inhabitants. Why this measurement was chosen and the goals of the MDG’s will first be discussed, after which MDG 1, 4, 6 and 7 will be discussed more elaborately.

3.4.1. MEASURING QUALITY OF LIFE

The goal of measuring the quality of life in this research is to see how it has changed for people after the implementation of the prepaid water meter. As discussed in paragraph 1.8 only the short-term impact (normally called ‘output’) can be measured. It is therefore important to find a measuring tool that is able to do this.

Measurements on wealth could be used, comparing the wealth before the prepaid meter with the wealth afterwards. The most commonly used indicator for wealth is the GDP per capita. This is however criticized for only looking at material wealth. Sen’s capability approach (Sen, 1985) looks at it from a different perspective, focusing on the capabilities and opportunities for people. Thus, instead of looking at what people own, it looks at their resources, functioning and capabilities. This approach was used for the development of the Human Development Index (HDI). The HDI includes the life expectancy, literacy, education and standards of living, taking multiple dimensions of under-development. Besides this index there are many more indexes based on the same ideas, like the Physical Quality of Life Index (Morris, 1979) and the Quality of Life Index (Dasgauta and Weale, 1992). Leaving their assets and shortcomings out of this discussion, it seems that all of them are based on broad, basic elements that could be used to compare countries or even cities. However, they are not developed to look at short-term impacts from changes. For example, it will be hard in this research to already see differences in the life expectancy from people, but the aspects causing changes for the life expectancy may already be observable.

The Millennium Development Goals are more specific in the formulations of the aspects, which contribute to improving changes in the quality of life. Another advantage of using the Millennium Development Goals is that there is a clear role for water, both direct and indirect: direct because one of the goals is to increase access to safe drinking water; and indirect because there is a big role for health improvements, where water could play a big part in improving the health. This is why the Millennium Development Goals are chosen to help seeing changes in the quality of life.

3.4.2. GOAL OF MDG’S

The Millennium Development Goals (MDG’s) are international agreed upon goals with the intention to improve social and economic conditions in developing countries before 2015. It consists of eight overall goals, which are divided by different quantifiable targets. The goals can be seen in Figure 3-3. The MDG’s, although sometimes criticized for the chosen indicators and how to measure them, have been widely acknowledged as being essential for improving the quality of life in developing countries. MDG 1,4,6 and 7 are expected to become most influenced by the prepaid water meters. Therefore, these goals will be discussed in more detail in the next parts.
3.4.3. WATER AND MDG 7

Millennium Development Goal 7 firstly looks at environmental sustainability, which is not the focus of this research. However, it also looks at the proportion of the population with sustainable access to an improved water source and to improved sanitation. Since this target is most directly influenced by water supply this one will be discussed first.

The target is to “halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation”. The definition of ‘improved drinking water’ is focused on the quality of the water, making household connections, public standpipes, boreholes and rainwater collections all count as improved sources. Not in the definition itself, but seen as an associated term is ‘reasonable access’. This means that at least 20 liters of water per person per day must be available, from a source within one kilometer of the user’s home (WHO, 2003). Those specific numbers for the amount of water needed and the maximum distance that people have to walk are not needed in this research. It will be measured, however, how much water people use and how far they have to walk.

Table 3-1: Goals and indicators for MDG7 in Namibia. Source: Republic of Namibia, 2008.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Ensure Environmental Sustainability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent Households with Access to Safe Drinking Water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>99</td>
<td>97</td>
<td>95</td>
<td>100</td>
<td>POSSIBLE</td>
</tr>
<tr>
<td>Rural</td>
<td>74</td>
<td>80</td>
<td>86</td>
<td>87</td>
<td>LIKELY</td>
</tr>
<tr>
<td>Percent Households with Access to Basic Sanitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>86</td>
<td>58</td>
<td>-</td>
<td>98</td>
<td>UNLIKELY</td>
</tr>
<tr>
<td>Rural</td>
<td>14</td>
<td>14</td>
<td>60</td>
<td>63</td>
<td>UNLIKELY</td>
</tr>
</tbody>
</table>

In Namibia, 97 percent of the people in urban areas had access to safe drinking water in 2008 and they estimate that it is possible to reach the target of supplying 100%. For urban households this is 80%, and it is
likely that they will reach the target of 87% in 2012 (Republic of Namibia, 2008). According to the definition of Banerjee and Morella (2011), which is assumed to be the definition of ‘access’ of the MDG as well\(^\text{10}\), where access means living in a community or cluster where the service of clean water is available, all people in Otjiwarongo have access to water. However, not everyone living in such an area uses this service. Foster and Araujo (2004) differentiate between households that do not use safe water because there is no pipeline near them and households that do not use safe water while there is a pipeline. The latter is called a demand-side deficit, meaning that there are barriers in using the safe water other than the distance from the network. For example, high connection charges could be a demand-side deficit. In Otjiwarongo, many people are cut off from water by the municipality because they did not pay.\(^\text{11}\) Thus, although ‘access rates’ are 100% in Otjiwarongo and close to 100% in Namibia, not everyone is able to use the water connections. Although this is not targeted by the MDG, this should still improve.

Furthermore, several researchers point out that the amount of water used is very important for people’s health (amongst others: Howard and Bartram, 2003; Haffejee 2007; Mihelsic, 2009). Lack of water for consumption can result in dehydration, but also in other diseases like urinary stones and certain types of cancer (Mihelsic, 2009). Furthermore, Curtis (2000, as cited in Mihelsic, 2009) claims that certain health behaviors, like hand washing, happens more often if more water is available.

The target also states that the access should be sustainable, including two components. The first one, focused on environmental sustainability will be left out in this research. The second component looks at how sustainable the program is in terms of supply and management, and will be included but in a modified way. Instead of looking at the long-term reliability of the supply, the short-term reliability of the supply will be included. This measures for example if water is available 24/7, not only looking at the reliability of the water distribution, but also at the reliability of the water meters. This is very important, since even a short disruption in the water supply can destroy the health benefits of using an improved source a (Newton, 2011). South Africa has a policy for this, saying that no consumer can be without a supply for more than seven full days in a year (Gowliland-Gualtieri, 2007).

Furthermore, as can be seen in Table 1 the access to sanitation is still low and it is unlikely that the targets for 2012 will be achieved. This will be discussed in part 3.4.5.

In short, changes in achieving MDG 7 that are related to water and will be measured are the water quantity used, the distance to the water source, and the reliability of the water availability.

### 3.4.4. WATER AND MDG 1

MDG 1 is focused on eradicating extreme poverty and hunger, with targets aiming at the income of people, their employment, and hunger. There are several roles for water in achieving these goals. In Namibia, as can be seen in Table 3-2, the unemployment rate is high, being 36.7% in 2008. Furthermore, the number of people considered ‘poor’ or ‘severely poor’ is declining, but still 28 and 4 percent respectively. Also, under 5 malnourishment is declining but still 24.2 percent. There are several roles for water for contributing to these goals.

\(^\text{10}\) From the definition of the MDG where “access to improved water source is the percentage of population with access to an improved drinking water source in a given year” (WHO SIS, n.d.) this cannot be known for sure.

\(^\text{11}\) Interview Hoko, Accountant, 03-08-2011, Appendix B12.
The first one only counts for the second new use of prepaid water meters, i.e. providing people in informal settlements with household connections. Before, they had to get the water at standpipes, costing a lot of time and effort. It is expected that mostly women and (older) children will take the burden of this task. Now, the time that becomes available can be used for childcare, food preparation or income-generating activities (Mihelsic, 2009). The time and the task division of collecting water will be measured. As well as the extra time spend in economic activities.

Secondly, the proportion of income devoted to water can be important. Most utilities and donors assume water to be affordable if it costs a household 5% of the total income or less, being unaffordable if it is more (McPhail, 1993). Thus, it is important to know the relative spending on water, since it can be a burden for the household, having less money for food and other basic needs. What might be even more important is if the inhabitants think water is affordable or not and if the costs of water are a burden for them for using more water.

Thirdly, water can make it better possible for people to harvest some food themselves or to trigger entrepreneurship. Therefore, it will be looked at more closely if the extra time and enhanced access to water is indeed used for this purpose. As stated above, extra time that comes available can also contribute to food harvesting and income-generating activities.

In short, the indicators for water and MDG 1 are the time and task division of collecting water, affordability of water and water costs as a burden for using more water, and enhanced food harvesting and entrepreneurship.

### 3.4.5. WATER AND MDG 4 AND 6: WATER AND HEALTH

The goal of MDG 4 is to reduce child mortality rates. Diarrhea, which globally is the second leading cause of death among children under five, can mostly be attributed to unsafe water, inadequate sanitation and poor hygiene (WHO & UNICEF, 2009). MDG 6 relates to MDG 4, combating several kinds of diseases. Different components contribute to this.
Table 3-3: Goals and indicators for MDG4 and MDG6 in Namibia. Source: Republic of Namibia, 2008.

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>REDUCE CHILD MORTALITY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant mortality rate deaths per 1,000 live births</td>
<td>56.6</td>
<td>49</td>
<td>36</td>
<td>38</td>
<td>UNLIKELY</td>
</tr>
<tr>
<td>Under-five mortality rate deaths per 1,000 live births</td>
<td>81.2</td>
<td>69</td>
<td>54</td>
<td>45</td>
<td>UNLIKELY</td>
</tr>
<tr>
<td>% of one-year old children immunized against measles (percent)</td>
<td>75.7</td>
<td>83.8</td>
<td>80</td>
<td>85</td>
<td>LIKELY</td>
</tr>
<tr>
<td>Employment growth, % p.a., average in period</td>
<td>-</td>
<td>-</td>
<td>2.6</td>
<td>2.6–3.2</td>
<td>POSSIBLE</td>
</tr>
<tr>
<td>GDP growth rate p.a., average percent in period</td>
<td>3.6</td>
<td>4.7</td>
<td>4.3</td>
<td>5.0–6.5</td>
<td>POSSIBLE</td>
</tr>
<tr>
<td>Cns-coefficient</td>
<td>0.701</td>
<td>0.604</td>
<td>0.6</td>
<td>0.58</td>
<td>LIKELY</td>
</tr>
<tr>
<td>Children under five, malnourished, stunted, in % of all children under five</td>
<td>28.4</td>
<td>24.2</td>
<td>-</td>
<td>18</td>
<td>POSSIBLE</td>
</tr>
</tbody>
</table>

| **COMBAT HIV/AIDS, MALARIA AND OTHER DISEASES**  |
|--------------------------------------------------|                    |                       |             |             |                          |
| **TUBERCULOSIS, MALARIA**                        |                    |                       |             |             |                          |
| TB cases detected per 100,000 population         | 656                | 755                   | -           | <100        | POSSIBLE - LIKELY        |
| TB cases treated successfully (percent)           | 64                 | 76                     | 75          | 85          | LIKELY                   |
| Incidence of malaria per 1000 population         | 307                | 48                     | -           | Halt and begin to reverse | ACHIEVED                  |

As shown in Table 3-3 the infant mortality in Namibia in 2008 was 49 deaths per 1,000 live births and it is unlikely that the target of 38 will be achieved in 2012. The under-five mortality rate is even 69 per 1,000 live births. Also, 24.2% of the children under five are malnourished. Furthermore, the number of TB cases successfully treated increased to 76% and the incidence of malaria drastically decreased since the baseline of 1900/1993. But as can be seen there is still much to achieve in this area.

Many studies show how increasing volumes of water can improve public health (amongst others: Howard and Bartram, 2003; Haffejee 2007; Mihelsic, 2009). This could help in decreasing mortality rates.

Second, the quality of the water and point-of-use water treatment proves to be important as well (Fewtrell et al, 2005). Degradation of the quality of water can occur during water collection or water storage. Treatment of water before use can improve the quality of the water again. Again, this helps in decreasing mortality rates.

Besides this, the knowledge of people on hygiene can help in improving health. For example, washing hands properly and at the right times can drastically improve health. Finally, the sanitation people use is important for their health and can have a great contribution in reducing child mortality and diseases. The last two are not directly related to water. They will still be included, because they complement the water improvements for a better health.

Hutton and Haller (2004) show how water access has a positive effect on health. They calculate that the return on investment for every US$1 invested in water and sanitation in developing regions was in the range of US$5 to US$28, mainly because of avoided costs for health and also because time is saved, which can be used for other purposes.

In short, hygiene indicators will be the quality of the water, the knowledge on hygiene and the kind of sanitation used.
3.4.6. OVERVIEW OF INDICATORS USED

An overview of the above mentioned indicators used to find changes in reaching the Millennium Development Goals is shown in Table 3-4. They will be measured on the household level, because the individual level is too narrow, only allowing a qualitative focus, while a broader focus would not show the differences between people.

Table 3-4: Indicators for the quality of life

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity used</td>
<td>Amount of water used per person per day</td>
</tr>
<tr>
<td>Distance to source</td>
<td>Distance from the user’s home to the water source</td>
</tr>
<tr>
<td>Reliability</td>
<td>Occurrence of lack of water caused by the distribution or the water meter</td>
</tr>
<tr>
<td>Collecting time</td>
<td>Time needed for collecting water</td>
</tr>
<tr>
<td>Affordability</td>
<td>If people can afford enough water</td>
</tr>
<tr>
<td>Costs</td>
<td>Water costs as a burden for using more water</td>
</tr>
<tr>
<td>Entrepreneurship</td>
<td>Extra time and water used for food harvesting and entrepreneurship</td>
</tr>
<tr>
<td>Quality of the water</td>
<td>Water collection, water storage and the treatment of water</td>
</tr>
<tr>
<td>Knowledge on hygiene</td>
<td>Education and knowledge on hygiene</td>
</tr>
<tr>
<td>Sanitation</td>
<td>Kind of sanitation used</td>
</tr>
</tbody>
</table>

3.5. PUBLIC PARTICIPATION

The use of public participation is widely acknowledged, also in water projects. Peña and Córdova (2001) conclude in their article on public participation and water supply that a public participation process is necessary for any institutional arrangement to succeed. This public participation process should include information sharing and education of the community. They argue that public participation not only gains support for the project, but also makes people aware of the costs that are needed for a better service delivery. Furthermore, Manikutty (1997) compared two rural drinking water supply projects in India, one with considerable participation, and one with no community participation at all, where in the first one much better results were achieved: the preferences of the people were better reflected, the percentage of working taps were higher, there was better cost recovery and better changes in health habits. Also, the users of the water taps were more satisfied in the first project than in the latter. Furthermore, Priscoli (2004) argues that public participation is necessary because, amongst other things, the ethical dimensions of water management. Water should be available for everyone; people have a daily minimum basic need for water. But there is an ethical consideration of the distribution of the benefits and the costs of water services. He says that:

“Lack of participation or non-meaningful participation allows stakeholders the luxury of negative ‘nay-saying’ without confronting the reality of decision making pressures.”

(Priscoli, 2004, p2).

Public participation is a broad concept and many different forms and definitions of public participation exist. In relation to the Water Framework Directive (a piece of legislation focused on the management of European water resources) three levels of participation are distinguished: information supply; consultation; and active involvement (Mouratiadou, 2007). Jaglin (2002) uses another definition of participation, where the citizens and users of the public service (in his case water supply) are actually taking over some tasks of the municipality, like managing the supply and helping with the infrastructure in their community. This should enable them to
get access to the water, while the municipality can still recover their costs. This, however, is mainly useful for people that have no (good) access to services, and there are a lot of obstacles and downsides (Jaglin 2002). Rowe and Frewer (2005) define three different forms of public engagement. In the first one, which they call public communication, information only flows from the sponsor to public representatives. In the second one, public consultation, the information flow goes the other way around, from public representatives to the sponsor. The third one is what they call public participation, which is a combination of the other two.

In our case, the service is already there. It is however unsure how good this service is for the users and how it could be improved. Thus, in this case good information provided by the municipality to the users is needed, as well as a consultation of (representatives of) users, getting information of their needs and experiences. The definition of Rowe and Frewer (2005) on public participation will be used, looking at public communication and public consultation.

For the consultation part, Abelson et al (2003) developed general principles for designing or evaluating public involvement. First, the representation is important, looking at participant selection and if there’s a representative sample. Second, procedures taken should be looked at, including the times in the decision-making process people are consulted and the degree of citizen input in agenda setting. Third, a look should be taken at the information that was available. And finally, the outcomes and decisions are important: for example what responses to the decisions were and if consensus over the decision has been reached.

Public communication can be measured with almost the same variables, looking at which people are being reached, at what times they were being informed, and how much information was given to them (e.g. only that water prices will change, or also reasons why they will change).

![Figure 3-4: Participation during different phases of the Innovation Process. Source: Douthwaite (2002). (Same as Figure 3-1).](image)

Besides looking at the information inhabitants receive and in how far they are being consulted it will be looked in detail in how far their goals meet. As seen in the figure above after the start-up phase both parties should collaborate. If this is not the case it will be seen what the problem is and if enhanced public participation could help.

3.6. CONCEPTUAL MODEL OF THE CONSEQUENCES OF PREPAID WATER METERS

Now the concepts named in the beginning of this chapter all have been discussed and indicators to measure them are derived from theory, the overview presented in the beginning can be filled in. Figure 3-5 shows this
filled in model. The model is the same as the model presented in paragraph 3.1.3, but now information on the theories used for the different parts is added.

![Figure 3-5: Conceptual model of the impact of prepaid water meters on the quality of life.](image)

The changes in the water supply, i.e. implementing prepaid water meters, have an effect on the achievement of the goals of the municipality. Theory of Gaillard (2001) describes how to find out the goals afterwards, leading to some specific and measurable goals. Again, these goals are expected to be formulated in such a way that it has a positive influence on the quality of life. The amount of resources needed for this change in the water supply (and therefore changes in the effectiveness) is measured by the efficiency.

The bottom part, showing the water use and the quality of life, has become more elaborate. The prepaid meter first has an impact on the access and reliability of the water supply to inhabitants and on the costs for inhabitant. These are mainly based on Millennium Development Goals 7 and 1. They, in turn, affect the amount of water people use, which is important according to MDG 7. Then, the amount of water used has an effect on the hygiene and health of the inhabitants, as discussed in MDG 4 and 6. The access, costs, and health finally influence the quality of life of the inhabitants. Since it might be too early to see changes in the quality of life already and because measuring the quality of life would not be sufficient in telling what role the prepaid water meter played in this, the boxes that influence the quality of life will be measured: these are shown in squares, whereas the other boxes (which are not directly measured, but derived from the other boxes) are in circles. The short term impact of the prepaid water meter on these aspects give an indication on what the long term impact on the quality of life will be.

Also, the ‘+’, ‘-’ and ‘?’ signs shows if the correlation between the boxes is positive, negative or still unknown (the magnitude of the correlations will not be measured). For the question marks it is not known yet what the correlation is, but this will be researched. The positive effect access and reliability have on water use follows from literature that shows how water use increases if people get a household tap instead of using public standpipes (Howard and Bartram, 2003; Newton, 2001) and from research that assumes that the closer the water is the more water people will use (Howard and Bartram, 2003). If costs get higher, it is expected that this has a negative effect on the water use, which follows from logic economics. Furthermore, if water use increases this has a positive effect on people’s hygiene which is good for their health (hygiene and health are
not separated in the model, as they are not measured separately). It is often shown how a lack of water causes diseases, like diarrhea. For example, Hutton and Haller (2004) show how health costs reduce if water use increases, and Howard and Bartram (2003) indicate that for bigger amounts of water used health risks become smaller. A lack of hygiene can also have other causes than a lack of water, like cultural behavior or a lack of knowledge. As the prepaid water meter does not change this, this is not in the model, but some attention will be given to this in the research, to indicate if this also has a negative impact on health or not. Furthermore, the reasoning behind the arrows to the quality of life is the following: as increased access saves time and effort this has a positive effect on the quality of life; increased costs, on the other hand, will leave less money for food and other basic needs (if people are really poor) and therefore has a negative impact on the quality of life, and better hygiene and health obviously have a positive effect on people’s quality of life.

Concluding, if the square boxes are measured the arrows can be filled in and it can be derived what the impact of the prepaid water meters is on the effectiveness and efficiency of the municipality and on the quality of life of the inhabitants, which answers the research question.
4. DATA COLLECTION

In the previous chapter it is discussed what needs to be measured to answer the research question. In this chapter an explanation of how this will be measured will be given. First, the data needed for each section will be discussed. Then, selected methods of data collection will be discussed and it will be shown what they measure and why they are useful in this research.

4.1. DATA COLLECTION FOR EACH SECTION

Measuring the effectiveness, the efficiency, the quality of life and public participation all need different approaches. For all of them combinations of different methods were selected. An overview of what kind of data will be used for each section will now be given:

The effectiveness: For the effectiveness, first the goals of the municipality have to be identified, after which they can be evaluated. Documents of the municipality will be used first, looking for the goals. After this, semi-structured interviews with Senior Executives of the municipality will give a better understanding of the goals, making them more specific and show where they come from. Then, grey data (probably mostly financial data) will be the basis for the analysis on how effective the municipality is in reaching those goals.

The efficiency: Looking at the efficiency, financial data and data about water amounts are most important. Besides this, some extra information will be obtained from semi-structured interviews within the municipality and outside the municipality. For example, information on the quality of the water will be gathered by interviews with the municipality and with Namwater. The interviews are also used to verify the data. Additional data from national reports helps in making a cost-benefit-analysis for the municipality.

The quality of life: A survey, observations and semi-structured interviews will be most important for this part. In Orwetooveni, households with prepaid water meters are compared to households with conventional water meters, and to their perceived changes. In the informal settlements households with prepaid water meters will be compared to households using prepaid standpipes, and to their perceived changes. Besides this, the opinion of all people (both people with and without prepaid water meters) on prepaid water meters will be asked.

Public participation: Interviews with the municipality will show what efforts they make to communicate with the inhabitants and to consult them. Interviews with the inhabitants, on the other hand show how they perceive this public participation, which information really reaches them, and how they react to it. Going back and forth between those groups, it is possible to ask questions to the municipality like: “How is it possible that one of the standpipes is broken for months already, while they did report this to the municipality?” And questions to the inhabitants could be: “If you cannot pay all your bills, did you ever go to the municipality to try to make an arrangement?” Besides the interviews, also observations on their actions can be used for this part, since those actions can indicate misunderstandings or misinterpretations.

4.2. METHOD OF DATA COLLECTION

For the impact measurement, the first distinction that can be made is between the ‘before and after’ method and the ‘with or without’ method. In the first case the same group of people is observed at different times: before the intervention and after the intervention. In the latter case comparable groups, one with the intervention and one without the intervention, will be compared (Gaillard & Bouwman, 2001).
For the impact on the municipality a combination of the before and after method and the with or without method is needed, because for some things it is hard to know the situation before and in some cases it is hard to compare the situation with the prepaid water meter to a situation without it. For example, it is impossible to know what the total amount of debts from inhabitants to the municipality would be if the prepaid water meter was not implemented, while it is possible to figure out the debts before the prepaid water meter and the debts now. But looking at the investment that was done for the prepaid water meter and the maintenance cost these costs could be compared to costs for conventional meters (the situation without the prepaid water meter).

For the inhabitants, again a combination of the two methods will be used. Groups with prepaid water meters can be compared to groups without prepaid water meters. And although people might not remember how much water exactly they used before the prepaid water meter, they might be able to tell if the situation became better or worse after using the prepaid water meter, so this will be asked.

It will be tried to always check the information received. Information from the inhabitants will be checked with other inhabitants and with the municipality. Information from people working at the municipality will be checked with other people from the municipality and with inhabitants. And finally, other parties involved will be interviewed to give their view on the situation.

### 4.2.1. DATA FROM THE MUNICIPALITY

Data from the municipality will mainly be quantitative data, but some qualitative data will be gathered as well. The following methods will be used:

**Grey data:** Selected reports from the municipality will be analyzed. These will mainly contain information on finances and water amounts, retrieved from the ‘Monthly financial reports’, ‘Water Purchases and Sales’, and ‘Tariffs 2012’ from the municipality and will be used for measuring the effectiveness and efficiency. Furthermore, a detailed map of the city shows how many households there are in each area, which can be useful since there are no numbers on the amount of citizens of Otjiwarongo. Also, there is one report on the communication between the municipality and inhabitants, which can be used for the public participation part.

**Semi-structured interviews:** The Senior Executives of the municipality are interviewed, with questions on how things work, why decisions were taken, the goal of prepaid water meters and their opinion on prepaid water meters. This mainly shows how things should go according to them and what their expectations are. This information will be used both for the effectiveness and the efficiency. Also, some municipal employees working in the field will be interviewed, focusing on the problems they experience with the prepaid water meter and the communication with the inhabitants. This gives more detailed information on the problems and the communication and shows how things in reality turn out.

**Observations:** Working at the municipal office for three months gives a better understanding on how they work and how they communicate with each other and with inhabitants. An extra advantage is that this makes it easier to obtain the grey data and interview the right persons. However, a pitfall is to get influenced by the municipality, losing the objectivity of the research. Thus, care should be taken in keeping an objective view.

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12 These numbers might, however, become available in 2012, since there was a census in August 2011.
4.2.2. DATA FROM INHABITANTS

Since qualitative and quantitative data both have their weaknesses and strengths both kind of data will be used. The qualitative data shows what kind of problems people face, what their opinion on prepaid water meters is, and why they act the way they do. The quantitative data adds information on how many people feel or act this way and allows for a comparison between different groups of people (with and without prepaid). Therefore, several ways of collecting data will be used, both quantitative and qualitative.

Surveys: One hundred household surveys (with over 30 questions each) are conducted and will be used for the collection of quantitative data for the households. For this, four different groups of people are selected (Figure 4-1) and 25 people from each group were interviewed. The first group, ‘prepaid water meter users in Orwetoveni’, will be compared to the control group ‘conventional water meter users Orwetoveni’. And the ‘prepaid household water meter users informal settlements’ will be compared to the control group ‘prepaid standpipe users informal settlements’ (Figure 4-1).

![Figure 4-1: Four survey groups. On the left the research groups and on the right the control groups.](image)

Four men who spoke English, Afrikaans and at least one other language were selected to conduct the interviews: two for Orwetoveni and two for the informal settlements. All of them did both surveys for prepaid users and for the control group, with a distribution of 50-50, to try to limit the influence they have on the outcome. They were also told to randomly select the households, going to different street and different areas. Ideally they would interview two households in the same street, one with and one without prepaid, and then move to another street, making the comparison best. However, some streets only had prepaid water meters or only had conventional or standpipe users, making this impossible.

Questions in the survey were about their total spending, spending on water, health, sanitation, water use, and changes in their water use. Also their opinion on prepaid water meters and the communication with the municipality was included. All questions can be found in appendix C.

Semi-structured interviews: 18 semi-structured interviews are used to provide more insight in the situation of the inhabitants and their opinion on prepaid water meters. Most of them were one on one interviews with randomly selected inhabitants and one or two translators. Two interviews, however, were in small groups and accompanied by someone from the municipality. And one interview was with the water committee, a committee which was mainly set up to help people in the informal settlements to use the prepaid water meters. The topics were similar to that of the survey, but the interviews were more open. Instead of asking for numbers, their opinion and their experiences were more important. The semi-structured interviews provided information for the quality of life and the public participation.
Observations: Observations at one of the municipal offices (Orwetoveni office) was done to understand how the charging of the tags work, how busy it is at the office and how much people charge at a time. Also, observations at a standpipe were done and will be used to get a better understanding of who is fetching the water, how much water they take at a time, how they carry it home and how long the waiting lines are. In addition, observations at the home of an inhabitant will give a view on their daily lives. Finally, living in this city for three months, walking around, reading the local news and informally talking to people also gives an idea of what is important for people and how they live.

4.2.3. OTHER DATA

Although the focus of the data collection will be on the municipality and the inhabitants other parties will also be interviewed. They can especially be used to give a view of the situation from an outsider perspective. Semi-structured interviews with Namwater, a local NGO, a research group and another city that used prepaid water meters will be done. Also, data from Frans van Herwijnen (forthcoming) will be used. This gives more information on the situation in other cities.

13 It was hard to find someone who agreed that I could follow her for a day, and I could only come for half a day. But she did show me how she did her laundry, went to the standpipe and spend the afternoon.
5. THE EFFECTIVENESS AND EFFICIENCY OF THE PREPAID WATER METERS

This chapter tries to answer subquestion 1: ‘How did the effectiveness and efficiency of the municipality’s water supply change after the implementation of prepaid water meters for new uses?’. So, this chapter is written from the perspective of the municipality, looking at how effective and efficient prepaid water meters are for them. Some of the goals of the municipality (like wanting well-being for their residents) overlap with the goals of the inhabitants and positively influence their quality of life. Influencing mostly the inhabitants, these overlapping goals will be discussed only shortly in this chapter and more elaborate in chapter 6 (the impact on prepaid water users in Orwetoveni) and chapter 7 (the impact on prepaid water household users in the informal settlements).

Many important people working for the municipality were interviewed: Naudé Slabbert, Strategic Executive Infrastructure & Technical Services; Burgert Liebenberg, Strategic Executive Finance; Agatha Mweti, Strategic Executive Community Service; Hilda Jesaja, Mayor of Otjiwarongo; and Manfred Uxamb, CEO (interviews can be found in Appendix A). Furthermore, some people working in the field were also interviewed. There were however no documents available which supported the information from the interviews. The goals are not formally stated anywhere, but on their website (http://www.otjiwarongomun.org/municipal-services/administration-hr/) some goals can be found. It was tried to triangulate the information received from the interviews, but the people from the municipality did not always know much about the other departments, making this harder. Also, the Strategic Executives did not always know where certain decisions came from or when they were made, because their predecessor did not tell them and did not write it down. However, most of the goals that appeared from the interviews were in line with each other, making this information very useful.

Furthermore, financial data from the municipality was received to look at the effectiveness and the efficiency. First of all it was hard to understand what kind of information they had and where this information was available. Second, it was sometimes difficult to understand where some numbers came from and what exactly they included and excluded. Therefore, follow-up interviews would have been useful. Finally, the municipality did not distinguish prepaid water household meters income from income from prepaid water standpipes, making it impossible to see how much water was used by each group and how much money was received from these groups separately. Therefore, information on the financial data retrieved from the municipality will be complemented with data from literature, calculations, and estimates. It will be shown for every number how this is retrieved. Even though the numbers are sometimes based on estimates or calculation, they still give a good indication of the situation.

First of all, a short discussion on water related policies and a summary of the relevant points from national policy will be given. Then, the goals from the municipality will be shown. This will show the goals the municipality stated with relation to water supply, followed by a discussion of these goals. After that, it will be shown in how far their goals are being reached, i.e. how effective they are in reaching their goals. Then, the efficiency will get more attention, looking at the amount of resources that was needed. A financial cost-benefit analysis will also be shown in this part.

5.1 LITERATURE REVIEW ON WATER RELATED POLICIES

One of the biggest debates on water related policies is about water pricing. Anna Matros-Goreses (2009) gives in her dissertation on “Putting a price on water for all, Namibia” an overview of the ongoing debate about water pricing. She shows the discrepancy between the different aspects that should be kept in mind: cost-recovery, environmental and economic sustainability on the one hand, and affordability and equity on the other hand.
It is acknowledged by everyone that it is hard to achieve this all in one. Different writers seem to focus on different aspects, not ignoring the other aspects, but putting priority to one or two of them. Also, different pricing policies are mostly appropriate for one side of the debate. From the point of view of the water users, The Bonn Charter for safe drinking water (2004) says the following:

“[Set the water price] so that it does not prevent consumers from obtaining water of sufficient quantity and quality to meet fundamental domestic needs.” (IWA, 2004: 9)

Water is a basic right and without water one cannot live. Connecting people to a safe water resource is also one of the targets of the Millennium Development Goals. However, if people have a water tap (nearby) but cannot afford to pay water, the water connection makes no sense. So, as stressed in the quote above, the quantity should also be sufficient to meet domestic needs. As already discussed in the theory using a sufficient amount of water is very important for people’s health, where it is disputable how big this amount should be to be sufficient.

On the other hand are the reasons for cost recovery. Amongst others, Dinar and Subramanian (1998) stress the fact that water prices have to be used to ensure efficient use of water, stimulating conservation of water:

“Countries have different reasons for charging for water. Some wish to recover costs, some want to transfer income between sectors through cross-subsidization, and others use charges to improve water allocation and water conservation.” (Dinar and Subramanian, 1998: 243)

Conservation of the natural environment and gaining sufficient revenue to ensure water delivery from good quantity and quality in the future are important aspects from this point of view. Therefore, charging for water services per cubic meter used, instead of charging of fixed amount or nothing at all, is a preferable method in this regard.

Subsidizing prices is a proposed solution to the problem of cost-recovery for ensuring water delivery, while at the same time offering an affordable price. However, water conversation is not stimulated this way, which may harm the natural environment. Also, this makes a government dependent on the subsidies, and it is not a long-term solution (van Ryneveld, 1995).

Prepaid meters turn out to be effective in both conserving water and recovering costs (Matros-Goreses, 2009). However, prepaid meters are sometimes seen as unethical towards water as a right, like in England where they are prohibited (Monbiot, 2004).
Furthermore, Increasing Block Tariffs seem like a promising way of including all factors. This means that a very low or free price is asked for the first cubic meters of water, allowing the poor to also consume water. For bigger amounts of water a higher price is asked. Increasing Block Tariffs are often justified by making water affordable for the poor, while promoting water conservation for high income users (Herrington, 2007; Dinar and Subramanian, 1997). However, to obtain cost recovery it is important to have transparency, flexibility, and simplicity in implementations. Also, for equity and affordability to be reached it should be taken into account that poorer families often have bigger households. So if the block tariff is per household care should be taken that bigger families are not disadvantaged. Also, if the amounts of water used by poor and by non-poor are almost the same, this is not a good way to subsidize the poor (Foster et al, 2003). Foster (2003) in his report shows how big parts of subsidies which are meant for the poor end up at the non-poor. He also advocates in this report that it is better to target subsidies at public taps instead of using the Increasing Block Tariff.

Furthermore, in a list of objectives for water price setting, Rogers (2002) also mentions that the public must understand the rate-setting process, and they should perceive the tariff as fair.

5.2. NATIONAL POLICY

The Water Act of 1956 is still the basic legal document in Namibia, although they are in the process of accepting a new one. The new Water Act will largely be based on the National Water Policy White Paper (MAWF, 2000). The National Policy on water in Namibia acknowledges both the need for cost-recovery and conservation, and the importance of equity and affordability. This is written in the National Water Policy White Paper (MAWF, 2000), which is a policy document written by the Minister of Agriculture, Water and Rural Development with the goal of enacting a new Water Bill to replace the Water Act 54 of 1956. It first of all recognizes the importance of giving everyone access to sufficient safe water, keeping in mind the affordability:

“All Namibians shall have the right of access to sufficient safe water for a healthy and productive life.” (MAWF, 2002, National Water Policy White Paper: 23)

“The pricing regime will take account of the social imperative to facilitate access of all Namibians to a minimum water supply as a necessity, recognizing that ‘ability to pay’ is constrained by low income.” (MAWF, 2002, National Water Policy White Paper: 27,28)

Furthermore, it stresses the need for conservation of the resources and a cost-effective use:

“The scarcity and vulnerability of Namibia’s water resources require that their economic value be recognized, and that their abstraction, management, conservation and use is efficient and cost-effective.” (MAWF, 2002, National Water Policy White Paper: 23)

Although these principles are being mentioned, they are only guidelines which should be taken into account. There are no rules saying what the maximum price of water can be, how much (and if) profits can be made by municipalities and if other costs can be included in the water price or not. Also, the minimum amount of water needed and the affordability are not quantified.
5.3. GOALS OF THE MUNICIPALITY

In Figure 5-1 the top of the organizational structure of Otjiwarongo municipality is shown. The council is elected every five years. There are seven councilors in Otjiwarongo, which meet every month (ms. Jesaja, Mayor of Otjiwarongo, interviewed on 05-07-2011). The CEO, Mr. Uxamb attends these meetings as well. The Mayor and the CEO are in close contact, meeting almost every day (ms. Jesaja, Mayor of Otjiwarongo, interviewed on 05-07-2011). The mayor, ms. Jesaja is from SWAPO (South West Africa People’s Organization), just like most of them. SWAPO is also the biggest political party on the national level (Bertelsmann-transformation-index). According to ms. Jesaja there are no big differences between the parties on municipality issues. For all of them providing shelter and care to the people and promoting development are important. Also, water and electricity for the informal settlements are a big issue. The council also promised to deliver individual water and electricity connections in this area (ms. Jesaja, Mayor of Otjiwarongo, interviewed on 05-07-2011).

Also, Namibia has universal suffrage: everyone has the right to vote and to stand for election on the national, regional and municipal levels (Bertelsmann-transformation-index). No information on the tasks of the Management committee is found on the website, neither was this mentioned in any interview. Furthermore, under the Chief Executive Officer, Mr. Uxamb, are four Strategic Executives: SE Finance, SE Community Services, SE Administration & Human Resources, and SE Infrastructure & Technical Services. The water supply falls under the last one, which next to that also is responsible for roads, sewerage, public buildings, etc.

\[ \text{Figure 5-1: Otjiwarongo Municipality top of organizational structure} \]

Source: based on poster at municipality: Otjiwarongo Municipality Organisational Structure.

In the next part a hierarchy of goals will be constructed. First, the broader goals, following from the website of the municipality will be shown. Then, the more specific goals, which are retrieved from the interviews, will be shown. This will show which goals leaded to the decision for prepaid water meters. After this a hierarchy of goals is made, showing the municipality’s goals and how they leaded to the decision for prepaid water meters. Finally, there will be a short evaluation of the goals.

\[ ^{14} \text{This information is confirmed on the website of the municipality: } \]
\[ \text{http://www.otjiwarongomun.org/municipal-services/council/}. \]

\[ ^{15} \text{His real name is actually Mr. /Uxamb. The ‘/’ sign is pronounced as a click sound and is common in several languages spoken in Namibia. To avoid confusion the signs referring to clicks will be left out in this report.} \]
5.3.1. BROADER GOALS OF THE MUNICIPALITY

The Mission Statement of the municipality is the following:

“Otjiwarongo Municipality exists to serve one united community in a highly responsive, committed and efficient customer friendly environment to achieve growth and prosperity.” (Otjiwarongo municipality B, Mission Statement)

They do not elaborate on this and some of the terms are vague and can be interpreted in different ways. It is clear though that they want to serve the whole community (one united community). Also, from the Mission Statement it can be derived that they probably want the communication with the inhabitants to be good (highly responsive). The ‘customer friendly environment’ might mean that they do not want to cause problems for the inhabitants. This could refer to making sure roads are well maintained, water is always available, and garbage is collected. However, it could also be interpreted as being friendly to the inhabitants when they are coming to the office with questions or complaints. Another view on this is that decisions and procedures are clear to the inhabitants, preventing them from the hassle of arranging things. From the Mission Statement it is not clear yet what they mean by a ‘customer friendly environment’. Finally, it seems to be the final goal of the municipality to achieve growth and prosperity, the rest is just a means to get there, according to how the Mission Statement is formulated. Again, these terms are not very clear. Growth could mean that the number of residents is increasing, but they probably mean economic growth. Furthermore, prosperity seems like a noble cause, but they do not add that they want prosperity for all or that they want more equality, while it could be doubted if they would really be satisfied if prosperity is reached, but only for the richest people in town. Therefore, it is assumed that they mean they want prosperity for all residents.

Furthermore, on the website they also state that they are responsible for the well being of the city’s residents, as well as the growth, management and development of the city (Otjiwarongo municipality). Again, they do not elaborate on how they interpret these terms or how they are going to achieve this. However, it can be seen already that they are giving themselves a very high responsibility. Being responsible for the well being of all residents is impossible for a municipality. It can, however, ensure certain services, like water, and try to help people in building houses and creating jobs.

A more specific goal the municipality mentions on the website is to ‘increase the revenue base by creating measures for cost recovery’. Later on, they add information by explaining that because they lost the income from electricity, the Council approved to recover all costs associated with providing services to the residents. Seven years ago the municipality provided electricity to the inhabitants herself, making large profits from this (Mr. Liebenberg, Strategic Executive Finance, interview 17-06-2011, appendix B7). However, when CENORED, a regional electricity provider, was established the municipality lost a part of this source of income. They were compensated by a ‘surcharge levy’, but because this is a nominal sum, Mr. Liebenberg says this is a

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16 It is unclear to me if they were forced to let CENORED take over or not and how exactly this process went. But CENORED and other RED’s in different regions took over several regions, getting much dissatisfaction from municipalities (Omu Kakujaha-Matundu, 2009).

17 This is confirmed by financial data from the municipality, in the Income Statement of the Financial Report June 2011 (Municipality Otjiwarongo, f), where it is shown that a surcharge levy of N$7,024,550 (€702,455) was received. The Income Statement from 2010 showed the same number.
diminishing source of income. The impact from this, they state on the website, is that ‘certain tariffs will have to increase substantially in order to recover costs that in the past used to be subsidized by electricity prior to the establishment of CENORED’ (Otjiwarongo municipality d, Tariffs). The goal to create measures for cost recovery seems fair, since otherwise it is also not possible for the municipality to pay their bills. However, with saying that they want to ‘increase the revenue base by creating measures for cost recovery’ they imply that revenue at this point is too low to recover the costs. Also, ‘losing’ the electricity revenue to CENORED is claimed to be a cause of the price increases. Later on it will be shown whether this is true or not.

Furthermore, the municipality also states on the website that they want to provide effective and efficient services to all customers. They also acknowledge that they are obligated to provide certain basic services. A summation of the services they want to provide include providing clean drinking water, promote greater involvement of the community and the health and well-being of the community. It is good that they want to achieve this, but the goals are still vague. Making them more specific would be better, as it is hard to see now how they want to obtain these goals and how they want to measure the goals. They also want the services to be affordable, at a cost-recovery rate (Otjiwarongo municipality). It is not explained though if it should be affordable for the municipality or for the residents, which makes a big difference. In the model that will be made it is assumed that besides the cost recovery for themselves (municipality affordability) they also want their services to be affordable for the users.

5.3.2. SPECIFIC GOALS OF THE MUNICIPALITY

One goal of the municipality that leaded to the prepaid household meters in the informal settlements was giving access to water for everyone. This follows from the decision of the Council that people should have their own meter, which was taken in August or September 2010. The main reason for this decision was, according to the mayor, that people had to walk a long distance to the standpipe. It was not mentioned in the interview, however, that prepaid household water meters could lead to increased water usage and therefore better hygiene and health. The first specific goal is based on this decision and is ‘granting access to water’, where ‘access’ is seen as having your own water meter. A better definition for this is ‘giving people household connections’, since the term ‘access’ also implies that people’s ability to pay is taken into consideration. Conventional water meters were not considered an option in the informal settlements, so prepaid household water meters became the envisioned solution. Considering cost-recovery, the municipality sees prepaid water meters as the easiest solution, and they are subsidizing the installments of prepaid meters for people to be able to afford them.

Another goal mentioned in all interviews was to deal with non-paying conventional water meter customers. There is now a culture of non-payment, says Mr. Liebenberg, Strategic Executive Finance (interview 17-06-2011, appendix B7). He says this could be caused by events in the past, right after independence was gained, where it was encouraged by some national politicians not to pay bills, arguing that services are a right. This might have stimulated the culture of non-payment. If this is true, the willingness from the people to pay this back now might be very low. More research on this would be useful to see how big the willingness to pay is and where this comes from. Mr. Liebenberg also says that many people do not have their priorities in payment right. For example they want to dress nicely, before they pay their water bills. Debts have run up to over N$20

18 Interview with Hilda Jesaja, Mayor of Otjiwarongo, 05-07-2011, Appendix B10.

19 From interviews with: Naudé Slabbert, Strategic Executive engineering; Burgert Liebenberg, Strategic Executive financial department; Agatha Mweti, Strategic Executive community services and economic development; Hilda Jesaja, Mayor of Otjiwarongo; and Manfred /Uxamb, CEO. Appendix A.
million (€2 million) (Municipality Otjiwarongo, c). Therefore, two other goals were specified: ‘increasing cash flow’ and ‘recovering debts’. The first one focuses on getting people to pay for the services they use, where the second one tries to recover the debts made in the past. With the first one ‘increasing cash flow’ they actually mean ‘getting people to pay for their services’, which closes the gap between the income they budgeted for and the income they actually get. Before, not everyone paid for their services, leading to debts and possibly also leading to shortages on the municipal budget. Now, they want to avoid that people are not paying for services.20

Finally, a long term goal which was only mentioned by Mr. Liebenberg, Strategic Executive Finance,21 is to educate people on paying their bills. If they learn to pay their bills before, for example, buying clothes this would ensure their payment, even without prepaid water meters.

5.3.3. HIERARCHY OF OBJECTIVES

From the broader and specific goals of the municipality a hierarchy of the objectives leading to the decision for prepaid water meters is constructed, which can be seen in Figure 5-2. The green boxes show the broader goals, as stated on the website of the municipality. The red boxes show more specific goals, retrieved from the interviews.

On the left, the goals following from ‘growth and development of the city’ are shown. From this follows that the municipality wants to create measures for cost recovery. Subgoals are that they want people to pay for their services, recover debts and educate people on paying their bills. Therefore, they want to install prepaid water meters. However, people who are already paying their bills can keep conventional water meters.

On the right of the hierarchy, providing effective and efficient services is a goal that follows from the goal that strives for well-being for the residents. The municipality divided this into subgoals, of which four seem to be important in this research: ‘affordable services’, ‘health and well-being of the community’, ‘provide clean drinking water to the community’ and ‘promote greater involvement of the community’. From the interviews follow that the municipality wants to enable people in the informal settlements to get a household connection. This seems to come from the goals related to health and providing clean drinking water. Keeping in mind that costs also need to be recovered, they chose for installing prepaid water meters in the informal settlements.

20 From interviews with: Naudé Slabbert, Strategic Executive engineering; Burgert Liebenberg, Strategic Executive financial department; Agatha Mweti, Strategic Executive community services and economic development; Hilda Jesaja, Mayor of Otjiwarongo; and Manfred /Uxamb, CEO. Appendix A.

21 Interview with Mr. Liebenberg, Strategic Executive Finance, 17-06-2011, Appendix B7.
Figure 5-2: Model on how municipal goals lead to installing prepaid water meters, and what should be taken into account.

Furthermore, the blue dotted lines indicate the goals that the municipality did not relate to prepaid water meters, but which should be kept in mind when installing them. Ignoring these goals may lead to the municipality succeeding in the goals that leaded to installing prepaid water meters, but failing on other goals they stated.

The user affordability, health and wellbeing of the community and providing clean drinking water to the community will be discussed in chapter 6 and 7. Promoting greater involvement of the community will be discussed in chapter 8.

In the rest of this chapter, the four most specific goals (in the red boxes) will be analyzed, looking in how far they are being reached. But first a short evaluation on the goals will be given.

## 5.3.4. EVALUATION ON THE GOALS

On the one hand we see that well-being for the residents and providing good services to them is important for the municipality, wanting to provide clean drinking water to the residents at an affordable rate. But at the same time they want to recover their costs. As we saw already in part 5.2 these are in line with national stated goals. And as seen in part 5.1 there is a large debate going on about how both can be achieved at the same time. The municipality also recognizes the conflict between those goals:
The prepaid water meters in Orwetoveni are seen by the municipality as a means to achieve the goals of cost recovery. It is, however, not being checked if this is affordable for those people (which is one of the goals on the right of Figure 5-2) and how it affects the health and access to clean drinking water of the people getting a prepaid water meter (which are also goals on the right of the model). Also, with the prepaid water meter as a solution, it is implied that people that did not pay before are in fact able to pay. This will be further analyzed in chapter 6. Also, the debts the municipality wants to recover are debts from all services, not only water. Using water to recover all debts puts extra weight on the price of water, which could make it too expensive for users.

The affordability is also important for people in the informal settlements. The municipality focuses on making the prepaid household connection affordable, subsidizing this. But their notion of affordability of water does not take amounts of water used into account. In their eyes water is affordable, because even for a few dollars you can buy water. However, they do not look at the amounts of water people use, which is also not mentioned in any of their goals. But it is mentioned in the national goals that people have the right to “sufficient water” (MAWF, 2002, National Water Policy White Paper: 23). So, it is lacking in their goals that the amount of water should also be sufficient. This could be added to the goal ‘providing clean drinking water to the community’, making it ‘providing clean and sufficient drinking water to the community’.

Furthermore, promoting greater involvement of the community is also one of their goals, but they do not make this more specific. It is therefore unclear if they want people to be well informed about their policies and changes in, for example, water tariffs, or that they want to involve inhabitants in decision making processes, or if they want both, or something else. In chapter 8 it will be shown how well public participation is at the moment and how it could be improved.

5.4. OVERVIEW OF REVENUE AND EXPENSES

Before looking at the effectiveness and the efficiency of the water supply an overview of the water prices and the costs for prepaid water meters will be given. An evaluation of this data will then be given in part 5.4: effectiveness of the water supply; and part 5.5: efficiency of the water supply.

5.4.1. WATER PRICES

The water prices in Otjiwarongo are different for different users. Table 5-1 gives an overview of the water prices for different users. The price for conventional meter users is the lowest: N$16.00/m³ (€1.60/m³). This is the basic water price everyone has to pay to the municipality. From this, N$8/m³ (€0.80/m³) is paid to Namwater and for a further N$2/m³ (€0.20/m³) is paid to the municipality for water. The rest is for water costs the municipality makes (estimated at N$2/m³ (€0.20/m³)) and for

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22 Interviews with: Hilda Jesaja, Mayor of Otjiwarongo, 05-07-2011, Appendix B10; Agatha Mweti, Strategic Executive Community Services, 13-06-2011, Appendix B5

23 Interview Naudé Slabbert, Strategic Executive engineering, 01-06-2011, Appendix B1; and Municipality document ‘Water Purchases and Sales 2002-2011’.
other (non-profitable) services the municipality is paying from this money (estimated at N$6/m$^3$ (€0.60/m$^3$)), like public buildings, community development, roads and street works, emergency services and environmental health.

Table 5-1: Overview of ‘water costs’ for different users 2011. Source: Table created by information from Tariffs 2012 (Municipality Otjiwarongo d), and interview with Mr. Liebenberg, Strategic Executive Finance, 22-11-2011, Appendix B7.

<table>
<thead>
<tr>
<th></th>
<th>Conventional meter users</th>
<th>Prepaid users Orwetoveni</th>
<th>Prepaid users informal settlements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic water price</td>
<td>N$16.00/m$^3$ (€1.60/m$^3$)</td>
<td>N$16.00/m$^3$ (€1.60/m$^3$)</td>
<td>N$16.00/m$^3$ (€1.60/m$^3$)</td>
</tr>
<tr>
<td>Basic charges</td>
<td>N$9.64/m$^3$ (€0.96/m$^3$)</td>
<td>N$9.64/m$^3$ (€0.96/m$^3$)</td>
<td>N$4.36/m$^3$ (€0.43/m$^3$)</td>
</tr>
<tr>
<td>Rent</td>
<td></td>
<td></td>
<td>N$4.36/m$^3$ (€0.43/m$^3$)</td>
</tr>
<tr>
<td>Total water price</td>
<td>N$16.00/m$^3$ (€1.60/m$^3$)</td>
<td>N$25.64/m$^3$ (€2.56/m$^3$)</td>
<td>N$30.00/m$^3$ (€3.00/m$^3$)</td>
</tr>
<tr>
<td>Basic charges</td>
<td>N$22.00/month</td>
<td>N$25.64/m$^3$ (€2.56/m$^3$)</td>
<td>N$30.00/m$^3$ (€3.00/m$^3$)</td>
</tr>
<tr>
<td>Rent, tax, sewerage, refuse.</td>
<td>Variable (around N$350/month$^{26}$)</td>
<td>Variable (around N$350/month)</td>
<td>N$25.64/m$^3$ (€2.56/m$^3$)</td>
</tr>
</tbody>
</table>

For prepaid water users in Orwetoveni the price is N$25.64 (€2.56) per cubic meter, and for prepaid users in the informal settlements (where everyone in the informal settlements uses prepaid) the price is N$30/m$^3$ (€3/m$^3$). Basic charges$^{28}$, which conventional meter users have to pay separately (N$22 (€2.20) per month) are included in the price for prepaid users. A calculation example shows that basic charges are likely to be much higher for prepaid users than for conventional meter users. The person for which the calculation is done has to pay more than three times as much on basic charges as a conventional meter user, while he is not even using a large amount of water (65 liters per person per day). Many people are using more and therefore have to pay even more basic charges. Mr. Liebenberg, Strategic Executive Finance, confirms that basic charges are much higher. The reason is that the costs for prepaid water meters are also much higher than the costs for conventional water meters.$^{29}$ Furthermore, for prepaid users in the informal settlements rent is also included in the price, which is the reason why their water price is even higher. They also do not have to pay tax, sewerage and refuse removal, but get these services for free (except for sewerage, which they do not have). If a family would spend N$200 (€20) a month on water (just like the family in the calculation example above did),

$^{24}$ Estimate based on the following calculation: 1,167,561 units sold in 2010/ 2011 (Municipality Otjiwarongo, g), and N$2,313,190 costs made on water in 2010/2011 (Municipality Otjiwarongo, f)(Salaries, wages and allowances N$1,538,190 + General expenses, excluding purchasing water N$303,000 + Repair and maintenance work, excluding prepaid water-house connec N$472,000). N$2,313,190 / 1,167,561 = N$2/m$^3$

$^{25}$ People in Orwetoveni also have to pay for rent, tax, sewerage and refuse.

$^{26}$ Estimate based on two interviews where people estimated their costs for rent, tax, sewerage and refuse.

$^{27}$ People are encouraged to pay for services and debt payoff before buying water. If they have not paid off debts that month, a part of their money meant for buying credits for water will go to debt payoff. How high this percentage is depends on arrangements that are made. It can be as high as 80-20, where 80% of the money goes to debt payoffs and 20% goes to water credits.

$^{28}$ It is not clear to the writer what exactly the basic charges entail.

$^{29}$ Interview Mr. Liebenberg, Strategic Executive Finance, 22-11-2011, email conversation.
which gives them 6,600 liters a month, they would pay around N$30 (€3) a month on rent. This is less than people in Orwetoveni pay for rent, but the plots are also smaller.

As can be seen in Table 5-2 the prices in Otjiwarongo are higher than in most cities in Africa. Water prices between cities in Namibia also vary widely. One reason for this is that prices Namwater charges municipalities already vary. They do not have one tariff for everyone, but calculate it dependent on their costs to supply water to a city. The price for Otjiwarongo is high compared to other cities: around N$8/m³ (€0.80/m³). In 2010 the Namibian reported that bulk water prices of Namwater varied from N$4.10 (€0.41) to N$7.50 (€0.75) per cubic meter (Namibian, 04-02-2010). In the year after that water prices increased. The price the municipality of Otjiwarongo pays to Namwater (N$8/m³ (€0.80/m³)) is among the highest in the country. Furthermore, the municipality also wants to recover the cost they make for the water supply, and they want to make extra money from water to pay for other services. Together this leads to a water price which is twice as high: N$16/m³ (€1.60/m³). Including basic charges within the water price for standpipe users and prepaid household meter users in the informal settlements again almost doubles the price to N$30/m³ (€3/m³).

So only a small part of the high water prices in Otjiwarongo can be explained by the relatively high price they have to pay to Namwater, which can either be caused by inefficiencies or by the fact that Otjiwarongo is located far away from any boreholes. The municipality more than doubles this price again for their own costs and for paying for other municipal services.

Table 5-2: Water prices in different cities in Africa. Source: based on Keener et al 2009.

<table>
<thead>
<tr>
<th>Country</th>
<th>City</th>
<th>Standpipe N$/m³</th>
<th>Standpipe €/m³</th>
<th>Household meter N$/m³</th>
<th>Household meter €/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cote d'Ivoire</td>
<td>Abidjan</td>
<td>0.29</td>
<td>0.03</td>
<td>0.36</td>
<td>0.04</td>
</tr>
<tr>
<td>DRC</td>
<td>Kinshasa</td>
<td>7.34</td>
<td>0.73</td>
<td>0.36</td>
<td>0.04</td>
</tr>
<tr>
<td>South Africa</td>
<td>Johannesburg</td>
<td>0.36</td>
<td>0.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madagascar</td>
<td>Antananarivo</td>
<td>0.79</td>
<td>0.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malawi</td>
<td>Blantyre</td>
<td>8.35</td>
<td>0.84</td>
<td>0.86</td>
<td>0.09</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Kaduna</td>
<td>1.22</td>
<td>0.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td>Nairobi</td>
<td>12.46</td>
<td>1.25</td>
<td>1.30</td>
<td>0.13</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>Addis Ababa</td>
<td>6.26</td>
<td>0.63</td>
<td>1.37</td>
<td>0.14</td>
</tr>
<tr>
<td>Chad</td>
<td>N’Djamena</td>
<td>1.58</td>
<td>0.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uganda</td>
<td>Kampala</td>
<td>1.80</td>
<td>0.18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

30 Calculated as follows: N$200/N$30 per cubic meter = 6.67 m³. 6.67 m³ * N$4.36/m³ = N$29.06.

31 Interview with Naudé Slabbert, Strategic Executive of the technical department of the municipality Otjiwarongo, 01-06-2011, Appendix B1; Interview with George Diergaardt, Namwater, 14-06-2011, Appendix B6.

32 The same exchange rate as above is used (1US$ - €0.72) to convert from US$ to € (x-rates,a). This could bias the numbers. Also, the prices for Otjiwarongo are for 2010/2011, while the other prices are from 2009 or earlier.
### 5.4.2. INVESTMENT COSTS OF PREPAID WATER METERS

Unfortunately not all investment costs could be located, due to the fact that only financial data from 2010-2011 was analyzed and the major investments were probably already made before. Therefore, less reliable sources have to be used.

What is known, is that the national government sponsored N$1.500.000 (€150.000) for the prepaid household connections in the informal settlements. Furthermore, it can be calculated that if the prepaid water meters indeed cost N$3300 (€330) and 2100 prepaid meters are installed already, the investment costs for the prepaid water meters would be N$3300 * 2100 = N$6.930.000 (€693.000). The municipality pays the biggest part of the prepaid water meters. If they force people to get a prepaid water meter the municipality pays the full costs. If people in Orwetoveni want a prepaid water meter and have problems with payments they get the prepaid water meter at a subsidized rate. If people in Orwetoveni want a prepaid water meter just for their own convenience they have to pay full costs. Furthermore, people in the informal settlements applying for a prepaid household meter get the meter at a subsidized rate of N$1000 (€100). However, the first 50 prepaid household meters in the informal settlements were subsidized at a rate of N$500 (€50). The tokens used together with the prepaid water meters cost N$150 (€15) each. Inhabitants have to pay this themselves, contributing to the investment costs.

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34 From interview (email) with Mr. Liebenberg, Strategic Executive Finance, 22-11-2011. Amount includes installation and labor costs.
35 Interview with Mr. Liebenberg, Strategic Executive Finance, 17-06-2011, Appendix B7.
36 Interview with Ms. Jesaja, Mayor of Otjiwarongo, interviewed on 05-07-2011, Appendix B10.
Furthermore, the municipality expects to place 2000 to 3000 household prepaid meters in the informal settlements over the next few years. This would cost them millions of dollars. They already applied for a subsidy from the national government to cover for a big part of the costs. 37

Thus, the municipality is paying for most of the investment costs. Two people working for the municipality already said they doubted that investments could be earned back. Furthermore, for the household prepaid connections the national government is sponsoring a big part.

5.4.3. YEARLY COSTS OF WATER

An overview of the yearly costs for the water supply for different actors is shown in Table 5-3. The total amount spent by conventional meter users and by prepaid users is achieved from the document ‘Water purchases and sales 2002-2011’. The total repair and maintenance come from the management report as on 30-06-2011. Calculations of the other costs are described in Appendix D.

The costs for water are calculated as being N$16 (€1.60) per cubic meter for both groups, but the prepaid users also pay for basic costs, repair and maintenance and other services within the water price. It can be seen from the table that the water costs for the conventional meter users are much higher than for the prepaid user. Both paying N$16/m³ (€1.60/m³) for water this means that conventional meter use consume much more water in total than the prepaid users. Still, the prepaid users are paying more for basic costs and for repair and maintenance costs. As discussed already in part 5.3.1 this is because prepaid water meters are much more expensive than conventional water meters. So the users are indirectly paying for the high costs of prepaid water meters.

Table 5-3: Who is paying for the water supply. Source: Based on data from municipality ‘Monthly financial report 2011’.

<table>
<thead>
<tr>
<th>Costs/Actor</th>
<th>Conventional meter user</th>
<th>Prepaid users</th>
<th>Municipality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair and maintenance costs</td>
<td>N$42.008 (€4.200)</td>
<td>N$225.000 (€22.500)</td>
<td></td>
</tr>
<tr>
<td>General (basic) costs</td>
<td>N$324.424 (€32.442)</td>
<td>N$480.574 (€48.057)</td>
<td>N$3.010.855 (€301.085)</td>
</tr>
<tr>
<td>Water costs</td>
<td>N$16.838.632 (€1.683.863)</td>
<td>N$1,172.073 (€117.207)</td>
<td>-N$7.279.104 (-€727.910)</td>
</tr>
<tr>
<td>Other services</td>
<td>N$147.181 (€14.718)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>N$17.205.064 (€1.720.506)</td>
<td>N$2,025.428 (€202.542)</td>
<td>-N$4,268.249 (-€426.824)</td>
</tr>
</tbody>
</table>

The second thing that stands out is that the municipality makes the water price higher to pay for other services. This is also seen in Figure 5-3, where it is shown where the municipal income from 2011 comes from. Here the ‘profitable & trading services’ (as the municipality calls it in this document) are shown, where the expenditure for each service was extracted from the income for that service. The extra income is used for the so-called ‘non-profitable services’ like roads and street works, public buildings, emergency services and the multipurpose help center.

37 Interview with Agatha Mweti, Strategic Executive community services and economic development, 13-06-2011, Appendix B5.
It can be seen in Figure 5-3 that most money comes from rates & taxes, water, and electricity. Electricity is a fixed amount the municipality gets from CENORED, the electricity supplier, so they cannot change this. Extra money from rates & taxes and for water increased compared to 2009/2010 and 2008/2009. Furthermore, rates & taxes, sewerage, sanitation and rent have to be paid by people every month. If they do not pay for this for three months, the municipality cuts off the water. So in order to receive water (and not be cut off by the municipality) all services have to be paid. The municipality defends this by saying that this way they do not have to throw people that do not pay out of their houses.

5.4.4. EVALUATION ON THE REVENUE AND EXPENSES

Water prices in Otjiwarongo are relatively high, because the municipality doubles the price they pay to Namwater. On top of this, prepaid water meter users have to pay a lot more basic charges (per cubic meter), according to the municipality to cover for extra costs of prepaid water meters. This also means that the more water people use the more they contribute to general water costs and repair and maintenance costs, which is not fair. Furthermore, water is one of the profitable services of the municipality (as they call it themselves), while this is a basic right. A part of the high water price can therefore also be explained by the fact that the municipality wants to make extra money on water, to pay for other services. On top of this, they also use the power of cutting people of from water if they do not pay for other services, like rent and sewerage.

5.5. EFFECTIVENESS OF THE WATER SUPPLY

The effectiveness of the water supply looks at the goals of the municipality and in how far they are reached. In this part only the most specific goals will be analyzed: Make people pay for services, debt collection, and enabling household connections. The goal to educate people on paying their bills will not be discussed here, because it is too early to tell if people learned from this to pay their bills before paying other things.

38 Interview with Agatha Mweti, Strategic Executive Community Services, 13-06-2011, Appendix B5.
When looking at the water revenue and expenses over the past three years it can be seen that, in real values, water revenue and water expenses did not change much (Figure 5-4)\(^{39}\).

**Figure 5-4: Water revenue and expenses for the last three years. Source: Monthly financial report June 2011 (Municipality Otjiwarongo b).**

From Figure 5-5 and Figure 5-6 follows that although less water is consumed, the amount of money received from water stayed the same. The reason for this is that water prices increased, including basic costs and sometimes also rent within the price.\(^{40}\) In Figure 5-5 can be seen that the cubic meters of water sold to the inhabitants decreased over the last two years. This could be because people are using less water. Since the prices for the richer people, using conventional meters did not change much, but prices for prepaid users did increase a lot, it is more likely that those people are using less water than before. This is alarming, because using less water for these people is bad for their hygiene and health. Furthermore, in Figure 5-6 it can be seen that despite the decline in water amounts sold, the amount of money received from water stayed the same. An explanation for this is the increased water price.

\(^{39}\) From 'Monthly financial report June 2011’ (Municipality Otjiwarongo, c).

\(^{40}\) As was seen in part 5.3.1.
Concluding, the municipal income did increase since the implementation of the prepaid water meters. But the most important reasons for this was the price increase of water, including other services (like rents) in the water price for prepaid users in the informal settlements, and raising high basic charges for prepaid water users.

But the goal of the municipality ‘make people pay for services’ does not mean they only want people to pay for water: they also want people to pay for other municipal services. If payments for these services are being collected with the help of prepaid water meters, the goal to make people pay for services could be achieved.
As can be seen in Figure 5-7 revenue from municipal services in 2009/2010 and 2010/2011 is higher than in 2008/2009, where all values are calculated to 2009 values, using an inflation rate of 8.0% for 2009/2010 and 6.5% for 2010/2011 and assuming that the municipality raised prices according to the interest rate. This shows that on average municipal income from other services has increased with N$367,571 (€36,757) a year (calculations in Appendix D). So, it could be that municipal income from other services increased because of the prepaid water meter. But, as it is seen that after 2009/2010 the revenue drops a little again in 2010/2011 it is more likely that there is no significant improvement in cash flow and that the difference is caused by regular fluctuations.

5.5.2. DEBT COLLECTION AND PREVENTION

Prepaid water meters are helping the municipality to recover debts. People have to pay a certain amount to debt payoff to the municipality every month. If they have not done this a part of the money they are buying water credits from goes to debt pay off, while the rest goes to water credits. Next to this, the municipality also tries to talk to people and convince them to pay off their debts. Also, arrangements can be made with the municipality about the amount that has to be paid off every month.

An advantage is that people realize they have to pay their bills. Also, more people might go to the municipality to try and make an arrangement. This is good, because if they are at the municipality they can ask questions and the municipality can explain things (like why they have to pay off debts). Besides, complaints will reach the municipality more easily. A negative aspect on the debt collection, however, is that it might be confusing for people where their money goes to. It is difficult for them to see which part of the money goes to debt pay offs and what goes to water.

From the ‘Debtors report’ of 2009/2010 and 2010/2011 (part of the Monthly financial reports 2010 and 2011, Municipality Otjiwarongo c) follows that debts for municipal services have increased over the past two years (Figure 5-8). It is split up in debts for services in Otjiwarongo (with which they mean only the city centre) and in Orwetoveni. In the informal settlements people cannot have debts with the municipality, since they only have prepaid meters and everything they have to pay is included in the water price. In July 2009 debts for Otjiwarongo services were N$3,842,714 (€384,271) and for Orwetoveni services N$13,820,748 (€1,382,075). In June 2011 both of them increased. Debts for Otjiwarongo services were N$4,757,192
(€475,719) and for Orwetoveni services N$17,552,850 (€1,755,285). This is a total increase of 26% in two years time.

These debts are from all municipal services: water, sewerage, rents & taxes. There are also other debts, like for the build-together project\textsuperscript{41}, but the biggest part is from municipal services (around 90%).

In June 2011 the municipality announced that they had recovered N$600,000 (€60,000) of debts over the past 6 months\textsuperscript{42}. Although this is less than expected, they are still happy with it. The reason, according to them, that the amount is lower is that people try to find ways to avoid paying off debts. Since one tag can be used on every water meter, people with debts borrow the tag of someone without debts. They take this tag to the municipality and put credit on it, receiving 100% water for this, paying nothing for their debts. They put the credits on their own meter and give the tag back to the owner. The municipality calls this ‘zoning’ and it is mentioned by many of the Strategic Executives and the CEO as one of the biggest problems with the current prepaid water meter. The KENT meter, which they are testing in 2011 and hope to implement soon (probably early 2012) can solve this ‘zoning’ problem. With this meter it is possible to allocate a tag to one prepaid water meter. However, this can also bring extra problems with it, which the municipality has not given attention to yet. People who cannot pay might stop using their meter completely and use their neighbor’s meter (who has no debts and has to pay less). In that case they are worse off and the municipality gains nothing. Another problem is with the provided services. If a meter breaks down this has to be fixed immediately as the tag cannot be used on another meter.

Concluding, if the municipality really recovered N$600,000 (€60,000) of the debts this year, together with the information that debts are still growing, this means that the debts would have increased even more without

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\textsuperscript{41} This is a program that helps people to build a house, having to pay this partly off over a couple of years.

\textsuperscript{42} The CEO announced this on 23-06-2011 to all employees who were at the municipal office that day, including me. I do not know how they calculated this number or if it is an estimation.
the prepaid water meters. It also means that debts grow faster than they are being recovered. 43 This raises the question if the prepaid water meters really tackle the real problems of the debts. The 2100 prepaid household water meters installed could not stop the total amount of debt from growing.

5.5.3. ENABLING HOUSEHOLD CONNECTIONS

Otjiwarongo is, according to their mayor 44, the first town in Namibia to provide also people in the informal settlements with household connections. So far, 50 households in the informal settlements have received a prepaid household connection at a subsidized rate. The municipality hopes to install 2000 to 3000 meters in the informal settlements in total (Namibian, 06-05-2010). There is already a waiting list of about 50 people who want a household prepaid connection and paid for it. However, they have to wait until the municipality starts replacing the Microplan Tagmeters in Orwetoveni for Kent meters, so the old Microplan Tagmeters can be placed in their households 45.

The mayor of Otjiwarongo, Ms. Hilda Jesaja, admits that not everyone in the informal settlement will be able to afford the prepaid household water meter, even at the subsidized rate. She estimates that less than half of the people can afford this. 46

5.5.4. CONCLUSION ON THE EFFECTIVENESS

The municipal income from water did increase, but this was probably caused by other changes than implementing the prepaid water meter: price increase of water, including other services (like rents) in the water price for prepaid users in the informal settlements, and increasing basic charges for all prepaid water users. Also, some debts were recovered, but the amount of debts from municipal services is still increasing. The municipality again tries to solve this with technique: a new prepaid water meters that has ‘zoning’. Therewith, the municipality implies that people can pay but are not willing to pay, not looking for solutions for people that are not able to pay.

Furthermore, 50 people in the informal settlement got a household connection and it is expected that a lot more people will get it next year. However, it is not possible to get everyone a prepaid household water meter.

5.6. EFFICIENCY OF THE WATER SUPPLY

First, the income and expenses for the municipality for prepaid water meters will be given. After that a financial cost benefit analysis will show the relation between the costs and the benefits and after how much year, if at all, the costs of the municipality will be recovered. From this a conclusion on the efficiency will be drawn.

43 In Holland we call this ‘Dweilen met de kraan open’, which literally means to mop the floor while the water tap is still open.

44 Interview with ms. Jesaja, Mayor of Otjiwarongo, interviewed on 05-07-2011, Appendix B10.

45 As described in part 2.1.2

46 Interview with ms. Jesaja, Mayor of Otjiwarongo, interviewed on 05-07-2011, Appendix B10
5.6.1. INVESTMENT COSTS

The total investment costs of prepaid water meters in Orwetoveni are estimated to be N$6,930,000 (€693,000). This is calculated by multiplying the costs per meter, which is N$3300 (€330), by the number of prepaid water meters installed, which is 2100 in Orwetoveni and 50 in the informal settlements. 47

A part of this is paid by the users themselves. For people with prepaid household connections in the informal settlements this contribution is known, it was N$500 (€50) 48, 49. The amount that is paid by prepaid household users in Orwetoveni, however, can only be roughly estimated. According to mr. Liebenberg, SE Finance, it depends on the situation how much people have to pay: if they are forced to get prepaid (the heavily indebted people) they do not have to pay anything, if they have some debts they can chose for prepaid themselves and pay a part of it, and if they just want it for themselves they have to pay the full price. 50 However, it is not known how much people with small debts actually have to pay and how many people want a prepaid water meter for themselves. The writers estimate is that on average users contributed N$500 (€50) to the prepaid water meter, assuming that most people received it for free 51 and about 1 in 6 people paid the full amount. Also, this is the same amount people in the informal settlements had to pay for a prepaid household connection.

5.6.2. EXPENSES

First of all, the repair and maintenance costs of prepaid water meters are much higher than for conventional water meters. As can be seen in Figure 5-9 66% of the repair and maintenance costs in 2010/2011 was for prepaid household connections, budgeted at N$220,000 (€22,000). The actual costs turned out to be a little lower: N$185,000 (€18,500). This while there are still more conventional water meters than prepaid household meters. A first explanation for this is that prepaid meters are much more expensive than conventional meters, where prepaid meters cost approximately N$3,300 (€330) and conventional meters cost only N$250 (€25) 52. Therefore, replacing parts of the prepaid water meters is also much more expensive than replacing parts for conventional meters. Also, the prepaid meters on the standpipe break very often. It was not asked to the municipality if prepaid household meters break more often than the conventional meters and from the financial data this also cannot be confirmed. However, it is expected that they break more often, because the


49 After the first 50 meters this contribution increased to N$1000 (€100). They are not installed yet and therefore not in the cost-benefit analysis.

50 Interview with Mr. Liebenberg, Strategic Executive Finance, 17-06-2011, Appendix B7.

51 This is based on the information that the municipality first wanted to give heavily indebted people prepaid water meters before giving it to other people. Also, it was noted that people without debts also received prepaid water meters, but they did not ask for it themselves, which is why it is assumed that they also did not have to pay for it. These people are either people moving into new houses or people living in a street where a lot of people received a prepaid water meter and where it was decided it was easier to give everyone prepaid at the same time.

52 E-mail conversation with Mr. Liebenberg, Strategic Executive Finance, 22-11-2011. Also, a newspaper says that the municipality estimates the costs of prepaid water meters to be N$3,000 (Namibian, 06-05-2010).
system is more complicated. A distinction between prepaid household connections in Orwetoveni and prepaid household connections in the informal settlements is not being made by the municipality. Taken the assumption that repair and maintenance work per meter is the same in both cases it can be calculated that the repair and maintenance costs for prepaid household connections in Orwetoveni are N$180,698 (€18,069) and for prepaid household connections in the informal settlements they are N$4,302 (€430).\(^{53}\)

However, the repair and maintenance work for conventional meters will decline, because there are 2100 less conventional water meters in use. Guessing that there are 4000 conventional water meters\(^{54}\) and knowing that the repair and maintenance costs for conventional meters in 2010/2011 were N$42,000 (€4,200) this means that the avoided costs for conventional meter repair and maintenance work is: N$\frac{42,000}{2100} \times 2100 = N$22,050 (€2,205). The amount of standpipes is still the same, so for the informal settlement no avoided repair and maintenance work for the standpipes is calculated.

![Repair and Maintenance work 2010/2011](image)

Figure 5-9: Repair and Maintenance costs of water meters in 2011. Source: Based on data Municipality Otjiwarongo A: Water June 2011

Salaries and allowances costs for water also increased last year, from N$706,757 (€70,676) in 2009/2010 to N$805,158 (€80,519) in 2010/2011. This could be because extra people are hired for the debt recovery, but it could also have other reasons that the writer is not aware of. Since it is not clear where the extra costs come from, these potential extra costs are kept out of the cost-benefit analysis in the next part.

Also, fixed costs for basic charges are lost, since they are now included in the water price for prepaid users in Orwetoveni. People in the informal settlements did not pay basic charges. The basic charges were N$22 (€2.20) a month for each household in Orwetoveni. So, a yearly amount of N$22/month \times 12 months \times 2100 prepaid users = N$554,400 (€55,440) is missing compared to the situation before. But this is recovered from the higher prepaid water price, as will be discussed in the next part.

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\(^{53}\) Calculation: N$185,000/2150 prepaid water meters \times 2100 prepaid water meters in Orwetoveni = N$180,698 (€18,069). N$185,000/2150 prepaid water meters \times 50 prepaid water meters in the informal settlements = N$4,302 (€430).

\(^{54}\) This guess is based on the number of people living in Orwetoveni or Otjiwarongo centre, which is around 30,000 and an average household size of around 5 (Republic of Namibia, 2004), which means there are around 30,000/5= 6,000 household water meters.
Furthermore, costs of the municipality for the tags can be considered zero, since these costs are being paid by the users. The users pay N$150 (€15) for a tag. In this part only a financial cost-benefit analysis for the municipality will be shown, so the costs of the tags will be zero. Later on, in chapter 6 and 7 these costs will be included.

5.6.3. INCOME

Instead of the basic price of N$16.00 (€1.60) per cubic meter prepaid users in Orwetoveni pay the prepaid water price of N$25.64 (€2.56) per cubic meter. Therefore, the extra costs for prepaid users in Orwetoveni are N$25.64 – N$16.00 = N$9.64 (€0.96)/m³. So, the extra money received from prepaid users due to the difference between the prepaid water price and the basic water price depends on the amount of water sold. According to the municipality’s document ‘Water purchases and sales 2002-2011’ the municipality sold 71,629 m³ to prepaid users. Assuming that 77% of this was consumed by prepaid water meter users in Orwetoveni, the extra money they received from this should in that case be 55,154 m³ * N$9.64/m³ = N$531,687 (€53,168). However, it is highly unlikely that this number of 71,629 m³ sold in 2010/2011 to prepaid users is true, as this would mean prepaid users (including standpipe users, prepaid users in Orwetoveni and prepaid household users in the informal settlements) used about 15 m³ water per household in 2010/2011, which is approximately 41 liter per household per day. The highest prepaid sales were in the financial year 2008/2009 and were 167,624 m³. This would, according to the same calculations, lead to 98 liters per household per day, which is still very low. In this case, the extra money received from this would be 167,624 m³ * 0.77 * N$9.64/m³ = N$1,249,290 (€124,929).

Prepaid household connection users in the informal settlements pay the same price as standpipe users in the informal settlements. Therefore, giving them household connections does not lead to increased revenue the way it does in Orwetoveni. However, the municipality is making revenue from every liter sold, so if this amount increases because of the prepaid household connections they can make extra revenue. This will be one of the scenario’s for the cost-benefit analysis.

55 Information from ‘Water purchases and sales 2002-2011’, numbers are from 2011.
56 Chris and Jackson, Technicians prepaid water meters, interview 06-06-2011, Appendix B3.
57 Information from ‘Water purchases and sales 2002-2011’, numbers are from 2010/2011.
58 This estimation is based on the following things: 2100 households in Orwetoveni have a prepaid water meter, 2750 (all) households in the informal settlements use prepaid water meters (either standpipes or household prepaid water meters), prepaid users in Orwetoveni use almost twice as much water as prepaid users in the informal settlements (from survey, see chapter 6 and chapter 7). The calculation: (2100 * 390)/(230 * 2753) = 1.29. 1/1.29 = 0.7731.
59 Calculated as follows: 71,629 m³ / 4700 households = 15,24 m³ / household. The number of households is calculated by adding the total households in the informal settlements, which is about 2750 to the number of households using prepaid water meters in Orwetoveni, which is 2100.
60 Calculated as follows: 15,000 liter / 365 days a year = 41.09 liters a day.
61 Before that time there were no prepaid meters in Orwetoveni yet, which is why it was lower. In 2009/2010 the amount declined to 107,391 m³ and in 2010/2011 it dropped again to 71,629 m³. No explanation for this was found.
As was seen in part 5.5 the revenue from other services than water may have increased slightly due to prepaid water meters (because of avoided debts). According to the calculations this increase would be approximately N$367,571 (€36,757) a year. Furthermore, in part 5.5 it was shown that according to the municipality they recovered N$600,000 (€60,000) of debt in 6 months, which comes to N$1,200,000 (€120,000) yearly.

### 5.6.4. FINANCIAL COST-BENEFIT ANALYSIS PREPAID WATER METERS

As the numbers on the income from prepaid water meters are highly uncertain, the focus will be on the costs of the prepaid water meter. From this will be calculated what the income has to be in order to break even. Together with calculations on affordability in chapter 6 it can be seen how realistic this is and how much pressure the costs put on the inhabitants’ budget.

An overview of the costs can be seen in Table 5-4. The assumptions for the costs are:

- Investment costs are N$3,300 (€330) per meter * 2100 prepaid water meters.
- Yearly maintenance costs for 2100 prepaid water meters are N$180,698 (€18,069), based on the maintenance costs in the financial year 2010/2011.
- Discount rate is 3.17 (((1,105/1,071)-1)*100), where the lending rate is estimated to be 10.5% and the inflation 7.1%.
- Prepaid water meters have to be replaced after 5 years (Mr. Liebenberg, Strategic Executive Finance, interview 17-06-2011, Appendix B7). (The calculation is done for 10 years, in case the lifespan improves).

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62 One uncertain factor is how much the municipality earns from the price increase (the prepaid water price is higher than the basic water price). This highly depends on the amounts of water consumed. But the amount mentioned in data of the municipality is so low that it cannot be true. Besides, it can be discussed if this price increase has to be included in a CBA as a price increase without prepaid water meters would also result in increased income. Another uncertain factor is the extra income from people that start paying for services who did not pay before. From the available data this amount cannot be determined. Estimations can be made, but have a very big effect on the outcome. An additional factor which is hard to include is the debt. The municipality wants to recover debts with the prepaid water meter. But the amount of debt they recover is uncertain. Furthermore, debt is not income and it is hard to place this in a CBA.

63 Estimation of the municipality (E-mail conversation with Mr. Liebenberg, Strategic Executive Finance, 22-11-2011). Adri van Iersel from Brabant Water thinks that around €150-€250 is paid for the meter itself, and the rest of the costs are estimated labor costs. Other cities estimate to spend much less on a prepaid water meter: €43 in Zimbabwe (calculated from US$60) (The Herald, 2012) and €125 (calculated from US$174) from which €63 on the meter itself in Kampala (Uganda) (COWI, 2007, via Berg et al, 2010).

64 From Water June 2011 (Municipality Otjiwarongo) it is derived that in the year 2010/2011 the municipality spend N$185,000 (€18,500) specifically on prepaid household water meters (not including general repair and maintenance costs like labor, which they did not specify for different meters; and not including standpipes). Assuming that this is the same for every meter and knowing that there are 2100 prepaid household water meters in Orwetoveni and 50 in the informal settlements, the yearly repair and maintenance costs can be calculated: (N$185,000/2150)*2100 = N$180,698 (€18,069).

65 Estimation, based on prime lending rates in November 2010, which were 10.5% (Making Finance Work for Africa, 2010).

66 Average calculated interest rate from 2006-2010 (IndexMundi, n.d.). Also, coincidentally almost the same as the interest rate of December 2011, which was 7.2 (Tradingeconomics, n.d.).
Table 5-4: Costs of 2100 prepaid water meters in Orwetoveni. Prices in N$ (divide by 10 to get price in €).

<table>
<thead>
<tr>
<th>Year</th>
<th>Costs prepaid meter (N$)</th>
<th>Costs tags (N$)</th>
<th>Costs maintenance (N$)</th>
<th>Total costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6,930,000</td>
<td>315,000</td>
<td></td>
<td>7,245,000</td>
</tr>
<tr>
<td>1</td>
<td>180,700</td>
<td>180,700</td>
<td></td>
<td>180,700</td>
</tr>
<tr>
<td>2</td>
<td>180,700</td>
<td>180,700</td>
<td></td>
<td>180,700</td>
</tr>
<tr>
<td>3</td>
<td>180,700</td>
<td>180,700</td>
<td></td>
<td>180,700</td>
</tr>
<tr>
<td>4</td>
<td>180,700</td>
<td>180,700</td>
<td></td>
<td>180,700</td>
</tr>
<tr>
<td>5</td>
<td>180,700</td>
<td>180,700</td>
<td></td>
<td>180,700</td>
</tr>
<tr>
<td>6</td>
<td>180,700</td>
<td>180,700</td>
<td></td>
<td>180,700</td>
</tr>
<tr>
<td>7</td>
<td>180,700</td>
<td>180,700</td>
<td></td>
<td>180,700</td>
</tr>
<tr>
<td>8</td>
<td>180,700</td>
<td>180,700</td>
<td></td>
<td>180,700</td>
</tr>
<tr>
<td>9</td>
<td>180,700</td>
<td>180,700</td>
<td></td>
<td>180,700</td>
</tr>
<tr>
<td>10</td>
<td>180,700</td>
<td>180,700</td>
<td></td>
<td>180,700</td>
</tr>
</tbody>
</table>

From this it is calculated how much yearly income there has to be in order to break even. In Table 5-5 it is assumed that the lifespan is 5 years and the needed income is the same every year. It is assumed that the municipality has enough money for the investment. Therefore there are no calculations on liquidity. From the table it follows that the yearly income should be N$1,770,570 (€177,057). For 2100 this means that for each meter N$843 (€84) has to be earned every year. (If the lifespan would be 10 years, the amount that has to be earned every year per prepaid water meter would be N$450 (€45). Following calculations will work with a lifespan of 5 years). As a comparison, the water supply for an average household (based on 21 surveys) using a prepaid water meter costs N$1,448 (€144). So, the costs of prepaid water meters are very high.

Table 5-5: Needed income to break-even for 2100 prepaid water meters with a lifespan of 5 years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Costs prepaid meter (N$)</th>
<th>Costs tags (N$)</th>
<th>Costs maintenance (N$)</th>
<th>Total costs</th>
<th>Income</th>
<th>Discount factor</th>
<th>Net cashflow (discounted)</th>
<th>Cumulative cash flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6,930,000</td>
<td>315,000</td>
<td></td>
<td>7,245,000</td>
<td>1</td>
<td>-7,245,000</td>
<td>-7,245,000</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>180,700</td>
<td>180,700</td>
<td>1,770,570</td>
<td>1,540,955</td>
<td>0.97</td>
<td>-5,704,045</td>
<td>-4,210,045</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>180,700</td>
<td>180,700</td>
<td>1,770,570</td>
<td>1,493,541</td>
<td>0.94</td>
<td>-1,359,874</td>
<td>-1,359,874</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>180,700</td>
<td>180,700</td>
<td>1,770,570</td>
<td>1,447,586</td>
<td>0.91</td>
<td>-2,762,919</td>
<td>-2,762,919</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>180,700</td>
<td>180,700</td>
<td>1,770,570</td>
<td>1,403,045</td>
<td>0.88</td>
<td>-1,359,874</td>
<td>-1,359,874</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>180,700</td>
<td>180,700</td>
<td>1,770,570</td>
<td>1,359,874</td>
<td>0.86</td>
<td>-0</td>
<td>-0</td>
<td></td>
</tr>
</tbody>
</table>

Given that a pensioner receives N$450 (€45) a month (International pension fund, n.d.) it can be concluded that the costs for the prepaid water meter cannot be asked from them as this would cost them already 15% of

67 Calculated as follows: N$1,770,570/2100 = N$843.

68 Calculated as follows: Yearly total income would have to be N$944,245. N$944,245/2100 = N$450.

69 Calculated from survey question 3.5: How much does the household spend on water each week? From the amount spend per household per week the amount used was calculated per household per week was calculated (2785 liters). This was multiplied by 52 weeks a year, and multiplied by N$10 per 1000 liters. This N$10 per m³ is an estimation of the costs made, based on the total costs and the total amount of water used (as calculated in part 5.4.1).
their yearly income\textsuperscript{70}. Furthermore, for people below the US$2 poverty line (which statistically should be most people in Orwetoveni, as will be shown in part 6.3.3), having to pay the costs of the prepaid water meter would cost them about two month salaries.\textsuperscript{71}

Furthermore, it can be estimated how many people that did not pay for services before have to pay now in order for the municipality to break even. Assuming that a household has to pay N$350\textsuperscript{72} (€35) for municipal services every month, the municipality misses N$4,200 (€420) every year if someone does not pay (N$350*12 months). This means that if 1 in 5 prepaid water meter users start paying services after getting a prepaid water meter (and they did not pay this before) this covers the costs for the prepaid water meters\textsuperscript{73}. Also, if everyone would pay N$843 (€84) on debt pay off every year (which is N$70 (€7) each month) costs would also be recovered.

For the informal settlements, where people could get prepaid household water meters instead of using standpipes, the costs per prepaid water meter are the same. This means that in this area the costs also cannot be paid by inhabitants who are living from a pension (or earning the same or less). Furthermore, there are no people in this area who did not pay for municipal services but are paying now (as they pay municipal services by a higher water price) and there are no debts that can be paid off.

\textbf{5.6.5. CONCLUSION ON THE EFFICIENCY}

In this part it was seen that investment costs for prepaid water meters are very high. Besides, repair and maintenance costs for prepaid water meters are much higher than for conventional water meters. It was calculated that for each household with a prepaid water meter the yearly costs are N$843 (€84) if a lifespan of 5 years is assumed. This cannot be paid by pensioners (or people with a similar or lower income) as this would cost them a too large amount of their total spending. For prepaid water meters in Orwetoveni the costs can be received from people who start paying municipal services who did not do this before (because they were not willing to pay). One in five people has to start paying this now in order to recover costs. In the informal settlements this is not the case and costs can only be recovered from subsidies.

\textsuperscript{70} Calculated as follows: 12 months * N$450 = N$5,400 per year. N$843/ N$5,400 * 100% = 15.6\%. Where it is assumed that the pensioner lives alone or with people that do not have any income.

\textsuperscript{71} Calculated as follows: US$2 * 0.72 = €1.44 = N$14.40, N$14.40 * 365 days = N$5652/ year, N$5652/12 = N$438

\textsuperscript{72} Rough estimation based on two interviews where people estimated their costs for rent, tax, sewerage and refuse.

\textsuperscript{73} Calculated as follows: N$4,200/ N$843 = 4.98
6. IMPACT OF PREPAID WATER METERS IN ORWETOVENI

This chapter tries to answer the subquestion: “How does the implementation of household prepaid water meters in Orwetoveni influence the quality of life?” In Orwetoveni, the area in between the city centre Otjiwarongo and the informal settlements, around 2100 people got a prepaid water meter in replace of the conventional water meter they used to have. The rest of the inhabitants of Orwetoveni have a conventional water meter. Although two people interviewed had no meter at all (because it was removed after they did not pay for water or other services or because it was broken and they could not pay for getting it repaired).

The information discussed in this chapter comes from interviews, observations and the survey. Seven interviews with inhabitants of Orwetoveni were done, with randomly selected households. The interviews were done in the house or in the garden of the interviewees, which helped in understanding their living situation. Observations were done by driving or walking around in the area and hanging out with people living there. Not every district in Orwetoveni has been visited though. Observations at Orwetoveni office, one of the municipal offices where people could charge their tag or ask questions, showed how long the queues were, how the charging of the tags worked and what kind of complaints people had.

For the survey, 50 people in Orwetoveni were interviewed: 25 with conventional water meters and 25 with prepaid water meters. It was expected that people with prepaid water meters would have more debts and therefore less income than people with conventional meters, because the municipality first wanted to give prepaid water meters to people with the highest debts. However, from the survey followed that only half the people with prepaid water meters interviewed had debts. Also, 7 people with conventional meters had debts. Therefore, this is not a big constraint in the comparison. The monthly spending of the households having prepaid water meters and the households having conventional water meters were comparable to each other, where the average for the prepaid users interviewed was N$1,460 (€146) and for conventional meters this was N$1,685 (€169). Therefore it is expected that this does not affect the results. However, other differences between the groups could always occur, so the data should still be handled with care.

Around 2,100 people in Orwetoveni have a prepaid water meter, and the writer estimates that over 15,000 people live here. A sample of 50 is therefore not big enough to reflect the population in this area. However, the survey can be used to show differences between the two groups. Differences in the amount of water they use and how much they spend on water will be most important. Other information, like on hygiene, will not be used for a comparison between the two groups, but more as an explorative study. Concluding, the survey will be used as an explorative study and to make some comparisons between the two groups. It does not reflect the whole population, so no generalization from this data to the whole area can be made.

74 They were randomly selected by driving around in different areas of Orwetoveni, stopping at a random house to see if someone was home. If not, it was tried if one of the neighbors was home.

75 There are no precise numbers yet, but they should be available in 2012 when the results of the Census from August 2011 are available. The estimate of 15,000 is made by the writer, based on the information that around 40,000 people live in Otjiwarongo, from which around 13,000 live in the informal settlements, and most people live in Orwetoveni. This information is received from interviews with Senior Executives from the municipality.
The water supply, being prepaid, first influences the access and reliability and the affordability (Table 6-1). Therefore, this will be discussed first, in part 6.2 and 6.3. This influences the water use, which will be discussed in part 6.4. Then, the hygiene and health of the inhabitants will be discussed, which is affected by a change in the water use. Together, this influences the quality of life. Before making conclusions on the impact on the quality of life a short summary of the perception of people on prepaid water meters will be given. But before starting with the analysis an overview of the services in Orwetoveni, based on observations and interviews, will be given. This will provide a background in the way people live in this area.

### 6.1. SERVICES IN ORWETOVENI

The way people live in Orwetoveni is, just like the physical location of this area, in between town (the city centre of Otjiwarongo) and the informal settlements. Almost everyone in this area has a brick house (Figure 6-2), although around a dozen shacks were still seen here by the writer. The streets are tarred and look clean. Furthermore, this area has most facilities, like a supermarket, a municipal office, schools, a church and a hospital. There is no gas station however.

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*Figure 6-1: Overview of the chapter*

*Figure 6-2: A house in Orwetoveni*
Figure 6-3: A barber shop and someone selling food in Orwetoveni
People in this area have to pay for basics, like rent, tax, sewerage and refuse. Also, one of the Strategic Executives of the municipality estimates that about 70% of the people are indebted to the municipality, because they did not pay (enough) for water or for the basics (like rents and taxes). Especially the pensioners, receiving around N$450 (€45) a month (International pension fund, n.d.)[^76], have a hard time paying the municipality.

There are quite some cars, mostly used as taxis. Other small businesses people have over here are running a small bar, running a small barber shop on the street or selling food on the street (Figure 6-3).

### 6.2. ACCESS AND RELIABILITY

The access to water and the reliability of the water supply both influence the above mentioned water use, but also have an effect on the quality of life. Almost all people do have access to water, if access is considered as having a water meter. It is, however, also important to see how much time or how much trouble it costs them to get water. Also, if the municipality cuts the water supply off there is no access to water anymore. This will be discussed first. The second point is the reliability of the water supply, meaning how reliable the water flow and the meters are.

#### 6.2.1. ACCESS TO WATER: TIME SPEND

Prepaid users have to spend some extra time on charging their tag, for which they have to go to the municipal office. On average, they go to the office a little less than two times a month. None of the people interviewed goes more often than once a week. Since there is an office in this area it does not take people that long to get there. However, the lines at the office can sometimes be very long, especially on Saturday morning, the only time it is open in the weekend, making the time it takes to recharge the tag much longer.[^77]

#### 6.2.2. ACCESS TO WATER: CUT OFFS

Cut offs by the municipality (from now on called ‘cut offs’) interrupt the access to water. After not paying for three months, the municipality can cut people off. Of the prepaid users 15 out of 25 people had been cut off from water when having a conventional water meter.[^78] Half of them got only cut off once, but several people got cut off 4 times or more.[^79] In most cases it took them a week or less to reconnect again. For the people that still use a conventional meter 10 out of 25 had been cut off at

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[^76]: From two interviews with inhabitants also followed that this was the amount pensioners received.

[^77]: More information on the waiting lines and the time it takes to recharge the tags can be found in part 7.2.2.

[^78]: Question 4.4 of the survey, Appendix C

[^79]: Question 4.4 of the survey, Appendix C
least once. Most of them got only cut off once or twice.\textsuperscript{80} This is remarkable because the municipality wanted to give people with high debts (and therefore many cut offs) the first prepaid meters, but it turns out that there are also a lot of people without debts having a prepaid water meter a people with debts still having conventional meters.

If cut offs can be avoided this helps the reliability of the water supply for the users. The prepaid meter should help in avoiding cut offs; by paying before use it is impossible to use more water than you are able to pay. However, in practice more changes are needed to be able to avoid cut offs. In some cases people using prepaid meters adapted to the situation; they are now paying more attention to their bills, paying everything before buying water, which avoids cut offs.\textsuperscript{81} However, there are also people that pay for all the water they use, as there is no other option when using a prepaid meter, but do not pay (enough) for basics or debts. They can still be cut off.

\section*{6.2.3. RELIABILITY OF THE WATER SUPPLY}

The water supply in Otjiwarongo is very reliable. So, if your meter works and you can afford it you can get water.\textsuperscript{82} However, broken meters can be a problem. If it is the owner’s fault that the meter breaks he or she has to pay for it. But, since the prepaid meter is expensive, replacing parts and fixing the meter is also expensive. This sometimes leads to people not getting the meter fixed, and they now have to live without a water tap. A positive effect of people having to pay for the repairs themselves, however, is that people are more careful with their water meters. Also, if bills can be paid or if the municipality pays for it the general opinion is that they are fast in fixing the meter, most often doing this the same day.\textsuperscript{83}

An old lady who has the prepaid meter for almost a year now is very careful with it. It was broken once and the municipality told her she should pay N$ 1,000. She paid this and they fixed the meter. That is why she is extra careful now. She does not have kids, but if her grandchildren come over sometimes they are naughty. She warns them not to play next to the water meter.

Prepaid user in Orwetoveni 3.

In one case, a middle aged guy had a prepaid water meter which broke twice. He went to the municipality and they came and repair it within one day. There were also pipe breaks on his erf, which he fixed himself.

Prepaid user in Orwetoveni 2.

\textsuperscript{80} Question 3.11 of the survey, Appendix C.

\textsuperscript{81} Information from two interviews with prepaid users.

\textsuperscript{82} There was one exception while the writer was in Otjiwarongo. Namwater had a pipe break which they could not fix soon enough and at the same time they did not had enough water in the water tank. This leaded to problems for a few days, where people in some areas only could get water several hours a day. This was, however, an exception and was solved in a few days.

\textsuperscript{83} Based on interview with Naudé Slabbert, 01-06-2011, Appendix B1.
6.2.4. SUMMARY OF THE ACCESS AND RELIABILITY

Most prepaid users used to be cut off by the municipality several times, which only happened to one of the interviewees after having a prepaid water meter. Broken meters do not seem to harm the reliability much if the municipality pays for it or if people can afford paying for it to get repaired, because the municipality is fast in replacing or fixing the meters. However, if people cannot afford to get it fixed this is another way of being cut off from water, and those people will not have access to water anymore, having to ask neighbors or friends for water.

Furthermore, having to go to the municipal office to put credits on the tag also harms the access, because it cost people extra time to do this and because the office is not always open.

6.3. AFFORDABILITY OF WATER

First, the price of water will be shortly discussed. Then, the affordability of water will be shown, including the perceived affordability of water and the calculated percentage of expenditures that goes to water. Finally there will be a short summary on the affordability of water.

6.3.1. PRICE OF WATER

The price of water is N$16 (€1.60) per cubic meter for conventional meter users and N$25.64 (€2.56) per cubic meter for prepaid water meter users in Orwetoveni. The difference in the price is caused by the basic charges, which are included in the water price for prepaid water meter users and have to be paid separately by conventional meter users, who have to pay N$22 (€2.20) each month. As seen in chapter 3 already, this price is much higher than in other countries, where the price for prepaid in Otjiwarongo is the highest, and the lowest price is N$0.29/m3 (€0.03) in Abidjan.

6.3.2. PERCEIVED AFFORDABILITY OF WATER

The water price for prepaid users is N$25.64/m3 (€2.56) and for conventional meter users this is N$16.00/m3 (€1.60). Prepaid water users are more aware of the water price: 6 of the 25 prepaid water users interviewed knew the price of water, where not a single conventional meter user knew this. But even though most people do not know the price, most of them think water is affordable. Of the prepaid water users 92% (n=25) thinks water is affordable, and from the people using conventional meters this is a bit lower; 68% (n=25). From both groups an equal amount of people (60%) at the same time says it sometimes happens that they do not have enough money left for buying water, which seems to contradict with the fact that they think water is affordable. When this happens, most of them go to their neighbors for help. Others get help from family or friends.

84 Question 5.7 of survey, Appendix C
85 Question 1.6 of survey, Appendix C
86 Question 3.8 of survey, Appendix C
6.3.3. EXPENDITURES ON WATER

From both groups 40% of the people say their income is not sufficient to afford their basic needs (n=50)\(^87\). However, the amount of conventional meter users saying their income is more than sufficient is higher than for the prepaid users (24% for the first group and 12% for the second)\(^88,89\). Thus, both groups have people who perceive their income as being insufficient, but in the first group more people think their income is more than sufficient than in the second group.

The average income in Otjiwarongo is hard to estimate. From interviews follows that expenditures for conventional meter users are in general a bit higher than for prepaid water meter users. According to the small survey conventional meter users in Orwetoveni make on average N$5,600 (€560) per person per year and prepaid meter users in Orwetoveni make N$3,900 (€390) per person per year\(^90\). This is much lower than the average income per capita per year, which is about N$12,000 (€1,200) (UNDP, n.d.). This is because of the high income inequality in Namibia, as shown in the introduction. The survey was too small for this numbers to be reliable. However, as it is known that 35% of the population lives below 1US$ a day (which is N$2,628 (€262) a year) and 56% lives below 2US$ a day (which is N$5,256 (€525) a year) (UNDP, 2005) it is likely that the magnitude of the numbers is correct, as this would mean that prepaid users in Orwetoveni are between the poorest 35 and 56% of the country, and conventional meter users live just above the poverty line of 2US$ a day, meaning that on average they are a bit richer than the poorest 56%.

Furthermore, it could be retrieved from the survey that people with a conventional meter spend more money on water than prepaid water meter owners (n=40). Also their spending relatively to their total spending is bigger, using on average 21% of their income on water (n=18) instead of the 12% (n=18) prepaid water users spend on water (α = 0.024), as can be seen in Figure 6-4.\(^92\) One reason that they spend more money on water

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\(^87\) Even though the focus is to look at the changes for prepaid water users and the differences between prepaid and conventional meter users, some results for the total group are also given. This information is important as background information for the situation, and to see the real numbers, instead of only looking at the relative numbers.

\(^88\) In some cases ‘n’ is not specifically mentioned. If this is the case, n=25 if one of the two groups is discussed and n=50 if both groups are included.

\(^89\) Question 3.7 of the survey, Appendix C.

\(^90\) Question 3.4 and 3.1 of survey: Total estimated spending of household per month/ number of household members * 12 months/year.

\(^91\) Calculated by dividing the amount spend on water (question 3.5 of the survey) by the total expenditures of the household (question 3.4 of the survey).

\(^92\) The thick line shows the median, where the tinted area shows the middle 50% of scores, and the top and bottom line show the lowest 25% and highest 25%.
relative to their income is that they do not have to pay off debts, which most prepaid water meter users do have to pay.

![Figure 6-4: Difference in percentage of income spend on water.](image)

### 6.3.4. CALCULATED AFFORDABILITY

As can be seen in Table 6-1 a pensioner, receiving N$450 (€45) a month who has a prepaid water meter (thus paying N$25.64/m³ (€2.56/m³)) uses 3.4% of her income on water if he/she has no children or other people to take care for and uses the absolute minimum amount of 20 liters/day. However, the wage pensioners receive is often also used to support other family members, like children. In the case of having 2 children, they already have to spend 10% of their income on water, and this is 17% of they are with 5 people. As can be seen in the table using the preferable amount of 100 liters/person/day is impossible, since this would cost 17 to 85% of the income, depending on the number of people.

Table 6-1: Different scenarios of the water expenditure for a pensioner.

<table>
<thead>
<tr>
<th>Person</th>
<th># Children</th>
<th>Income/ month 93</th>
<th>Water use/ Person/ day</th>
<th>Water expenses/ month 94</th>
<th>% of spend water 95</th>
<th>income on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pensioner 0</td>
<td>N$450 (€45)</td>
<td>20 liter</td>
<td>N$15 (€1.50)</td>
<td>3.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pensioner 2</td>
<td>N$450 (€45)</td>
<td>20 liter</td>
<td>N$46 (€4.60)</td>
<td>10.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pensioner 4</td>
<td>N$450 (€45)</td>
<td>20 liter</td>
<td>N$77 (€7.70)</td>
<td>17.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pensioner 6</td>
<td>N$450 (€45)</td>
<td>100 liter</td>
<td>N$77 (€7.70)</td>
<td>17.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

93 From: International Pension Fund. Confirmed by two interviewees (pensioners).

94 Calculated as follows: (Water use/ person/ day * number of persons * 30 days)/1000 * N$25.64/1000 liter water.

95 Calculated as follows: (Water expenses/ month) divided by( income/month).
Furthermore, the adjusted per capita income\textsuperscript{96} for the poorest 25% in Namibia is estimated to be N$2,004 (€200) a year. For the poorest 25-50% it is estimated to be N$3,993 (€399) a year (Republic of Namibia, 2004).\textsuperscript{97} As can be seen in Table 6-2 the poorest 25% of the people already have to spend 8.9% of their income on water if they want to use 20 liters. For 100 liters this is 46.5%, which is clearly unaffordable. For the poorest 50% they have to spend on average 4.5% to use 20 liters of water a day, and 23.2% to use 100 liters.

Table 6-2: Different scenarios of the water expenditure for the poorest 25% and the poorest 25-50% of Namibia.

<table>
<thead>
<tr>
<th>Person</th>
<th>Income/ month</th>
<th>Water use/ day</th>
<th>Water expenses/ month</th>
<th>% of income spend on water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poorest 25%</td>
<td>N$167 (€16.70)</td>
<td>20 liter</td>
<td>N$15 (€1.50)</td>
<td>8.9</td>
</tr>
<tr>
<td>Poorest 25%</td>
<td>N$167 (€16.70)</td>
<td>100 liter</td>
<td>N$77 (€7.70)</td>
<td>46.5</td>
</tr>
<tr>
<td>Poorest 25-50%</td>
<td>N$332 (€33.20)</td>
<td>20 liter</td>
<td>N$15 (€1.50)</td>
<td>4.5</td>
</tr>
<tr>
<td>Poorest 25-50%</td>
<td>N$332 (€33.20)</td>
<td>100 liter</td>
<td>N$77 (€7.70)</td>
<td>23.2</td>
</tr>
</tbody>
</table>

It can easily be seen that using as little as 20 liters a day is already very expensive for many people. Using 100 liters a day, which would be optimal (Howard and Bartram, 2003) is out of reach for the poorest 50% with the current prepaid water price.

Now if the municipality wants people to have access to a minimal needed amount every day and wants this to be affordable, it can be calculated what the price of water should be to achieve this. In the calculation example the scenario is shown that the municipality wants people to have access to a minimum amount of 50 liters a day, considering it affordable if people spend 5% of their income on water (McPhail, 1993) and looking at the poorest 25% of the country. In this case, the price per cubic meter has to be N$5.56 (€0.55). Almost 5 times as low as the prepaid water price is now. Since the municipality already has to pay Namwater N$8 (€0.80) per cubic meter water the only way to be able to set the price at N$5.56 (€0.55)/m\textsuperscript{3} is to subsidize it. This could be either a subsidy from an authority like the national government, or a cross-subsidization like the Increasing Block Tariff (IBT). In the latter case there is a low price for low consumers and a higher price for households using a lot of water (more

\textsuperscript{96} In the adjusted per capita income it is assumed that the consumption needs for children are less than those of adults. Therefore, a child below or equal to the age of 5 was counted 0.5 and children between 6 and 15 were weight 0.75. People of 15 years and older were weight 1.

\textsuperscript{97} Although this data is old (from 2004) the magnitude of these numbers is assumed to be still correct as this matches with other data: 35% lives below N$2628 a year (UNDP, 2005), making it believable that the poorest 25% earn on average N$2,004 a year; 56% live below N$5,256 a year, so it could be true that on average they make about N$3,993 a year.)
information about the IBT can be found in part 5.1.

### 6.3.5. PERCEIVED CHANGE IN EXPENDITURES ON WATER

Compared to their situation before, many prepaid users (64%) say they pay less for water now than they did when they had a conventional water meter. There are, however, also people who say they pay more now than before (28%). The most mentioned reason for people paying less is that they also use less water than they did before.\(^{98}\)

One couple especially moved to Otjiwarongo to help their family out. The guy’s brother lived in Orwetoveni, but could not pay his bills. He got a prepaid water meter, but this did not solve the problem of not being able to pay the bills. Now they moved in with him and they help him with paying the bills and paying off his debt.

Prepaid user in Orwetoveni 2.

### 6.3.6. SUMMARY OF THE AFFORDABILITY

Concluding, people with a prepaid water meter in Orwetoveni are in general spending less money on water than before (when they had a conventional water meter). Many of them say they pay less for water because they are using less water than before. Also, they spend less money on water than conventional meter users, both in real terms and relatively to their total income. More than half of both groups experience sometimes that they do not have enough money left for water. From calculations follows that for the poorest 25% of the country it is hard to afford even the small amount of 20 liters a day and 100 liters a day is impossible as they would have to spend almost half of their income on water in order to receive this amount. Making a sufficient amount of water affordable to this group is only achievable with some kind of subsidization.

### 6.4. WATER USE

First, the amounts of water people used will be discussed. In addition it will be shown where they use the water for. After this, differences between the conventional meter users and the prepaid meter users in the amount of water used will be shown. Then, the perceived change in water use for prepaid water users is given. Following, it is discussed what alternative water sources are being used. And finally, a short summary of this part will be given.

#### 6.4.1. AMOUNTS OF WATER USED

It is a topic of debate how big the minimum amount of water people need is. Different amounts of water are being mentioned. Howard and Bartram (2003), for example, estimate that 7.5 liter a person a day is the absolute minimum amount people need, excluding health and well-being related demands. At the same time, they show that with 50 liters a day basic hygiene can be assured and health risks are low, 100 liter per person per day is the optimal access of water. The World Health Organization (2003) also mentions that 100 liter per

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\(^{98}\) Question 4.1a and 4.1b of the survey, Appendix C
person per day is needed for optimal access, but says that 20 liters is the minimum amount people need. And according to the CESR (2001) 20-40 liters is the basic water requirement, but “greater amounts of water significantly increase health and quality of life” (CERN, 2001, p2). So it is hard to say what amount would be good. In this report 20 liters per person per day will be taken as the minimum water need, 50 liters as a sufficient amount for basic health, and 100 liters as the desirable amount.

An overview of the liters used per person per week for the different groups is given in Figure 6-5. The amounts for Otjiwarongo are calculated by dividing the amounts of Namibian dollars spend on water (question 3.5 of the survey) by the number of household members (question 3.1 of the survey). This amount was then multiplied by the amount of liters each group gets for one Namibian dollar (Municipality Otjiawarongo d). From this follows that the average use per person for people with prepaid connections in Orwetoveni is 390 liters/ week (n=21) (55 l/c/d). For people with conventional meters this is 1,284 liters/ week (n=21), more than three times as much. The amount of water used was also asked in the survey, but almost no one could answer this question. Also, the amount of money spend on water is only an estimation of the interviewees, making it imprecise. However, no data on the total amount of water used by standpipe users was documented at the municipality (they only have numbers on the total prepaid water use, including prepaid household meters in the informal settlements and prepaid household meters in Orwetoveni), making it impossible to get the real numbers.

In a different research, focused on water consumption in Windhoek, the water use for low and middle income, all having conventional water meters, was comparable to the water use for conventional water meter users in Orwetoveni: 1,316 liters/ week for low income persons, and 1,764 liters/ week for middle income persons (Uhlendahl et al, 2010). In this research the water use was measured by looking at the total amounts used and dividing this by the number of people living in there. As a comparison, the average person in the Netherlands uses 868 liters a week (124 liters/ day) (TNS NIPO, 2010). Information on water use for prepaid household meters has not been researched yet and can therefore not be compared to other research.

Since the numbers are based on estimations care should be taken with drawing conclusions. It is, however, clear that within Orwetoveni prepaid users use much less water than conventional meter users. Also, conventional meter users use just as much water as low-income conventional meter users in Windhoek.
The big difference between the water use can partly be explained by the money they both spend on water, which is higher for the conventional meter users, as will be shown in part 6.4. A second reason could be that water prices are different, i.e. N$16.00/m3 (£1.60/m3) for the conventional meter owners and N$25.64/m3 (£2.56/m3)\textsuperscript{99} for the prepaid meter owners. This means that if they would spend the same amount on water, the second group receives a smaller amount of water. The reason for the price difference, as discussed in part 5.2.1, is that the price for conventional meters excludes basic charges and administration fees (which are N$22 (£2,20) a month), where the prepaid tariff includes basic charges and administration fees.

Results from the survey also indicate that more prepaid users claim they would like to use more water. From this group, 56% would like to use more water. From the conventional meters this is only 32%\textsuperscript{100}. This indicates that there is a bigger need for prepaid users than for conventional users to use more water. In all cases constraint for buying more water is the cost.

### 6.4.2. DIFFERENT WATER USES

The water is most frequently used for drinking and cooking. Most people use it for cooking multiple times a day, and they cook at least once a day. Bathing is also of high priority, and happens at least once a day. More than half of the people interviewed say they bath multiple times a day. Furthermore, washing clothes happens on average once a week. Finally, using water for food harvesting or for people's own business does not happen much: only 10% of the people use water for this purpose.\textsuperscript{101}

A study by Haffejee et al (2007) indicated in a research in South Africa that people using prepaid water meters practiced less hygienic behavior than people using post-pay water meters. However, they do not elaborate on how this was caused. Saying earlier in their report that people were against the prepaid water meter because they thought water should be free, and given the fact that they say it looks like prepaid users are trying to save water on things like body hygiene it seems like the difference might be caused by people paying for water versus people not paying for water. However, since they do not elaborate on the question if the post-paid users actually are paying for water and if the water price is the same for both user groups, this cannot be known for sure.

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One man has a household of 8 people: 2 children, 2 elderly and 4 adults. Only one of them has a job, and their total spending each month is N$1100 (£110). Most of this (N$600 (£60)) goes to food. Also nine percent (N$100 (£10)) of this goes to water, which gives them each 122 liters per week. From this they cook and bath once a day, wash their clothes once a week and flush the toilet multiple times a day. They would like to use more water, but cannot afford this.

Survey interviewee 6, prepaid user

### 6.4.3. PERCEIVED CHANGE IN WATER USE

Besides the difference in water use between prepaid users and conventional meter users, the perception of almost half of the prepaid users interviewed is that their water use decreased. A third of the people said it did

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\textsuperscript{99} These are the prices for 2010/2011, in 2011/2012 they are: N$17.50 for conventional users and N$28.00 for prepaid users, an increase of 9%.

\textsuperscript{100} Question 5.3 of the survey, Appendix C

\textsuperscript{101} Question 5.2 of survey, Appendix C
not change, and some people said their water use increased since they have the prepaid water meter\textsuperscript{102}. A decrease in the water use is in line with the difference in amounts of water used between prepaid water users and conventional meter users as discussed in part 6.4.1.

6.4.4. WATER FROM ALTERNATIVE SOURCES

There are no alternative water sources like a river or a public tap where people can get free water and increase their water use. The water use can be increased, however, by reusing water or using rainwater. Several studies already indicated that rainwater harvesting is a good way for people in Namibia to save money on water or to get better access to water (Sturm et al, 2009, Baker et al, 2007). Two different ways of rainwater harvesting are being discussed: roof catchments using corrugated iron roofs (Figure 6-6) and ground catchments using treated ground surfaces. Investment costs for these methods are very high when using new materials: N$1.800 ($180), giving a payback time of approximately 18 years (Ward, 2007). But, according to the research, costs can drop to as little as N$80 ($8) if recycled or found materials are being used. For ground catchment systems the investment costs and the yearly costs are higher (Sturm et al, 2009).

![Figure 6-6: Roof catchments. Source: Sturm et al, 2009](image)

In Orwetoveni 70\%, says they use rainwater in the rain season\textsuperscript{103}. This water is mostly used for washing clothes, but sometimes also for cleaning the house. However, since there are on average only 41 days a year on which precipitation greater than 0.1 mm occurs (climatetemp.info, n.d.), most of the time it is not possible to use rainwater. If rainwater is being used, it is expected from observations (which were unfortunately only done in the dry season) that rainwater is collected in barrels, because barrels were present in some houses and no roof catchment systems like in Figure 6-6 were seen. However, no special attention was given to locating roof catchment systems, so it is possible that some of these systems were present after all. It is safe to say, however, that most houses did not have such a system. Furthermore, 21/50 people interviewed said they reuse water\textsuperscript{104}. This water is mostly used for watering plants, but some people also use it for flushing the toilet or cleaning the house.

\textsuperscript{102} Question 4.2 of the survey, Appendix C
\textsuperscript{103} Question 5.5 of the survey, Appendix C
\textsuperscript{104} Question 5.4 of the survey, Appendix C
6.4.5. SUMMARY OF THE WATER USE

Summarizing, prepaid users are in general using much less water than conventional meter users. Almost half of them also claim they are using less water now as they did before they had the prepaid water meter, and they also spend less money on water than they used to. More than half of the prepaid users would like to use more water, but costs are often a constraint. In the rain season most people are also using the rain water for their water needs, and throughout the year water is being reused by 42% of the people in Orwetoveni, mostly for flushing the toilet.

6.5. HYGIENE AND HEALTH

The hygiene and health of the people is being influenced by the amount of water used. Besides this, there are three main indicators: the quality of the water, the knowledge on hygiene and the kind of sanitation used. These will be discussed in this order.

6.5.1. QUALITY OF WATER

According to Adri van Iersel (Brabant Water, interview 01-02-2012), based on where the water comes from (mainly groundwater) and how they transport it, the water is of a drinkable quality. The municipality extracts the water directly from the reservoirs of the supplier Namwater. These reservoirs are situated in Otjiwarongo from where it is distributed by Otjiwarongo Municipality to its customers. The municipality does not systematically control the quality of the water. Besides, there is no systematic quality control and the mechanics of the Otjiwarongo water department do not have or follow rules on hygiene, while in the Netherlands these rules are very strict (Iersel van, Adri). Now, if they make new water connection sometimes some sand slips into the water pipes. Adri van Iersel (Brabant Water) concludes that the quality of the water can be improved, but it is not the highest priority: which is delivering water.

The people in Orwetoveni in general do not prepare the water before using it, but trust it to be from good quality. However, they sometimes boil the water if they are making coffee or tea. They also sometimes boil the water if they are cooking dinner. Since they do not store the water, but use it right from the tap, no quality decrease will take place at this point.

6.5.2. KNOWLEDGE ON HYGIENE

Basic information about hygiene seems to be present. They know for example when to wash their hands, using soap, and claim they also wash their hands at all necessary occasions. Visiting people’s houses in Orwetoveni there were never dirty dishes or leftovers lying around. Nor were there animals other than pets in the house. Although 78% of the people (n=50) said they received information on hygienic behavior, 22% claimed they never received this kind of information. From people who did receive information most of them got the information in the hospital, at school, from TV or from books (Figure 6-7), where several people received the information from multiple sources. At the hospital, people get information on hygiene at every visit. Especially pregnant women and people that look like their hygiene is not good get much information (nurse student).

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105 I also trusted the water quality and always drank the water from the tap. It tasted good and I never got sick from the water.

106 But it is very difficult and time consuming to check this.
6.5.3. SANITATION

In Orwetoveni all of the people asked had a flushed toilet at home. Also, all of them said they flush the toilet multiple times a day. However, some of them use very little water and also use reused water for flushing the toilet. It is therefore not sure if all people flush the toilet every time they use it. Not flushing the toilet every time already appeared to be a problem in South Africa (Anti Privatisation Forum, 2006). However, this was not asked to the interviewees, so no information on this is available.

6.6. OPINION ABOUT PREPAID WATER METER

Users of the prepaid water meter perceived multiple positive aspects about the prepaid water meters, the most mentioned being that the meter gives more control over the water use and that it costs less. Other positive factors were, according to the interviewees, that people are not being cut off anymore and for some people that their water use increased. By far the most negative aspect mentioned is that the meter breaks often (mentioned by almost half of the people) and for some people that their water use decreased. In general, from the 25 prepaid users in Orwetoveni 22 said that the prepaid water meter improved their situation.

6.7. CONCLUSION ON THE IMPACT OF PREPAID WATER METERS IN ORWETOVENI

Most prepaid water meter users spend less on water than when they had a conventional water meter, because they are also using less. Since they now also have to pay off debts, cuts in other expenses have to be made. The high cost of water and the cost of paying off debt are a constraint for these people in using more water. Furthermore, they can still be cut off by the municipality, although it happens less often for prepaid meter users, and if they cannot afford to get their meters repaired they are also cut off from water.

It is therefore striking that most people say the prepaid water meter improved their situation. The perceived advantages are that it gives them more control over their water use and it cost less (because they are using less). This implies that control over the amount of money spend on water is very important for them, and that without the prepaid water meter they find it hard to save water, getting high bills at the end of the month. However, now they are saving too much water. The decrease in the amount of water used, and the high
percentage of expenditures that goes to water means that the water is not affordable for these people, and they also cannot afford to pay off their debts.

So prepaid water meters in Orwetoveni has a negative impact on many inhabitants, making them use much less water than before. Given the fact that most of them still are happy with the prepaid water meter implies that they have already accepted the fact that they have to pay off debts and pay a high price for water.

The prepaid water meter itself is therefore probably not the problem, but the fact that debts have to be paid off and that the price for water is high makes people use less water than they should for their health. Increasing the amount of water used would help most in contributing to people’s health.
7. CHANGES FOR PREPAID HOUSEHOLD METER USERS IN THE INFORMAL SETTLEMENTS

In this chapter the analysis for subquestion 3 will be done: “How does the implementation of household prepaid water meters in the informal settlements influence their quality of life?” In the informal settlements everyone used to use the standpipes (public water taps). All the standpipes have prepaid water meters, so everyone is paying for their water. Now, 50 people got their own prepaid water meter, and more people will get this in the near future.

The information discussed in this chapter comes from interviews, observations and the survey. Eight interviews with inhabitants in the informal settlements were done, with randomly selected households. The interviews were done in the garden of the interviewees, which helped in understanding their living situation. Observations were done by driving around in the area. Furthermore, observations at one household were done for one afternoon. Besides that, sitting at a standpipe for over 5 hours gave insight in the way people acted around the standpipe, how much people came to the standpipe, who came to the standpipe (women, men, or children), how much water they took each time, and how they carried the water back home. As discussed already in Chapter 6, observations at Orwetoveni office, one of the municipal offices where people could charge their tag or ask questions, showed how long the queues were, how the charging of the tags worked and what kind of complaints people had. Most of the people living in the informal settlements went to the other municipal office: Satellite office. This office was also visited twice, after which the writer concluded that it was similar to the other office, and no separate observations had to be made here.

For the survey, 50 people in the informal settlements were interviewed: 25 prepaid household water meter users and 25 standpipe users. The standpipes also have prepaid water meters, so the difference between the two groups is that the first group has the prepaid water meter at home, while the rest has to walk to the standpipe to get water. Differences in the amount of water used, the access to water and hygiene and health are therefore expected. They do not result from prepaid water meters in general, but from having a household prepaid water meter, instead of using a prepaid standpipe.

Another big difference between the two groups is that the first group, with the prepaid household meters, is probably richer than the second group. This is expected from the fact that they were able to buy the prepaid household water meter, which cost N$500 (€50). This difference makes it hard to really compare the two groups. So from a comparison alone no conclusions can be drawn. However, together with information on the perceived impact from the prepaid household meter users some conclusions can be drawn.

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107 They were randomly selected by driving around in different areas of the informal settlements, stopping at a random house to see if someone was home. If not, it was tried if one of the neighbors was home.

108 It was planned to do it the whole day, but she had to go to church in the morning and wanted to meet in the afternoon. Also, when it got dark people told me that I should leave, for safety reasons. It was difficult to find someone who was okay with me observing and asking questions a whole day, so I was happy I could at least follow her for one afternoon.

109 I located myself in the garden of a small bar that was across the street of the standpipe. This way I had a good view on the standpipe and the people using it. And although people could see me and often noticed me (as being the only white person there) they did not know I was there to observe what they did at the standpipe. Also, my presence apparently did not restrain people from behaving bad, because some early visitors of the bar started fighting. I think my presence did not influenced the way people behaved in front of the standpipe.
Again, a sample of 50 is not big enough to reflect the population in the informal settlements, having almost 13,000 people living there\textsuperscript{110}. However, the survey will be used as an explorative study. And it is not the goal of the research to gain statistical information which reflects the whole population.

An overview of the chapter can be seen in Figure 7-1. As in the previous chapter an overview of the services available in the informal settlements will be given first, showing some background information on this area. After that the access and reliability and the affordability of water will be shown. Next, the water use will be discussed, followed by the hygiene and health of the people in this area. Then, the opinion of the prepaid household water meters on these meters will be given, ending with a conclusion of the chapter.

7.1. SERVICES IN THE INFORMAL SETTLEMENTS

In general people living in the informal settlements are poorer than the rest. Some people have brick houses (Figure 7-2), but based on observations it is guessed that around two out of three people in this area live in shacks made of corrugated iron (Figure 7-3). Even though this is the poorest area, it is still pretty organized and everyone has enough space. Every household has its own plot, which is fenced and registered with the municipality. The streets are also quite wide, but none of the roads are tarred, they are all gravel roads. Some of the roads are very clean, but there are also areas where garbage is lying next to the roads. Furthermore, this area has fewer facilities and people have to walk a few kilometers to town. There are a lot of small bars, small shops and schools, but there is no supermarket, municipal office, hospital or gas station. For people that need TB medicine every day there is, however, a small clinic and one of the municipal offices is placed close to the informal settlements.

\textsuperscript{110} Estimate Municipality (http://www.otjiwarongomun.org/municipal-services/projects/)

74
People in this area pay a higher price for water: N$30/m³ (€3/m³). Just like the price for prepaid users in Orwetoveni this includes basic charges and administration fees. But unlike the tariff for Orwetoveni prepaid users it also includes rent of the plots. Also, they are not paying for other services (like garbage removal), which have to paid separately in Orwetoveni. The standpipes already have prepaid meters for many years, but about two years ago they were replaced by a different type of prepaid water meter. A lot of people in this area live below the poverty line, but no one has debts with the municipality (as all their expenses are included in the water price, so they cannot get indebted with the municipality).

7.2. ACCESS AND RELIABILITY

The access to water, defined here as the physical access to water, leaving out monetary constraints which will be discussed separately in the next part, and the reliability of the water supply both influence the above mentioned water use, but also have an effect on the quality of life. All people registered at the municipality in theory have access to water from the standpipe. In Swakopmund it turned out that a lot of people living there were not registered. Therefore, they could not get a tag, and thus no water (McClune, 2004). In Otjiwarongo more than 100 people live there illegally, on not prepared ground 111. It is not known if they also can get a tag and how they get water, but it is expected that they cannot get a tag and get water by borrowing someone else’s tag, and that they pay this person back.

Furthermore for all the people that do have access it is also important to see how much time or how much trouble it costs them to get water. This will be discussed first. The second point is the reliability of the water supply, meaning how reliable the water flow and the meters are.

7.2.1. ACCESS TO WATER: TIME SPEND

Both prepaid household meter users and standpipe users spend time on recharging their tags. Beside this, standpipe users have to spend more time on fetching the water.

111 Interview Agatha Mweti, Strategic Executive Community Services, 13-06-2011, Appendix B5
The average time spend on fetching water each day by standpipe users is almost 30 minutes\textsuperscript{112}. People go on average almost twice a day to the standpipe, so on average it takes them 15 minutes each time\textsuperscript{113}. Prepaid household meter users also used to spend almost 30 minutes on fetching water\textsuperscript{114}, now saving this time every day. The time spent on fetching water is lower than the average time spent on water fetching in Africa, which is 45-50 minutes per day (Banerjee et al, 2008). The woman of the house in general goes more often than the rest, but most of them also get help from their husband or older children. Most buckets are 20 or 25 liters and very heavy to carry. Some people, probably around 1 in 4\textsuperscript{115}, have a wheelbarrow in which they can transport the water (Figure 7-7). This makes it easier to carry the water, but it is still heavy. Most people carry the buckets of water in their hands (Figure 7-5 and 7-6). Some people find it easier to carry it on their head (Figure 7-8).

\textsuperscript{112} Question 5.9 of survey, appendix C
\textsuperscript{113} 30 minutes/ 2 times a day = 15 minutes each time
\textsuperscript{114} Question 4.4 of survey, appendix C
\textsuperscript{115} Estimate based on observations at the standpipe
There are 53 standpipes in total. Most people have a standpipe in their street, or within a radius of approximately 200 meter. However, standpipes are often broken in which case people have to walk twice this distance. From interviews it follows that having to walk to the standpipe for water is the biggest frustration for people. Many standpipe users also want their own prepaid meter, and the prepaid household meter users are happy that they don’t have to walk far anymore to fetch water.

“Only the distance that I walk is now shorter”. Prepaid user informal settlements

Waiting lines at the standpipe can make the time needed for water fetching even longer (Figure 7-8). Most of the time people do not have to wait or only have to wait for less than 5 minutes. At some times, however, it is busier at the standpipe and people have to wait a bit longer, this happens mostly early in the morning. Also, if some standpipes are broken more people have to share the same standpipe and queues can be longer. Normally, people are friendly to each other when standing in line. But if there is not a clear line people sometimes fight over who came first.

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116 Based on a map of the informal settlements indicating where the standpipes are located.
Second, both groups have to walk to the closest municipal office to put credit on their tag. Most people go 3 or 4 times a month to the municipal office\textsuperscript{117}, and for some people this is a walk of a few kilometers. Remarkable is that not only grownups are doing this, but also young children. According to Ms. De Klerk, working at Orwetoveni office (interview on 08-06-2011, Appendix B4), this is sometimes a problem. Parents sometimes come back and complain that there is not (enough) credit on the tag. But they do not know what their children have done with it. Maybe their children used it wrong\textsuperscript{118} and they have to teach their children how it works, said Ms. De Klerk. The time it takes people to recharge their tags depends a lot on how far from the office they live and how long the queues at the office are. Especially on Saturdays queues can be very long. Mr. Slabbert, Strategic Executive of the technical department, agrees that the ability of charging the tag 24/7 would be desirable. He sees this as one of the improvements that needs to be done in the near future.

As discussed in chapter 3 the time spent on fetching water, and the time spend on recharging tags, could also be used on education, food harvesting or entrepreneurship. Urban Agriculture, including any form of farming within the boundaries of a city, could enhance when more time is available. However, not much information on urban farming in Namibia is known (Dima and Ogunmokun, 2004) and there seems to be a wide disagreement in the amount of people using Urban Agriculture. According to Dima and Ogunmokun (2004), from the university of Namibia, 70% of the residents in two cities they researched (Windhoek and Oshakati) was practicing urban or peri-urban agriculture. But Frayne (2005), PhD at Queens University, says that only 5% of the people in Windhoek was involved in some form of Urban Agriculture. In Otjiwarongo, as stated above, 8

\textsuperscript{117}Question 5.6 of survey, appendix C

\textsuperscript{118}One possibility where it sometimes goes wrong is at the test standpipe, which is in the garden of the municipal office. Here, people can check their newly bought credit. However, it works differently from the other standpipes, where you automatically check out when removing the tag. That does not happen here and sometimes people forget to check out of people do not understand that this standpipe works different. (From the interview with the technicians and observations at the Orwetoveni office, where it was seen that water was still running out of the test standpipe). Appendix B3
out of 50 people interviewed (16%) in the informal settlements said in the survey they are using water for food harvesting. There is, however, agreement of what the limiting factors of urban agriculture are: the main limiting factor in sub-Saharan Africa is water (Frayne, 2005, Dima and Ogunmokun, 2004). Other limiting factors can be incidences of pests and diseases, lack of capital, frequent droughts, lack of information and theft of products (Dima and Ogunmokun, 2004). So, it could be that time is available and maybe also water is available, but that there are other barriers for food harvesting or entrepreneurship.

Since unemployment rates in Otjiwarongo are high, estimated at 45%, (Namibian, 27-04-2010) and the water use of people did not seem to increase (much), it is unlikely that people can actually use the extra time on entrepreneurship or Urban Agriculture. From observations in Otjiwarongo also follows that people do already have the time for this, but do not have the opportunities because there are other limiting factors like job opportunities, water or money.

### 7.2.2. RELIABILITY OF THE WATER SUPPLY

The standpipes are broken very often, making people to have to walk long distances to the next standpipe. The reason that the standpipes break so often is, according to most people, that some people vandalize the standpipes. But from one interview follows that there are probably more reasons. Kids sometimes hit the meter with stones, or at night frustrated people break it. It also happens, however, that people are drunk and put in the tag in a wrong way, for example pushing it too hard. Then, the meter is not working and they get angry and start hitting the meter.\(^{119}\)

It varies a lot how long it takes for the meter to be repaired. According to the municipality meters are always fixed within one week and most of the time even in one day.\(^{120}\) According to interviews with inhabitants it happens often that a meter gets repaired in one day or in the same week. However, there are also some meters that have been broken for several months already, without being repaired\(^{121}\). One reason for this could be that there were no spare parts available to fix the meter earlier.

The prepaid household meter users also recognized that the standpipes were often not working. Most of them are satisfied about their own prepaid meter, but 4 of them \((n=25)\) say that a negative aspect is that the meter breaks often.

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\(^{119}\) Interviews with inhabitants

\(^{120}\) Interview with Naudé Slabbert, Strategic Executive of the technical department, 01-06-2011 appendix B1

\(^{121}\) Interviews with inhabitants
7.2.3. SUMMARY OF THE ACCESS AND RELIABILITY

Prepaid household meter users do not have to spend the time and effort in collecting the water, which standpipe users have to. This saves them the effort and frustration of carrying the water, and approximately 30 minutes a day. But they do have to go to the municipal office to put credits on the tag, just like the standpipe users. People go there almost every week. Also, the limiting opening hours limit the access to water, especially in the weekends. Furthermore, the prepaid meters, especially the standpipes, are often broken, again limiting the access to water. Prepaid household water meters also block if they are used in a wrong way, but this can be solved within one day.

The availability of extra time is often mentioned as an opportunity for people to harvest food or spend the time on a form of entrepreneurship of studying. However, it turns out that time is not the limiting factor for this in Otjiwarongo. With other barriers for food harvesting and entrepreneurship not being solved the extra time can only be used as free time and not for providing extra food or money.

7.3. AFFORDABILITY OF WATER

First, the price of water will be discussed. Then, the affordability of water will be shown, including the perceived affordability of water and the calculated percentage of expenditures that goes to water. Finally there will be a short summary on the affordability of water.

7.3.1. PRICE OF WATER

The price of water in the informal settlements in Otjiwarongo is N$30/m³ (€3/m³), including basic charges for water and rent. As seen in chapter 5 this is very high compared to other cities in Africa. Also if you exclude the basic charges and rent, resulting in a price of N$16 (€1.60) the price is still higher than in most cities.

Water prices between cities in Namibia also vary widely. One reason for this is that prices from Namwater already vary. They do not have one tariff for everyone, but calculate it dependent on their costs to supply water to a city. The price for Otjiwarongo is high compared to other cities: around N$8/m³ (€0.80/m³). In 2010 the Namibian reported that bulk water prices of Namwater varied from N$4.10 (€0.41) to N$7.50 (€0.75) per cubic meter (Namibian, 04-02-2010). In the year after that water prices could have increased till N$8/m³ (€0.80/m³), making the price the municipality of Otjiwarongo pays to Namwater among the highest in the country. Furthermore, the municipality also wants to recover the cost they make for the water supply, and they want to make extra money from water to pay for other services. This leads to a water price which is twice as high: N$16/m³ (€1.60/m³). Including basic charges within the water price for standpipe users and prepaid household meter users in the informal settlements again almost doubles the price to N$30/m³ (€3/m³). An overview of how costs for the water price are constructed can be found in Table 7-1.

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122 Interview with Naudé Slabbert Strategic Executive of the technical department of the municipality Otjiwarongo, 01-06-2011, appendix B1; Interview with George Diergaardt, Namwater, 14-06-2011, Appendix B6.
Table 7-1: Construction of the water price for users of the informal settlements

<table>
<thead>
<tr>
<th>Costs paid</th>
<th>Price in N$</th>
<th>Price in €</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water price paid to Namwater/m3</td>
<td>N$8</td>
<td>€0.80</td>
</tr>
<tr>
<td>Costs added by municipality for cost recovery and to pay for other services /m3</td>
<td>N$8</td>
<td>€0.80</td>
</tr>
<tr>
<td>Cost added by municipality for basic charges and rent /m3</td>
<td>N$14</td>
<td>€1.40</td>
</tr>
<tr>
<td>Total price paid by inhabitants /m3</td>
<td>N$30</td>
<td>€3</td>
</tr>
</tbody>
</table>

7.3.2. PERCEIVED AFFORDABILITY OF WATER

From the prepaid household meter users (which is the economic stronger group in this area, as described above) 80% of the people interviewed in the informal settlements say that water is affordable (n=25). This is a big difference with the standpipe users, from whom only 36% says it is affordable (n=25). For both groups a big part states that their income is not sufficient for their basic needs. The standpipe users seem to have it more difficult in general: to 76% of this group it happens that they do not have money left for buying water. For the prepaid household meter users this is lower: 32%. It also happens more frequently to the standpipe users that this happens. In this case, most people buy water for only a few dollars (for example N$3 (€0.30), which gets them 100 liters) and try to limit their use (for example by not washing their clothes that week). Some of the standpipe users also go to their neighbors for water.

The fact that there are still so many people that do think water is affordable, might be explained by their notion of affordability. One woman living in the informal area, Sippora Kamati, teaches at a kindergarten and is a

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123 Question 1.6 of survey, Appendix C
124 Question 3.8a of survey, Appendix C
125 It is not known exactly how often, since this was an open question in the survey (question 3.8b) and most people answered in vague terms like ‘often’ or ‘very often’. A few people were more specific, saying that it happened for example once or twice a month.
126 Question 3.8c of survey, Appendix C
member of the water committee. She explains that she considers water to be affordable, because small amounts, like N$5, can be purchased. At the same time, the mayor gives a similar reason for water being affordable for people. If more inhabitants think of affordability as the ability to buy water, regardless of the amounts of water that can be bought, this explains why some people say water is affordable, while at the same time having too little money sometimes to buy water.

“Even if you only have N$10 or N$20 you can still buy water”. Ms. Jesaja, mayor of Otjiwarongo

7.3.3. EXPENDITURES ON WATER

The total spending of the prepaid household meter users seems to be much higher than the spending of the standpipe users (which makes sense, since they also had the money to buy a prepaid household water meter): N$4,420 (€442) per person per year for prepaid household meter users, compared to N$2,100 (€210) for standpipe users. The survey was too small for this numbers to be reliable. However, as it is known that 35% of the population lives below 1US$ a day (which is N$2,628 (€262) a year) and 56% lives below 2US$ a day (which is N$5,256 (€525) a year) (UNDP, 2005) it is likely that the magnitude of the numbers is correct, as this would mean that the standpipe users are among the poorest 35% of the country and the prepaid household meter users among the poorest 35-56%.

There is a big difference in the percentage of income spend on water (α=0.005, n=30). For prepaid household meter users this is on average a little less than 10%, where for standpipe users it is almost 20% (Figure 7-9). The difference is mostly caused by the total amount of money prepaid household meter users spend, which is higher. Also, these numbers could be biased because it is hard for inhabitants to estimate how much they spend on total and how much they spend on water, and because the numbers are based on small amounts of people (n=30).

127 The water committee consists of about 18 members from all over the informal settlement. They are elected by the community and their main task was to help educate inhabitants how to use prepaid water meters. At the moment their tasks are mainly to report to the municipality when taps are not working.

128 Question 3.4 and 3.1 of survey: Total estimated spending of household per month/ number of household members * 12 months/year.

129 Calculated by dividing the amount spend on water/week *4 (question 3.5 of survey) by the total spending of the household per month.
Most of the prepaid household meter users say that they pay the same now as they did before (72%), but 20% say they pay less and 8% say they pay more than they used to.\textsuperscript{130}

7.3.4. CALCULATED AFFORDABILITY

Just like in part 6.3.4 calculation examples on the affordability will be done. The situation is almost the same, but the prepaid price for people in the informal settlements is N$30 (€3)/m\textsuperscript{3} instead of N$25.64 (€2.56)/m\textsuperscript{3}.

Table 7-2: Different scenarios of the water expenditure for the poorest 25% and the poorest 50% of Namibia.

<table>
<thead>
<tr>
<th>Person</th>
<th>Income/ month</th>
<th>Water use/ day</th>
<th>Water expenses/ month</th>
<th>% of spend on water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poorest 25%</td>
<td>N$167 (€16.70)</td>
<td>20 liter</td>
<td>N$18 (€1.80)</td>
<td>10.7</td>
</tr>
<tr>
<td>Poorest 25%</td>
<td>N$167 (€16.70)</td>
<td>100 liter</td>
<td>N$90 (€9.00)</td>
<td>53.9</td>
</tr>
<tr>
<td>Poorest 25- 50%</td>
<td>N$332 (€33.20)</td>
<td>20 liter</td>
<td>N$18 (€1.80)</td>
<td>5.4</td>
</tr>
<tr>
<td>Poorest 25- 50%</td>
<td>N$332 (€33.20)</td>
<td>100 liter</td>
<td>N$90 (€9.00)</td>
<td>27.1</td>
</tr>
</tbody>
</table>

As can be seen in Table 7-2 the percentage of income spend on water for the poorest 25% is already 10% if they only use 20 liters per person per day. Using 100 liter is also for the poorest 25-50% not feasible, as this would cost them 27% of their income. As shown in part 6.3.4 the price per cubic meter has to be N$5.56 (€0.55) in order to provide 50 liters of water per person per day at not more than 5% of their income (where spending more than 5% of you income on water is seen as unaffordable (McPhail, 1993)). As already concluded in part 6.3.4 some form of subsidization is needed to be able to offer water at this price.

7.3.5. SUMMARY OF THE AFFORDABILITY

Prepaid household water meter users, which are also the richest people of the informal settlement, mostly see water as being affordable. From the standpipe meter users two out of three people say it is not affordable. The reason that the rest does say it is affordable, can be cause by their notion of affordability, which does not look at the amount of water that can be purchased, but only if water can be purchased. Also, a big part of the income goes to water, especially for standpipe users, where this is around 20% on average. Furthermore, most

\textsuperscript{130} Question 4.1a Of survey, Appendix C
prepaid household users (72%) say their expenditures on water did not change, and 20% said it even decreased after they got the prepaid household meter.

The price of water is so high because the municipality wants to recover its cost and use higher water prices to pay for other services, which doubles the water price. Finally, the price people pay is again almost doubled for including basic services within the water price. As shown in the calculation this is not affordable for the poorest half of the country. The price has to decrease drastically to be affordable for the poorest 25%.

7.4. WATER USE

First, the amounts of water people used will be discussed. In addition it will be shown where they use the water for. After this, differences between the conventional meter users and the prepaid household meter users in the amount of water used will be shown. Then, the perceived change in water use for prepaid household meter users is given. Following, it is discussed what alternative water sources are being used. And finally, a short summary of this part will be given.

7.4.1. AMOUNTS OF WATER USED

A study by Water and Environmental Health at London and Loughborough (via Newton, 2011) showed how water use increased from approximately 108 liter/ person/ week when using standpipes to 350 liters/ person/ week when having a yard tap. Furthermore, a research of Howard and Bartram (2003) shows if the distance to a source is 100-1000 meter and it takes 5-30 minutes to collect the water, people use approximately 140 liters/ person/ week (20 liters/ day). If people get a household connection, according to the same research the water use will increase to approximately 350 liters/ person/ week (50 liters/ day).

The average water use per person for prepaid household meter users is around 230 liter per week. For the standpipe users this is 195 liters a week\(^{131}\) (n =43, no significant difference). From a research by Uhlendahl et al (2010) followed that the average use per week for people in the informal settlements in Windhoek was 189 liters per person\(^{132}\), where people in the informal settlements either used community taps (using 147 liters/ week), prepaid standpipes (using 202 liters/ week) or had their own tap (using 763 liters/ week). In the Netherlands the average water use is 124 liters a day (TNS NIPO, 2010), which is 868 liters a week. This is approximately four times as much as people in the informal settlements use. Also, it is only half the amount prepaid water users in Orwetoveni used (part 6.2.1). An overview of the water amounts used per group is given in Figure 7-10.

\(^{131}\) This information is received by dividing the amounts of Namibian dollars spent on water (question 3.5 of the survey) by the number of Household members (question 3.1 of the survey). This amount was then multiplied by the amount of liters each group gets for one Namibian dollar (from the document ‘Tariffs 2012’).

\(^{132}\) Calculated by multiplying the use per person per day by 7: 27liter/day*7days/week= 189liter/week.
As can be seen the water use for standpipe users in Otjiwarongo is almost the same as the water use for standpipe users in Windhoek. Both use prepaid standpipes, making the situation comparable. Furthermore, the water use for people with a household water meter in the informal settlements in Windhoek more than three times as high as the water use of household meter users of the informal settlements of Otjiwarongo. The first difference between the household meter users in Otjiwarongo and Windhoek which could explain this difference is that households in Otjiwarongo have prepaid meters, while households in Windhoek have conventional water meters. Also, the water price in Otjiwarongo is much higher than in Windhoek (N$30/m³ (€3/m³) in Otjiwarongo compared to N$6.77/m³ (€0.68/m³) to N$20.75/m³ (€2/m³) in Windhoek^{133}). More than half of the people in the informal settlements of Otjiwarongo interviewed also perceive the costs of water as a constraint for using more water.^{134} Furthermore, the heavy weight of carrying the water was also mentioned by several standpipe users as a constraint for using more water.^{135} A lot of people also say would like to use more water: 72% of the prepaid household meter users and 84% of the standpipe users^{136}.

### 7.4.2. DIFFERENT WATER USES

The amount of water a person needs depends on many factors, like body weight, climate, and physical activity (Mihelsic, 2009). In general, not a big difference between the two groups can be seen in the water use. Most people with household prepaid connections use water for cooking multiple times a day. They at least cook once a day. Furthermore, they wash their clothes once a week (13/24) or multiple times a week (11/24) (Figure

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^{133} Windhoek has an increasing block tariff, so if you are using less you are paying less. For 0-6m³ you pay N$6.77/m³ (€0.67/m³), for 6-36m³ you pay N$11.26/m³ (€1.13/m³) and for more than 36m³ you pay N$20.75/m³ (€2/m³).

^{134} Question 5.3a of survey, Appendix C

^{135} Question 5.3b of survey, Appendix C

^{136} Question 5.3a of survey, Appendix C
7-11). Most of them (15/23) bath multiple times a day, but some of them (5/23) bath once a day and 3 out of the 23 people interviewed bath less than once a day. Only three of them also use water for food harvesting. For the standpipe users the frequencies are comparable. Again, everyone cooks at least once a day, and most people (19/24) cook multiple times a day. Again, most people wash their clothes once a week (10/24) or multiple times a week (5/24). However, also 7 people say they wash their clothes every day or even multiple times a day. Also comparable to prepaid household meter users most standpipe meter users (14/23) bath multiple times a day. Five of them bath once a day, 2 bath multiple times a week and 2 bath multiple times a month. Five of them say they also use water for food harvesting.

Figure 7-11: Woman washing clothes next to her house.

The fact that some standpipe users wash their clothes more often than household prepaid meter users could be explained by the fact that they have fewer clothes because they have less money. Uhlendahl et al (2010) also suggest that having fewer clothes can cause people to do their laundry more often, resulting in a higher water use for laundry.

Furthermore, the research of Uhlendahl et al (2010) shows that laundry is the first use where water is being saved in low income areas in Windhoek. Together with the knowledge that the poorest people often do not have many different clothes and therefore wash their clothes more often than others, it can be concluded that if they save on this they have to walk around in filthy clothes. Also, it is alarming that the second point on which they save water is body hygiene. This can have very negative consequences for people’s health. It is not know if this is the same for people in Otjiwarongo, since this was not asked.

7.4.3. PERCEIVED CHANGE IN WATER USE

Most of the prepaid household meter users, 18 out of 25, say their water use did not change since they have their own prepaid water meter. But six of them did say they are using more water than they did before. One of the interviewees said his water use decreased.\textsuperscript{137} As just explained, the amount of water used when changing from standpipe use to household use is expected to more than double (Howard and Bartram, 2003). Therefore, it is strange that most people interviewed say their water use did not change at all.

\textsuperscript{137} Question 4.2 of survey, Appendix C
7.4.4. WATER FROM ALTERNATIVE SOURCES

As pointed out in part 6.2.4 several methods for harvesting rain water can be used, helping people in reducing the money spend on water and increasing the amounts of water used. From the survey follows that almost everyone in the informal settlements uses rainwater in the rain season: 90% of the interviewees. Most of them use this water for washing their clothes. Bathing, doing dishes and drinking the water were also mentioned several times. 138 Roof catchment constructions, however, were not seen in the informal settlements. Since the period of my stay was not in the rain season and people were not asked how they catch and store the rain water it is not known how they do this. However, it is expected that they do it only in small amounts, putting buckets and barrels outside, because it would have been noted if constructions like the roof catchments would be present. The roof catchments would be helpful in harvesting more rainwater, which could both save costs for water and allows people to use more water. However, it is not applicable to all households, since at least half of them do not have a suitable roof for this, based on observations. Since no special attention was given by then to looking at the roofs it is not possible to give a good estimate of the number of houses that would be able to install this.

Furthermore, water is not being reused a lot. Less than a third of the people interviewed say they reuse water, mostly for the purpose of doing dishes. Two interviewees also use it for washing clothes and one person uses it for cleaning the house. 139

7.4.5. SUMMARY OF THE WATER USE

People in the informal settlements use a lot less water than people in Orwetoveni. The inhabitants with prepaid household connections only use slightly more than the standpipe users, and most of the prepaid household meter users (72%) say their water use did not change after getting the prepaid household meter. This is unexpected since it follows from the literature that people with household connections use much more water than people using standpipes. Only 6 of the 25 people thought their water use increased after having their own prepaid meter instead of using the standpipes.

7.5. HYGIENE AND HEALTH

The hygiene and health of the people are being influenced by the costs and time spend on water and the availability of water. Besides this, there are three main indicators: the quality of the water, the knowledge on hygiene and the kind of sanitation used. According to the inhabitants there are not many problems with diseases, saying that some people with very bad hygiene are used to it 140. It is, however, still important to look at the hygiene and health of people to see how correct this perception is and where improvements could take place.

138 Question 5.5 of survey, Appendix C
139 Question 5.4 of survey, Appendix C
140 Interviews with inhabitants
7.5.1. QUALITY OF WATER

In part 6.4.1 we saw already how Namwater treats and tests the water. In Orwetoveni the water is used right from the tap. In the informal settlement all standpipe users also have to transport and store the water, which leads to a deterioration of the quality of the water. In a study of van Zijl (1966) it was found that all earthen jars used for water storage were faecally contaminated. Even though the inhabitants do not see the quality of the water as a problem, an overview of how water is being transported, stored and prepared will be given, indicating if and how much the water quality decreases after fetching water.

Several studies prove that the quality of drinking water significantly declines after collection (among others: Wright, 2004; Zijl, 1966; and Nath et al 2006). But there is also a big difference in the way the water is stored and the degree of contamination. As the World Health Organization states: “Household water treatment and safe storage interventions can lead to dramatic improvements in drinking water quality and reductions in diarrhoeal disease” (WHO, n.d.). Seeing over 100 water buckets pass at the standpipe, it is safe to say that the majority of the people uses jerry cans. Since jerry cans can be closed and only have a small opening, it is impossible to put your hand or a cup into the jerry can, reducing fecal coliform contamination by 45% compared to traditional containers (Mazengi, 2002). Therefore, this is the best option for transport and water storage. More than a quarter was, however, still buckets, most of them without a cover (Figure 7-12). Buckets with a cover still are much better in reducing contamination compared to uncovered buckets (Wright, 2004; 1966, Nath 2006. That still many buckets without a cover are used is therefore alarming. However, in a few cases people with an uncovered bucket had a jerry can as well and the water in the bucket was only used for washing clothes or cleaning the house.

Figure 7-12: Transport and storage of water. Source: observations at the standpipe.
At the standpipe only very little people clean the buckets and jerry cans. But, almost everyone states that they regularly clean them at home. Most of them clean it with water and soap, but some people also use clean pebble stones which they shake around in the container to clean it.\(^{141}\)

Point of use treatment can also significantly improve the quality of water (Nath et al, 2006). Sippora Kamati from the water committee tells that she thinks people usually boil the water if they are not sure their water is clean or if the water is for their babies\(^{142}\). However, it was seldom seen in observations that people were boiling water, or treating it in another way, before drinking it. Sometimes people drank tea, using boiled water, but often they drank unboiled water.\(^{143}\) Also, you do not see much people boiling water during the day. Many people do not have electricity and both electricity and wood are expensive for people, which might be a burden for boiling the water. However, this was not a part of the research, so this is not known for sure.

For prepaid household water users the quality of the water they use might improve if they use it right from the tap. However, 24 out of the 25 people interviewed say they still store the water.\(^{144}\) The cause is probably that they have a yard connection instead of a connection inside the house. Therefore, their water still gets contaminated during storage.

### 7.5.2. KNOWLEDGE ON HYGIENE

Of the fifty people interviewed in the informal settlements, 96% said they did receive information on hygienic behavior. Most people received this information in the hospital, but also quite some people heard things on the radio (Figure 7-13).

![Figure 7-13: Where people in the informal settlements received information on hygiene from. Source: survey question 6b.](image)

\(^{141}\) Interview with inhabitants

\(^{142}\) Interview with water committee, 12-07-2011, Appendix B11

\(^{143}\) Observations in the informal settlements, August and September 2011.

\(^{144}\) Survey question 6.5, Appendix C
The writer’s impression is that, indeed, many people have basic knowledge on hygiene, but it differs a lot from one person to another if they also act to this knowledge. People, especially children, walking around without shoes and with clothes with holes in it indicate that families do not always have money for this. However, when asking a girl who lives in a shack in the informal settlements and only eats once or twice a day, she says that she does have enough money to buy soap. She even buys the more expensive Dettol soap (of N$6 a piece) instead of the cheapest one, which is only half the price, because she thinks the Dettol soap is better and it is important to have good soap.145

“Everyone learns about this, it’s not a problem”. Prepaid user informal settlements

Almost everyone claimed they washed their hands after defecation, before eating, before feeding children, before preparing food and after preparing food.146 However, this does not mean that they all actually do this, because they might have answered the desirable answer. If they wash their hands they use a small bucket in which they throw water from a bigger bucket or jerrycan. Then they get some soap and wash their hands with soap above the small bucket, regularly scooping water out of the small bucket with their hands. Then they throw the water away.147

Furthermore, some people have dogs or chickens walking around in their garden (not in the house) and a couple of people also have goats.148 Besides this some people claim they have cockroaches or mice in their house.149

7.5.3. SANITATION

From the prepaid household meter users only 3 people (12%) did not have improved facilities, where improved facilities include a flushed toilet, a ventilated improved pit latrine, a pit latrine with slab or an Otji-toilet (Figure 7-14). An Otji-toilet is a toilet designed by an NGO in Otjiwarongo (the Clay House Project). It is a form of a ventilated improved pit latrine, where extra effort has been put in separating solid from liquid. People that did have improved facilities mostly had a pit latrine with slab.

From the standpipe users, however, 72% lacked improved facilities. Most people had a pit latrine without slab, which they made themselves by digging a hole in their yard. Some people had no facilities at all.150 All the

145 Interview inhabitant informal settlement, 07-08-2011, Appendix B13.
146 Survey question 6.2, Appendix C.
147 Based on two separate observations where one or two persons washed their hands like this.
148 Observations in informal settlements, August and September 2011.
149 Question 6.7 of survey, Appendix C.
150 Question 3.10 of survey, Appendix C.
‘toilets’ stand in people’s garden, away from their house (also for people with improved facilities). Most of them had a self-made shelter, giving people some privacy. Facilities for washing hands were not present at the toilet, but only in the house. Also, there was no light present in the toilet and no toilet paper either. Even though toilets were present people complained that it smelled bad and little boys were still seen peeing in the garden instead of at the toilet. Grownups were also seen peeing or even defecating in the bushes in Orwetoveni (probably on their way from the informal settlements to the centre, or on their way back).

Figure 7-14: Otji-toilet standing in the informal settlements

7.5.4. SUMMARY OF HYGIENE AND HEALTH

Big health improvements can still be obtained in the informal settlements. Storage and transportation of water contaminates the water. Even though most people use jerry cans with a small, closable opening there are still people using open buckets. Also, even though the jerry cans prevent some contamination the quality of the water still deteriorates. Point of use treatment or using water right from the tap would increase the water quality. However, even the people with a household water connection have their own tap now, they still store the water. Therefore, their water quality does not increase (much) compared to when they used water from standpipes.

Furthermore, in general it can be concluded that most people know the basics of hygiene, but they do not always know enough or act to this knowledge. Improvements in hygiene can therefore still be made for a lot of people. For example with sanitation, people do not have facilities for washing their hands near the toilet. Sanitation is also still a problem, with many people not having improved sanitation.

151 Observations in informal settlements, August and September 2011.
152 Observations in informal settlements, August and September 2011.
153 Observations from apartment in Orwetoveni, June - September 2011.
7.6. SOCIETAL COST-BENEFIT ANALYSIS PREPAID HOUSEHOLD METERS INFORMAL SETTLEMENTS

No societal CBA will be shown in this part, as there was not enough data collected to do this. However, it will be shown here what the societal benefits are and how they could become bigger.

Besides the costs shown in part 5.6.4 there are also non-monetary costs and benefits, like pollution as a cost or health improvements as a benefit. This could change the results of a CBA. Hutton et al (2004; 2007) perform an Economical CBA on water supply and include the following non-monetary benefits in their calculations: time savings due to easier access; gain in productive time; reduced health care costs saved due to less illness; and prevented deaths. In their article of 2007 they come to a total yearly benefit per person getting intervention of N$212.7 (€21.27) time savings being the biggest part. However, in their article of 2007 the benefits per person are calculated to be only N$90.62 (€9.06). The main difference is that they value time savings lower than they did in 2004. These numbers will not be exactly the same for this case. In their calculations Hutton et al (2004; 2007) look at the case that people were using unimproved water sources in the situation before and improved water sources in the situation after, where they consider standpipes already as an improved source since it provides water of (relatively) good quality. So, the health benefits will be lower in our case than in their scenario.

Furthermore, as was seen in earlier in this chapter people with household prepaid water meters use more water as people using standpipes. However, the increase is much lower than would be expected from literature. This is probably caused by the high water prices, which is a burden for people to use more water (next to the burden of having to walk to the standpipes to get water). Therefore, the health benefits are lower than they could be. However, the time benefits (time saved by not having to walk to the standpipe) are the same.

So, big time and health benefits can be obtained from making water available. But given that the costs of prepaid water meter are very high and that not much health benefits are obtained (as people do not use more water), it is assumed that other interventions might have bigger benefits for the society. The municipality could for example look at the option of installing more standpipes (also decreasing the time people spend on fetching water), installing conventional household water meters (which may lead to more problems with payments, but also means the investment costs are way less than they are now) or focusing on improved sanitation (also giving many health benefits). An elaborative comparison between different solutions would be great to see when the financial and the economic CBA are best.

7.7. OPINION ABOUT PREPAID HOUSEHOLD METER

Almost all prepaid household meter users mention that the biggest advantage of the household prepaid meter is that they do not have to walk to the standpipe anymore. Most of them do not see any negative aspects on the prepaid household meters, although a few of them complain that the meter breaks easily. It is therefore no surprise that almost all prepaid household meter users said that the prepaid meter improved their situation.\footnote{Question 1.5 of survey, Appendix C}
Some prepaid household meter users use more water since they have the household meter, but most of them say they use the same as before. The biggest improvement with the household meters is that people do not have to walk to the standpipe anymore, which saves them a lot of trouble. The fact that water use did not increase for most of them, while they are using much less than people in Orwetoveni, and the fact that high percentages of income have to be spent on water and people mention costs as being a limiting factor in using more water means that the price for water is too high: the price of the water is a constraint for them for using more water.

Also, people with prepaid household meters still store their water. Quality improvements of the water, in comparison to using standpipes, are therefore minimal, while much bigger improvements could be obtained if people use the water right from the source. Also, water is not treated much before use.

Limiting opening hours of the municipality where credits can be put on the tag harms the access to water at all times. This is the same for standpipe users and therefore not caused by prepaid household meters, but it is a problem for all of them. Furthermore, the extra time that becomes available for not having to walk to the standpipe could in theory be used for food harvesting, entrepreneurship or other useful, income-generating activities. However, it turns out that availability of time is not the main constraint for this. Therefore, since there are other factors like money and availability of jobs that prevent people from the income-generating activities the extra time cannot be used in a useful way.

The economic cost-benefit analysis, which also includes time and health benefits, shows that costs are still higher than the benefits. A different solution might have a better cost-benefit ratio.

So even though people are happy with the prepaid household meter and standpipe users also want their own meter, the impact is minimal because prices are high and because people still store their water without treating it before use. A lower water price could take this burden away and make the positive impact of having an own water meter much bigger. Also, putting the water tap inside the house instead of in the garden could improve the quality of the water. Promoting water treatment and education on safe storage would also help in improving the water quality. But a totally different solution (like putting in conventional water meters or increasing the number of standpipe) might have even more benefits for the society than this solution. More research is needed for this to be confirmed.
This chapter gives an answer to subquestion 4 and 5: ‘what forms of public participation are being used?’ and ‘how could enhanced public participation help in avoiding and solving problems of the inhabitants and the municipality?’.

As seen in part 3.5 public participation gains support from the people and makes them aware (Peña and Córdova, 2001). Also, Manikutty (1997) shows that with good public participation the whole system is working better, more taps are working and user satisfaction is bigger compared to a place where public participation was lacking. For answering subquestion 4 it will be seen if information reaches everyone, if they are informed or consulted at the right time and if enough information is given.

Furthermore, from part 3.5 also follows that it is important that during the implementation of an innovation (in this case the prepaid water meter) the communication between the municipality and the users is good. Also, following theory of Douthwaite (and shown in Figure 3-4) the role of the inhabitants (which are the users) should become bigger as the project progresses: the goals of the municipality and the inhabitants should meet. It will be shown in how far this is true in this case and how this could become better.

The role of prepaid water meters on public participation was not specifically researched, but it is assumed that this does not have much impact on public participation.  

In reviewing the public participation both the municipality and the inhabitants were consulted. Interviews with three Strategic Executives of the municipality and three people of the municipality working in the field show what they do to try and inform the people. Interviews with inhabitants show if the people also receive this information and if it is clear to them. Furthermore, it will be shown how inhabitants can give the municipality input, again both from the municipality’s and from the inhabitant’s perspective. Both groups were literally asked about the communication in the interviews. But some misunderstandings of the inhabitants also appeared from other questions.

First, the different forms of public participation that are already being used will be discussed, answering subquestion 4. Then, it will be shown how and where enhanced public participation could contribute to more satisfaction or the inhabitants and the municipality, to answer subquestion 5.

“Munisipaliteit moet praat met die mense.” Interviewee #1,
(The municipality has to talk to the people)

\[155\] Although it is suggested by Gowlland –Gualtieri (2007) that prepaid water meters prevent communication between communities and water providers and does not allow for adequate public participation the writer still thinks that prepaid water meters do not have a bad influence on public participation. Moreover, with the prepaid water meter people have to visit the municipal office more often to charge their tags, making communication even easier. Furthermore, it is true that people can cut themselves off, but the municipality can still see this in their system. The problem is not that the municipality does not know that people are cut off from water; the problem is that they do not know how to solve this.
8.1. FORMS OF PUBLIC PARTICIPATION USED

A short summary of the forms of public participation the municipality is using will be shown. The summary will show the information the municipality is giving to the inhabitants, how the inhabitants are being consulted and which miscommunications occur. Both the municipality’s and the inhabitant’s opinion on this will be shown.

8.1.1. INFORMATION

In general, most people say the communication with the municipality is good: 64 out of 100 people interviewed say this. However, also 27 people say the communication is not good. Complaints of these people were that they are not informed well or do not understand things, that not sufficient information is given, and that the municipality is not listening to them or is rude. So improvements can still be made.

"[We] don’t understand a lot of things. [They] mostly talk English, which we don’t understand". Interviewee 25 from survey, as translated by one of the interviewers.

The municipality informs inhabitants on water prices by meetings, newsletters, and messages at the bottom or their accounts, but still only 9 of the 100 people interviewed said they knew the price of water. All of them were prepaid water meter users. The inhabitants also do not know how this price is built up and what is included and excluded in the price. Therefore, it is expected that most prepaid water users do not know that they are paying a higher water price than conventional water meter users.

Looking at prepaid water meters, information is given on how they work and why they are installed, but in the informal settlements it took a while to reach everyone with the news that they could get a prepaid household water meter and the price increase of this meter, from N$500 (€50) to N$1,000 (€100) is not understood by the inhabitants. For explaining people on how the prepaid water meters work, different methods were used in different areas. In the informal settlements, the water committee (consisting of inhabitants of the informal settlements) stood at the standpipes for days to show people how it worked. In Orwetoveni, on the other hand, prepaid meters were demonstrated house by house by technicians. Also, people who do not pay are sometimes visited by the municipality to try and convince them to at least pay a little. Hoko, debtor accountant

156 But maybe they were confused if the survey was from the municipality or from an independent research, which could have influenced the answer.

157 Survey question 2.1, Appendix C.

158 Interview with Agatha Mweti, Strategic Executive Community Services, 13-06-2011, Appendix B5.

159 Survey question 5.7, Appendix C.

160 Interview with water committee, 12-07-2011, Appendix B11.

161 Interview with Agatha Mweti, Strategic Executive Community Services, 13-06-2011, Appendix B5; interview with Naudé Slabbert, Strategic Executive Infrastructure & Technical Services, 17-06-2011, Appendix B8.
at the municipality Otjiwarongo, tells that a typical reaction is people asking “where do you think I should get this money from?” The municipality also does not know this.

8.1.2. CONSULTATION

The inhabitants are represented by the council, which is elected every five years. The council can make decisions, like giving people in the informal settlements household connections. Furthermore, in the informal settlements a water committee of about 18 members was elected by the community. Their main task was to help educating inhabitants on how to use prepaid water meters. They also report problems to the municipality, like broken standpipes, they help the municipality with announcing meetings and they can call for a meeting with the municipality.

But people can also reach the municipality themselves. When a standpipe is broken, one of the technicians can be reached 24/7 to report this. His phone number is written on the standpipes (Figure 8-1), so everyone can reach him. From the 100 people interviewed for the survey, 72 say they go to the municipality or talk to someone who works for the municipality if they have complaints or questions. However, one interviewee told that she got three different answers from three different people from the municipality, which was very confusing.

8.1.3. MISCOMMUNICATION AND PUBLIC PARTICIPATION

This part looks at the miscommunication between the inhabitants and the municipality. Some situations will be discussed in which information is not reaching everyone, leading to unfair situations. Public participation can help in solving this.

Water prices

As seen above the water prices are not well-known by the inhabitants, but if they want to know this they can look on their receipt and see it. What is not on there, however, is information on how the price is build up. The inhabitants do not know where they are paying for. Therefore it is also not clear for the inhabitants that they are paying a higher price for the prepaid water meter. Some people who are happy with the prepaid water meter might be less satisfied if they knew they were paying extra. So, providing more complete information to the inhabitants and making water prices more transparent would be best.

Prepaid water meter availability

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162 Interview with Hoko, debtors accountant, 03-08-2011, Appendix B12.
163 Interview with Agatha Mweti, Strategic Executive Community Services, 13-06-2011, Appendix B5.
164 From survey question 2.2, Appendix C.
Not everyone in the informal settlements knew at the same time that it was possible to get a prepaid household water meter at the municipality. It is obviously hard to reach everyone and inevitable that many people hear it later or only find out if they see others with a prepaid household water meter. However, as the municipality increased the price after the first 50 meters from N$500 (£50) to N$1,000 (£100), it is unfair that most people did not get the chance to get a meter for N$500. They hear from people in the street who got a prepaid household water meter that they bought it for N$500 (£50), but when they arrive at the municipality they hear they have to pay N$1,000 (£100). They do not understand this price increase. Especially in the informal settlements where news travels slowly and it is hard to reach everyone it is important to be clear and do not change things too often. If it is decided that things have to change fast (like with the price of prepaid household water meters) it is crucial that information is provided faster. An increased role for the water committee could help in this case.

**Test standpipe**

Just outside the municipal office where people can put credits on their tag (Orwetoveni office) is a test-standpipe. Here, people can test if the credits are put on their tag. However, this standpipe works different than the regular standpipes, making it confusing for people. Where at regular standpipes water stops flowing if you pull out the tag, in this standpipe water keeps flowing and you have to check out. People do not always understand this or forget this. When they arrive home and go to fetch water they see there is no (or less) credit on their tag. The water at the municipal office is wasted and the inhabitants are angry for having no credits and blame the municipality. The municipality sees this happening sometimes: they see that water is sometimes running from the test-standpipe and they know that the reason is that someone forgot to check out (Interview Jackson, Appendix B) (if they see this they do check out, in case to prevent even more water from being wasted and more credits being lost). Even though the municipality sees this happening, they are not looking for solutions, while some solutions are probably quite simple achieve: e.g. they can change it for a standpipe that works like other standpipes where you do not have to check out.

### 8.1.4. SUMMARY OF FORMS OF PUBLIC PARTICIPATION USED

People are informed in several ways, like through meetings, newsletters, and messages at the bottom of their accounts. Also, people can easily reach the municipality and they are represented by the elected council. Although there is room for improvement, the municipality already gives the inhabitants most information and also complaints or question often end up at the municipality.

### 8.2. CONTRIBUTION OF PUBLIC PARTICIPATION TO PROBLEM SOLVING

Following the theory of Douthwaite (2002) the objectives of the municipality and the inhabitants should meet. They should cooperate in achieving both their goals. However, as the situation is now the goals do not meet. The municipality wants to recover the costs of water and of other services and wants to provide good services to the city, while the inhabitants want to get water at an affordable price. Affordability also contributes to good services, but this is not the main focus of the municipality. In this part it will be seen where it goes wrong and how public participation could help.

With the prepaid water meters they tried to force people to pay. For some inhabitants this worked, but many tried to bypass this system. They used the tags from people without debts to buy credits and put them on their own water meter. This way they did not have to pay off their debts. The municipality reacts to this with a plan to install different prepaid water meters, where a tag can only be used on one prepaid water meter. But for people who are not able to pay this does not solve anything. The municipality still does not get more money from them and they lose their water connection. The municipality acknowledges that some people are just not
able to pay. As seen in 8.1.1 they sometimes get the question from people how they should get the money to pay this, but they cannot answer this.

So even though some people are not able to pay and the municipality knows this they act like the only problem is willingness to pay. Talking to the people to convince them to pay (which already happens sometimes) or trying to force people to pay by installing prepaid water meters is of no use if people are really not able to pay. Concluding, the biggest problem is not that the municipality does not hear from people what is wrong or does not talk to people. The biggest problem is that they do not know how to solve these problems.

So in order to have the municipality and the inhabitants meet with their goals the municipality should think of a solution to make water affordable and recover costs at the same time. The biggest discrepancy, therefore, is not between goals of the municipality and goals of the inhabitants, but between two contradicting goals of the municipality. Although input from the inhabitants for a solution might be useful, public participation cannot solve the whole problem.

8.2.1. SUMMARY OF CONTRIBUTION PUBLIC PARTICIPATION

The biggest problem turns out to be the high price that makes the water unaffordable for many inhabitants, not a lack of public participation. Therefore, enhanced public participation cannot solve much of the problems. It can help solving some miscommunication that is still present, but this cannot solve the discrepancy between cost recovery and affordability. For solving the problem of the high price, more actors than only the inhabitants and the municipality are probably needed.
9. CONCLUSION

Namibia is the most arid country south of the Sahara and almost half the people live below the poverty line of US$1.25 per day (UNICEF, n.d.), making it very difficult to supply water at an affordable price. This is alarming as water is a basic right and essential for people’s health.

Municipalities, who provide water to their inhabitants, have a hard time collecting money, which is why many of them use prepaid water meters in order to collect money. In this research the impact of prepaid water meters on different groups of people in the city Otjiwarongo was examined, looking at the effect on the quality of life, mainly for vulnerable groups, and the effect on cost recovery of the water supply. This is done by comparing prepaid water meter users in Orwetoveni (an area with lower and middle income households) with conventional meter users in this area, and by comparing prepaid household water meter users in the informal settlements (the poorest area) with prepaid standpipe users in this area.

![Figure 9-1: Woman fetching water at prepaid standpipe](image)

Information used for this came from a literature study, observations, 100 surveys, 18 semi-structured interviews with inhabitants and more than 10 semi-structured interviews with the municipality (see part 4.2). The analysis was based on these data and from this analysis conclusions follow which will be discussed in this chapter. From the conclusions follow the recommendations, which will be discussed in the end.

9.1 RESEARCH CONCLUSIONS

The research question is: “What is the impact of prepaid household water meters in Otjiwarongo on the effectiveness and the efficiency of the municipality’s water supply and on the quality of life of inhabitants, and how can public participation contribute to improve the quality of life?” Before answering the main question, subquestions will be discussed.

**SUBQUESTION 1: HOW DID THE EFFECTIVENESS AND EFFICIENCY OF THE MUNICIPALITY’S WATER SUPPLY CHANGE AFTER THE IMPLEMENTATION OF PREPAID WATER METERS FOR NEW USES?**

The effectiveness looks at the goals of the municipality and in how far the prepaid water meters help in reaching these goals. The goals that directly led to installing prepaid water meters were recovering and preventing debts and enabling household connections. The prepaid water meter helped in recovering some debts, although results are not as good as hoped for: (according to the municipality €60,000 debt was collected in the first half of 2011, partly due to prepaid water meters). Also, despite this part that is recovered, the total amount of debts still increased over the past two years, from €1,766,346 in July 2009 to €2,231,004 in June 2011 (part 5.5.2). In the informal settlements 50 people received a household connection so far, but the
The municipality acknowledges that it is not possible for everyone to buy a prepaid water meter (part 5.5.3). So the prepaid water meters only have moderate results on the goals, the effectiveness could be better.

Moreover, prepaid water meters have a negative effect on one of their other goals on which they did not put enough thought: affordability. As costs for prepaid water meters are higher than for conventional water meters (around €330 for the first, compared to €25 for conventional meters: part 5.6.2) the discrepancy between cost recovery and affordability becomes even bigger. Water prices in Namibia were very high already and increased even more due to the high price of prepaid water meters: the basic water price in Otjiwarongo is €1.60/m³ from which €0.80/m³ has to be paid to the water company Namwater (a price which is approved by the national government) and the rest covers the costs of the municipality and helps financing some other services they deliver. Prepaid water users even pay €2.56/m³ to cover for the extra costs of prepaid water meters. As a comparison in Mozambique, Tanzania and Nigeria water prices are respectively €0.80, €0.32 and €0.14 per cubic meter (part 5.4.1, Keener et al, 2009). The reason that they do not carefully look at the affordability could be that their notion of affordability is wrong as this does not look at the amount of water people use, but only looks if people can pay for very small amounts of water (see quote below: for N$10 (€1.00) you can get water, but only 330 liter, which is not even enough for a family for one week).

“This while the amount of water used is proved to be very important for people’s health (Howard and Bartram, 2003; Haffejee 2007; Mihelsic, 2009). A lot of indirect costs come from a lack of (enough) clean water: health costs, lost time or deaths (Hutton et al, 2004). But these costs are not visible to the municipality, and avoiding these costs mainly helps the health sector (funded by national government) and the inhabitants. Concluding, an increased focus on affordability for the inhabitants and the indirect costs of water related problems is necessary.

The results for the efficiency are not much better, as the prepaid water meters are very expensive. It was analyzed if it is possible at all to recover the costs of the prepaid water meters. From this analysis (part 5.6.4) follows that there is a group of vulnerable people who are not able to pay. The municipality cannot get more money from this group than they are already asking, so the prepaid water meter only increases the costs, not the income. The yearly costs per prepaid water meter per year are estimated to be €80 (part 5.6.4), which is really high compared to the average costs per household for the water supply, which is estimated to be €144). This money is lost if the prepaid water meter is not being used or if no extra income is received. However, there are also people who started paying once they got the prepaid water meter. So it looks like there is also a group of people for who it does work, and if 1 in 5 people that did not pay for services before start paying now the costs of the prepaid water meters are already being recovered (part 5.6.4). So for some people the prepaid meter can be efficient, but for people that are not able to pay, like pensioners, it is definitely not efficient.

SUBQUESTION 2: HOW DOES THE IMPLEMENTATION OF HOUSEHOLD PREPAID WATER METERS IN ORWETOVENI INFLUENCES THE QUALITY OF LIFE?

Prepaid water meters in this area, Orwetoveni, were placed to avoid and recover debts. They have some positive effects, but more negative ones. A positive aspect of the prepaid water meter is that it gives people more control over their water use, making it easier for them to oversee their expenses on water. However, a big setback is that people with prepaid water meters are using less water than people without prepaid water
meters. From the survey, where 25 prepaid users and 25 conventional meter users in Orwetoveni were interviewed, follows that the average use per person for people with prepaid connections in Orwetoveni is 390 liters/week (n=19). For people with conventional meters this is 1,284 liters/week (n=21) (based on their weekly expenses on water: part 6.4.1). Also, almost half of the prepaid users interviewed say they use less water than they did before. As they cannot afford to pay off debts and spend the same amount on water as they did before, and because the prepaid water price is higher (N$25.64/m³ (€2.56/m³)) than the basic water price conventional meter users pay (N$16/m³ (€1.60/m³)) to cover for higher costs, they have to decrease their water use. Most often around 20-25 liters per person per day is seen as the minimum water amount needed (The World Health Organization, 2003; Determined minimum South Africa: hhropenforum, 2009). However, the 20-25 liters cover for drinking water and cooking, but not for all hygienic activities. From Howard and Bartram (2003) follows that 100 liters per person per day (700 liters per person per week) is the optimal water use for all basic needs, hygiene is good and health risks are low. On average, prepaid water users use only half the amount. A decrease in water use is therefore expected to increase health problems, having a negative impact on their quality of life. This also reflects in a negative impact on achieving the MDG’s related to water supply and health.

So the high water price is the biggest constraint for using sufficient water. The poorest 25-50% of Namibia only earn N$332 (€33.20) a month (Republic of Namibia, 2004). This means that for 20 liters per person per day they would have to use 4.5% of their income on water, and for 100 liters this would be 23.3%, which is clearly impossible. For making 50 liters of water per person a day (which is the amount that brings low health risks according to Howard and Bartram (2003)) affordable for even the poorest quartile of the country (where affordability means spending not more than 5% of your income on water (McPhail, 1993)), the price has to be N$5.56 (€0.55)/m³. Since the municipality already has to pay Namwater N$8 (€0.80) per cubic meter water the only way to be able to set the price at N$5.56 (€0.55)/m³ is to subsidize it.

SUBQUESTION 3: HOW DOES THE IMPLEMENTATION OF HOUSEHOLD PREPAID WATER METERS IN THE INFORMAL SETTLEMENTS INFLUENCES THE QUALITY OF LIFE?

In this area of the city, the informal settlements, prepaid standpipes were already in use and prepaid household water meters were installed to enable people household connections. In general, people are happy with the meters as it saves them the time and effort of walking to a standpipe. This time could be used for economic activities, childcare or leisure.

An extra advantage could be increased water use, which would give positive health effects as their water use at the moment is low (230 liters per person per week (part 7.4.1)). But the amount of water consumed did not increase much: 18 out of 25 people interviewed said their water use did not change (part 7.4.3). According to literature water amounts used are expected to more than double after getting a household water meter (Howard and Bartram, 2003; Newton, 2011), but because of the high prepaid water price the water use only slightly increased. Besides the water amounts used the water quality is also important. People with a household prepaid water meter are still using jerry cans or buckets to store water, which has the risk of water contamination. Using more water right from the tap instead of storing it or using point-of-use treatment would improve the quality of the water (Fewtrell et al, 2005). Concluding, more positive effects could be reached if water would be more affordable and if decreasing water quality at point of use would be prevented.
Health improvements are still very important in this area. The MDG’s show that in 2008 infant mortality rates per 1,000 live births was 49 and it is unlikely that the goal of 38 will be reached by 2012 (part 3.4.5). Besides increasing amounts of water used, there are many other ways in which health improvements can be reached in this area, for example through better sanitation, improved hygienic behavior or point of use water treatment.

**SUBQUESTION 4 AND 5: WHAT FORMS OF PUBLIC PARTICIPATION ARE BEING USED? AND HOW COULD ENHANCED PUBLIC PARTICIPATION HELP IN AVOIDING AND SOLVING PROBLEMS OF THE INHABITANTS AND THE MUNICIPALITY?**

Finally, the public participation was researched. Although there is room for improvement, the municipality already gives the inhabitants most information and also complaints or question often end up at the municipality. So, the municipality sees the problems, but they do not always know how to act on it, how to solve it. From the model of Douthwaite follows that the users (inhabitants) should be more involved as the project develops. This means that by now, as they are in the stage of expanding the market, the goals should meet. But this is not the case. The discrepancy between cost recovery for the municipality and affordability for the inhabitants again turns out to be the problem. So enhanced public participation could help in preventing miscommunication and inhabitants can help in looking for solutions for making water affordable while recovering costs at the same time, but only public participation cannot solve the whole problem of this discrepancy and outside help is also needed.

**OVERALL CONCLUSION**

The prepaid water meter helped in reaching some of the municipal goals, but harmed reaching other goals at the same time. The impact on the quality of life of prepaid water users in Orwetoveni is mostly negative, as the costs become a bigger constraint for them for using more water. The impact on the quality of life of prepaid household meter users in the informal settlements is positive, but with a lower water price the positive effect on the water use could be much greater, leading to a more positive effect on the health of people and on their quality of life.

One problem is the struggle of the municipality with having people pay for services (which comes partly from unemployment and people being unable to pay and partly because of a low willingness to pay). The way it is solved now, with people having to pay other services through the water consumption, puts a big pressure on the water consumption of people. The high water price is the biggest problem for the inhabitants. Because of the high water price the amount of water used is low, which has a negative impact on their health and therefore on their quality of life.

To make water affordable the water price has to decrease drastically. (Increasing incomes would also help in making it more affordable, but this is out of the scope of this research). It is not only the municipality’s responsibility to achieve this and probably they cannot accomplish this by themselves: outside help is needed. Maybe Namwater can lower its price, the national government can sponsor water for vulnerable groups, or there could be alternatives for a more affordable water supply (like using more rainwater or using only dry toilets).
Prepaid water meters in general are working well, although they do bring some problems with them. The main disadvantage of the prepaid water meter is that it is very expensive. The costs are now largely paid by the inhabitants (not directly, but through increased water prices), which many people are not able to pay. These people could not pay for services and enough water before the prepaid water meter, and now it only gets more expensive for them. So, it is the cost that causes the most negative impacts, not malfunctioning of the meters.

9.2 RECOMMENDATIONS

Recommendations will be made for the municipality of Otjiwarongo, Brabant Water and for further research. Many of the recommendations for the municipality will also be useful for other municipalities.

**MUNICIPALITY**

A first recommendation is to put more emphasis on making water affordable for people, as many people cannot afford enough water now. Also the poorest people are forced to use prepaid water meters and pay the highest water price which is not fair. To be able to make water more affordable alternatives have to be explored and help from Namwater, the national government and maybe other parties has to be asked. Also inhabitants can help in looking for solutions and the possibility of an increasing block tariff, as already used in other cities, like Windhoek, can be explored.

Furthermore, a recommendation specifically focused on prepaid water meters in Orwetoveni is to stop installing prepaid water meters for people who cannot afford to pay for services and/or to pay off debts. At the moment these people cost the municipality a lot, as they are not paying (because they are unable to pay) and they did receive an expensive prepaid water meter. At the same time these people are also suffering because their water is cut off or they do not have money left for food and other basic needs after paying the municipality. Examples of solutions are to group them (e.g. make a building for pensioners, asking no or low service costs), give people with a pension a reduced tariff, or advice them to move in with family or friends (to share the service costs).

For people in the informal settlements the household connections have a positive effect. However, these household connections are very expensive. The municipality could also look at other ways to improve their quality of life, like increasing the numbers of standpipes, increase rainwater use or improve sanitation, which might have fewer costs.

Furthermore, it would be very useful to state more specific goals. This will enable the possibility to measure progress and evaluate the interventions. For example, the minimum amount of water needed could be defined. Also, a transparent cost structure would make it easier for inhabitants to know and understand the price.

**BRABANT WATER**

Brabant Water can help investigating if Namwater or the municipality can save costs on the water supply by making it more efficient. Furthermore, Brabant Water could help in searching for organizations that could sponsor the water supply in Otjiwarongo: organizations that subsidize the water price for the poorest or who can arrange debt forgiveness.
Another role for Brabant Water could be to look at the recommendations made in this report for the municipality and help the municipality with understanding the recommendations and doing something with the recommendations. They could help the municipality in stating more specific goals (formulating Service Level Agreements), and in approaching other parties for decreasing the water price.

Finally, the writer recommends Brabant Water to keep in close contact with the university and try to help more students in going to Otjiwarongo for research. The university has a lot of useful knowledge, like on the impact water has on people’s health. The students can be really helpful for an extensive research as they have the time to visit Otjiwarongo for several months.

**FURTHER RESEARCH FOR OTJIWARONGO**

It would be very interesting to look deeper to the ethical aspects of providing water. Ethical considerations can be made on including other services into the water price, charging higher prices for prepaid users, and cutting off water if other services are not being paid.

For the municipality it would be very useful if a follow-up research will look at ways to increase the affordability for inhabitants. It would also be useful for them to look at alternatives for the prepaid household water meters. So, alternative ways of collecting debt and making people pay can be researched for Orwetoveni, as well as looking for a solution for people that are not able to pay (e.g. pensioners). And in the informal settlements alternative ways for improving the situation can be looked at, for example putting in more standpipes or improve sanitation. Also increasing rainwater use (and making sure that this happens in a way that the quality of the water is good) is an interesting topic for a next research, as this could increase the water use and benefit people’s health at a price that is possibly lower than other interventions.

Finally, a research on the discrepancy between affordability and cost recovery could be useful. This could show the positive and negative aspects of solutions used in all parts of the world in different situations.

**9.3 METHODOLOGICAL REFLECTION**

Looking at the goals of the municipality turned out to be very useful, since many of the problems came from discrepancies between the goals or the fact that goals were not specified.

For the quality of life, it turned out that the Millennium Development Goals were good background information for making this part of the conceptual model. The MDG’s do not define or measure the ‘quality of life’, but they do state goals which are aimed at improving the situation of people, putting a lot of emphasis on health and on water supply. Another advantage of using the MDG’s as a guideline was that other articles also refer to the MDG’s, like Hutton and Haller (2004; 2007) who made an economic CBA of providing improved water sources. However, a drawback from the MDG’s is that they are too broad to be really useful at the local level. They measure access to water, but do not take cut offs (by municipalities or other water suppliers) into account and also make no distinction between standpipe users and household users. For the national level at which they measure this is very hard to do. But on a local level this distinction is important, as cut offs really harm the access and the difference between amounts of water used by standpipe users and household users is proven to be very large. Also, the goals focus on a first improvement (e.g. providing clean water), but not on the steps that follow after this (e.g. providing household connections). In Namibia most people have access to water according to the definition of the MDG’s, but still many improvements are necessary for people’s health and quality of life. Concluding, when looking on a more local level or when the first steps are being made but still many improvements can be done, the MDG’s are less useful to use and are only useful as guidelines.
Using Douthwaite for the part on public participation was in this case quite difficult. He stresses that the further you are in the project, the more the users should be involved, which is also true for the prepaid water meters. But he looks at (agricultural) innovations, that people adapt voluntary, while the prepaid water meter is mandatory for some people and the only option for a household connection for others. The most important consequence is that the need for the municipality to meet the inhabitants halfway is lower than for voluntary adopted innovations. Public participation and knowing what the inhabitants want is therefore only one step in this process. The other step, which is still missing, is for the municipality to use this information and to actively try to find a solution which suits them as well as the inhabitants.

Finally, creating the conceptual model had several benefits. It enabled to measure the first steps in this model where the changes (impact) could already be seen, and use literature to translate these initial effects to the final impact: changes in health and quality of life. Water use did indeed seem to depend on the accessibility and affordability, and health was related to water use, and quality of life to health. The model also made clear where the biggest problems were for reaching a better quality of life.

**FURTHER RESEARCH FOR METHODOLOGY**

One interesting point of research is to broaden the model made in this research that showed what factors leaded to the quality of life. From this it was seen that access and affordability leaded to water use, which had an influence on hygiene and health, which is important for the quality of life. This model can be broadened by including all the MDG’s or by looking at more factors that influence the quality of life.

Furthermore, the influence of access and affordability on the use of services can be researched for more services than water supply. Also, more factors could be included, e.g. cultural preferences.

Furthermore, the model of Douthwaite on public participation could be adjusted for forced instead of voluntary innovations. With a forced innovation the roles of both parties are different, the users have less power. It would be interesting to see how this changes the role of public participation.

**9.4 DISCUSSION**

The number of surveys was very limited: 100 in total, where in many cases two groups of 25 people were compared to each other. These 100 people do not reflect the whole population. However, they do give an indication of their opinions, the differences between the groups and the magnitude of certain numbers. For this explorative research this number was just sufficient. But for more specific details a bigger survey will have to be done.

Also, not much information on changes in people’s health was collected, which is why most conclusions on the health had to come from literature (what impact a changing water use has on health). Information on changes in people’s health was not asked in the survey as it was estimated that it would be impossible for people to tell how much more or less health problems they had since the prepaid water meter. Only a before and after survey could show this. The hospital in Otjiwarongo was visited, but no information on diseases like diarrhea followed from this visit.

Furthermore, it was difficult to get a complete overview of the financial data. It was often not known by the writer how the municipality came to the numbers in their overview, i.e. if the numbers were based on estimates, calculations or measurements. Also, it was not always clear what was included and excluded in the numbers. Interviews after the analysis would have been useful for asking explanations for some numbers in their financial data that were not understood by the writer. Interviews at the end of the project would also be useful for checking if the municipality agreed with the hierarchy of goals that was based on their interviews.


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Municipality Otjiwarongo (b), Monthly Financial Report June 2010. From database municipality. For this information Burgert Liebenberg, Strategic Executive Finance can be contacted at: burgert@otjimun.org.na

Municipality Otjiwarongo (c), Monthly Financial Report June 2011. From database municipality. For this information Burgert Liebenberg, Strategic Executive Finance can be contacted at: burgert@otjimun.org.na

Municipality Otjiwarongo (d), Tariffs 2012. From database municipality. For this information Burgert Liebenberg, Strategic Executive Finance can be contacted at: burgert@otjimun.org.na

Municipality Otjiwarongo (e), Water June 2010. From database municipality. For this information Burgert Liebenberg, Strategic Executive Finance can be contacted at: burgert@otjimun.org.na.

Municipality Otjiwarongo (f), Water June 2011. From database municipality. For this information Burgert Liebenberg, Strategic Executive Finance can be contacted at: burgert@otjimun.org.na
Municipality Otjiwarongo (g), *Water Purchases and Sales Financial year 2002/2003 - 2010/2011*. From database municipality. For this information Burgert Liebenberg, Strategic Executive Finance can be contacted at: burgert@otjimun.org.na.

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APPENDIX B: SUMMARIES OF MOST IMPORTANT INTERVIEWS

APPENDIX B1: NAUDÉ SLABBERT, 01-06-2011

Tags

Recharge tags: vending stations

1. Office of municipality in Orwetoveni: open during official hours
2. Satellite office/ police station: open during normal working hours

View of Naudé: Need to have it available 24 hours → this is the aim for the long run.

Now it is technically difficult to accomplish this.

Other services

Before 2004/2005 power was distributed by the municipality. This was the main source of income for the municipality. Water was the second.

After that it was privatized (but still controlled by the government?). In Otjiwarongo it is called CENORED. Water is now the first source of income.

In informal settlements lots of people did not have electricity (before 2004?). After that Naudé thinks to remember that the government gave a grant to assist in getting electricity to everyone. Now, (close to) everybody has power.

No prepaid electricity meters are used in Otji, but prepaid electricity meters are more advanced and easier than prepaid water meters.

Second (?) source of income are property taxes paid by house owners.

Other services are sanitation, sewerage.

Technical problems

Problems to interlink water and financial system → now this has to be done manually.

Prices

Low income people: pay tax through water bills. Example: for the first N$100, 50% goes to tax and debt. If that is paid off, 100% goes to water.

NAMwater tariff N$8/ m² increases 9% in July

Municipality tariff N$ 16/ m² in July: N$17/m²

This profit is made to balance the budget.

Loss of electricity income after 2004/05 → still need to balance budget

Government does give some support (to compensate for this/ for their land use etc): a fixed amount, around N$ 7 million/ year. This has been the same amount since 2004.

Maintenance

Because meters are replaced now, the meters will be newer and therefore less maintenance is expected for the next years. Old meters (10-15 years old) need more maintenance.
Water department: 10 people working there, 2 of them work only on prepaid meters.

Conventional meters: People with conventional meters pay a connection fee in the beginning, which gives them the right to some services.

The municipality pays for needed replacements. Unless the meter is damaged by the user himself, then he has to pay for it.

If the meter does not work it needs to be fixed ASAP. Normally they respond the same day. If the water supply is still ok, than it can take a little longer. In worst case scenarios it takes 2 days.

There is a 24 hour standby. They can be called 24 hours/ day and they will repair it.

This goes for both conventional and prepaid meters.

Test

To test the new prepaid water meters 20 staff members got them placed in their houses. The municipality first wanted to test it themselves before giving it to the public.

Debt/ cut-off

Since 1994 (independence) debts have raised till N$ 20 million.

Thus: stop increasing the trend of debts

How Naudé thinks it goes:

Normally they don’t cut off people immediately

A cut off date is put on their bill (if you don’t pay before …. you might be cut off)

It usually takes up to three months before cut off

Sometimes people are making arrangements with the municipality that they pay a little later.

Because they have been lenient in the past (partly due to policy decisions?) there now is a total debt of N$ 20 million.

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APPENDIX B2, NAUDÉ SLABBERT, 03-06-2011

1. **When did you become involved in the prepaid water meter project?**

   Until 2007, mr. Slabbert was employed by NamWater. He then transferred to the municipality of Otjiwarongo. His predecessor had already done some research on prepaid water meters. Although the technology still had growing pains in the beginning. The prepaid meters were tendered in 2007 on which a lot of parties responded. The choice was then made by mr. Slabbert and others for the Microplan meter. The criteria centred on technical features and the presence of a local supplier. There was a test period of six months, which in hindsight proved to be a short period. However, the supplier of prepaid water meters won’t give you a longer test period.

   From mid 2009 there have been serious problems between Microplan (Dutch) and the Namibian supplier which caused severe issues with spare parts delivery for the municipality.

   Since that time there is a direct contact with Microplan and they are still together looking into some issues with the meters. For example the interface between the meter-software and the financial software is not working, causing a lot of extra work. Also, zoning is an issue, by which is meant that tags and meters are not coupled together: people paying a higher tariff (because of debts) can avoid this by borrowing tags from people that have a lower tariff using them on their own meters. This could be solved through software.
Furthermore, currently there is a test going on with new meters manufactured by Kent, these will have those features. Brabant Water has expressed its enthusiasm for meters from this manufacturer. At present they also have a local supplier (this wasn’t the case at the time of the first tender in 2007).

2. **Can you tell us about the decisions and developments since that time?**
   Mr. Slabbert’s predecessor passed away in 2005, but before that time the decision has been made to look into prepaid meters as an option. He (the predecessor) was already researching issues with hardness of water, where he and mr. Slabbert already got in contact when mr. Slabbert was employed at NamWater. Other issues of interest were in software and manufacturers with local support. This was all as a result of the political decision to connect more people to public services like water.

   The municipality also keeps in contact with other cities, most of all with Windhoek. “We and Windhoek municipality are following each other.” They were a little bit more pro-active with the Kent meter and already installed more Kent meters.

   Other towns are also using prepaid water meters. Rundu town and Katima Mulilo also uses the Kent meter. “We would obviously use them as reference to check.”

3. **What have been the main arguments to choose for PP meters?**
   The main reasoning was giving access to water for everyone, coming from a national level. Also from a national level, the decision has been made never to give away water for free. In connecting poor, often informal residents, conventional meters were not considered as an option.

   The second main reason was the way to look for a way to deal with non-paying conventional meter customers. When connected to prepaid meters, defaulting is prevented.

   From a national level, access and raising living standards have been stressed since the independence of Namibia. After the independence, the poor majority of the population came more into the centre of attention, which according to Naudé is partly to increase voters. Also politicians come from this background nowadays, so they fight for their people.

   At the local level, council forced the technical department to look at prepaid meters (which was a political decision): they had to explore what’s on the market.

   This was to make sure that the poor payer can also have access to water: even if I only have N$10 for water, make sure he can get the N$10 worth of water.

4. **How successful is the project in your opinion? (How do you see the future of the prepaid meters?)**
   It is still in the phase of growing pains, with issues being discovered as they’re being used for a longer period. Currently it is the best option for water supply and from the municipality’s side a lot of attention is paid to the workings of the device itself to ensure as good as possible operation. For the prepaid meter, mr. Slabbert expects further improvements in the working of the system: battery life, the possibility to charge the tag with credit 24/7, stronger casing, etc.

   In the field of conventional metering, mr. Slabbert sees a future for Automated Meter Reading (AMR)-technology which will automate a lot of the work in metering and charging water usage. It still requires a payment collection of some sort after consumption. Therefore, he expects it to be used parallel to the prepaid system, serving another group of customers.

5. **Can you tell some more about the technical evaluations that have been carried out?**
   There are different classes of meters with different qualities. Some points the municipality is looking at are:
   - Accuracy.
   - Strength of the meters; needed to withstand the pressures/strains of daily use in sometimes cramped houses. Vandalism or accidents (people stepping on the small meters) can damage the meters.
   - Software capacity; for instance for zoning, after hours vending possibilities and smooth interfacing with financial system.
   - Battery life; the experienced lifetime sometimes differs greatly with the promised lifetime (weeks vs. years). For instance due to great differences in temperature the meter’s exposed to.
   - The presence of local agents for spare parts.
• Wear and tear from ‘ledging’ (opening and closing of the meter, which happens often if people run out of credit regularly).

A lot of the points of interest pop up over the years of use, for example problems with moisture leaking into the electronics. So far 500-600 of the meters have already needed repair or replacement, which has not been planned for and is a setback. Naudé tells us that the “bodies laying around” (meter bodies) show the malfunction of water meters. While they didn’t expect to need to replace any, they assumed it would be working well.

Twenty new meters are being tested at the moment. This is done by staff of the municipality, because the municipality first wants to test it themselves before exposing the public to it. For the new meters being tested, it is made sure that they are used intensively and exposed to the different possible conditions: the staff that is testing the meters gets a little amount of water at a time, to see how opening and closing works and because of the cold now they can also see how the meters respond to the weather. After six months of testing, the devices will be opened and checked for the effects. The shortcomings from the current meters offer special attention points for these tests.

There are some tendering evaluation reports available, which are made before the decision to purchase a certain meter. There are no documents reporting on the experiences after some years of usage.

6. **Who were the main proponents for the prepaid meters?**

From the town council the decision was made to provide access to water services for everyone. The municipality then selected the prepaid meter as a feasible option. The municipality proposed to install them at standpipes, but this was overturned by the council as humiliating for the residents. They decided that everyone should be able to get a connection, which resulted in a N$10m project being executed in phases. The agreement was for council members to arrange additional funding, which resulted in a N$1.5m subsidy. Mr. Slabbert argues that it is a politically sensible decision, but not from a financial view and the costs will have their consequences for the overall municipal budget and operations. It is good to improve social wellbeing, but this does not give us a return on investment. In this project you put in N$10m, you get 0 back. (Maybe you will get some of the N$20m debts back, but that is not ROI). → “This political decision does not make sense.” Politics and business cannot really mix.

Hopefully the first meters installed will create some awareness.

Currently the network has been installed and the first fifty households are being connected (against the subsidized tariff of N$500), from July onwards, the next 100 households will be connected (for N$1000 each).

**APPENDIX B3: CHRIS AND JACKSON, 06-06-2011**

Their role and way of working:

Technicians for the municipality specialized in prepaid water meter s. Used to work for the company Tagmeter Namibia, but were recruited by the municipality of Otjiwarongo after it decided to go ahead with prepaid water meters. Jackson has previously worked in Rundu, Katima and Windhoek. Chris worked in Windhoek before in a similar workshop carrying out repair on prepaid meters.

They are on a 24/7-support basis active. Often they get calls during afterhours and they have to remain standby at all times. Jackson does this most of the times.

Their job consists of going to help requests, carrying out regular checks, checking computer readings to see whether there are any irregularities and doing repair work in the workplace on the municipality’s technical yard.

The phone number of Jackson is written on all the prepaid standpipe meters. People can also reach him (or Chris) by going to one of the charging stations and fill in a little form, with their location and the problem on it.
Jackson goes to the charging station(s) every day to pick up these forms. He then goes to see these water meters to fix them on the spot or he takes the meter with him to the workshop. Later that they he will bring the fixed water meters back and he completes the form, writing down what the resolution of the problem was. This file is then archived at Orwetoveni office, one of the charging stations.

At the same time Chris is often fixing meters in the workshop.

Types of meters:

Two types that are similar but differ on their application: household or standpipe. The standpipe meter has its own generator and therefore uses a lot less battery power to operate. It only uses the battery for turning it on and turning it off. Furthermore in the standpipe meters, the tag has to be inserted all the time you are taking water. After you remove the tag the water stops running and the remaining credit will still be on your tag. The household meter just needs to be swiped with the tag and then gives water on this account. Thus the credits stay on the meter and not on the tag.

Types of malfunctions

- Mechanical (e.g. broken valves): these can be dealt with at the workshop. After a call is received, one of the guys goes out to inspect the malfunction and if necessary takes the meter with him to the workshop. They have spares and can carry out these repairs. They repair it the same day.

- Electronical:
  - Batteries run out. Lifetime depends strongly on the type of batteries. They had yellow ones which last for a long time (some still running) and now the supplier gave blue ones which don’t work that well, sometimes dying after just a week or so. The technical details are not clear to them. A suspicion is that it might have to do with the fact that blue batteries are old - past (expiry?) date printed on the battery.
  - Internal electronics and/or display malfunctions. Since they are not given spares for this, they cannot repair electronic problems. Here there also seems to be a difference between two types of meters: those with a white coating over the electronics and those with transparent coating. The latter have a lot less problems and are also easier to inspect for loose wires.

- Tags can break but do not when used and store properly. When damaged it is often because it is kept in the back pocket. The damaged tag is judged before replaced and if it is because of human error it costs N$151.80 to replace. This is the same price for lost tags or new tags.

- Weather and cold: according to the guys, cold is not a problem. Direct sunlight can cause damage to the display. They now fit all meters that are outside with a protective cover. Or in the informal settlements (the guys call it ‘(re)settlement areas’) by concrete boxes around the meter installation.

- Vandalism: The meters do get vandalised sometime, e.g. by people throwing rocks against it. The meters are quite fragile, but the protective cover should also keep them from accidental damage.

- Some broken meters still give water without charging. This will show on the computer readings (for instance, someone using N$50 for a month) and then this will be checked. For the time it was broken (since last charging) the average use is calculated and charged afterwards. This means that nowadays most people give a call when the meter is malfunctioning and not deducting credit.

- Ordering of spares goes through Naude Slabbert.

Chris and Jackson’s opinion on prepaid water meters:

They think it is a good system, since it doesn’t require the large sums needed when reconnecting someone in conventional way. People can start using water for small amounts of money. This is the big advantage.
They themselves also have these prepaid water meters which helps them better understand the issues that can occur with the prepaid meters.

There are still small problems that have to be worked on

- An issue they think is important is the ‘zoning’ issue: one tag per meter to prevent people from using their neighbours’ cheap tariff.

Different types of meters:

- **Kent meter** that the municipality is now testing is shown to us. It works with a different kind of tag, more like a key. It is a two-in-one meter that can either be used in conventional or in prepaid way. It supports ‘zoning’. A possible problem is that it seems to give water without charge when it’s opened just a little bit. This one is used in Windhoek, sometimes they have contact with them about it. The guys do not know what to expect since the problems show only after a longer period of use (not 6 months or a year).

An issue of concern is that it is hard to replace parts of the meter. When something is broken, the meter has to be replaced completely, which makes it impossible to carry out the mechanical repairs that they do on the current meters.

- **Meters used in Rundu**: Here a meter of South African origin is used. This meter, however, malfunctions very often, sometimes even right after installing it.

About the new meters being installed in Otjiwarongo:

- Recently, 50 new meters have been installed in the informal settlements, these are household connections. These meters are first supplied to the workplace at the technical yard. For these installation works, extra technicians from the municipality are appointed to the job to be able to do this. After our talk we are shown this work in progress. See observations below.

- When all the new meters are installed, there will be hundreds of extra ones to look after. The guys expect that they will need an extra full-time colleague for this, so two people can be out and one is permanently in the workshop.

- They experience a lot of people that want to switch from conventional meters to prepaid meters. This is mainly because they don’t like being charged afterwards in unexpected ways (for example being charged an average amount because they weren’t at home when the meter inspectors came by). According to them, these meters are provided free of charge.

Observations from the installation of the standpipes and visit to the charging points:

- The new connections in the informal settlements serve a household each. They are installed with an extra valve to prevent the other from leaking. Also there is a safety valve that is used to prevent sabotage and can only be opened with a special magnetic key.

- The grid for these connection has already been installed in 2009-2010. A new connection can be made quick, on average they can connect 5 or 6 households per day.

- A rule is to have the meter and tap not more than one meter from the property border. This is to make sure that they can easily be inspected and discourage tampering with the installation.

- At the satellite office charging station, we can see a girl buying credit of N$5 which is purely for water and not any other public provisions. This buys her 166 litres of water.

- Malisha (?) of the charging point at the satellite office of the municipality tells us that it gets crowded between 12pm and 1pm, just before the office closes for lunch.

- When arriving at Orwetoveni office around 11am, around 10 people are already standing in line to buy water. Jackson picks up the forms (around 10 I guess) to see where he has to go.

- There is test-standpipe at the Orwetoveni office where people can check their newly bought credit. When we arrive, we see it running because someone made the mistake of leaving without checking out. This works differently from the other standpipes, where you automatically check out when removing the tag, but works the same as the household meters. However, apparently not everyone
understands this or people just forget to check out. Jackson expects that the person that didn’t check out this time will come back and complain that there is not N$100 on his tag, while he did buy it.

- Jackson has a collection of tags which helps to solve the simplest blockage of the meters that occur sometimes.

**APPENDIX B4: INGRID, 08-06-2011**

People come to the charging station to:

- Put credit on their tag
- Buy a tag
- Have problems with their tag (e.g. they put credits on it, but they lost)
- To get a refund

Biggest problem according to Ingrid: tags work on different meters.

Ingrid thinks it (prepaid meter) is a nice system. If people are educated how to use it.

**People trying to get free water/ not paying debt**

- People sometimes go to family/friends to put credit on that meter and then come back and say the money was not on the tag. They hope they get the credits again. (They think people do/did this, because sometimes people come back a lot, while no problems could be found on the tag or meter).
  
  → Thus now if they cannot find a problem on the tag or meter, they don’t get the credits again.
- Asking for a refund, while nothing was wrong (see: ‘refund’).
- Sometimes people only charge N$3 or N$10, then she sometimes gives them 100% water (because otherwise there almost nothing left for water). But she says she has to be careful with this, because some people come every other day to do this, to not pay debts.
- One time a meter was broken, it didn’t charge, but it did give water. Jackson saw a guy filling around 20 barrels and putting them on a truck (he was probably selling the water). When he saw that (by a coincidence) he asked what was going on and then shut the meter down. (I think he had to pay afterwards for reopening the meter and an average usage rate for the weeks or months that it didn’t charged the water).

It is peoples own responsibility to tell if something is wrong.

**Procedure**

Someone gives his tag and some money (this can be any amount, there’s no minimum, in theory they could even ask to put N$0.10 on it).

Ingrid tells she then can see if the customer has their own tap or uses a standpipe. In the first case she checks if the person already paid for his debts of the month. If not, a part of cash will go to debts (see more, at ‘debts’).

The tag is then put on the scanner, the money is put away (in a cash desk). Finally, the customer gets back his tag, the change (if there is any), and a receipt. The receipt shows how much money is been put on the tag, how much of this goes to tax and debt(?) and how much water can be purchased.

This takes a few minutes in total (I guess around 2 minutes).

At the end of the day they print the total amounts received by prepaid charging and by payments of conventional meters. They deduce the refunds from this (since they gave away that credit without receiving money for it). Then they count the money to check if it is right.

**Refund**
If a meter (or tag, but this doesn’t happen much) was broken and has been fixed and credits on the meter are lost, they will refund this. Jackson and Chris will let her know if credits have been lost. She only refunds if Jackson or Chris told her that this was the case. She tells me that Jackson and Chris are very good in seeing if people are honest or not.

While I was there someone was trying to get a refund and told that her water meter was broken, fixed and now the credits were lost. Since Ingrid didn’t know about this she called Jackson to check if this was true. When he told her that no credits were lost, the women didn’t get a refund.

Not sure, but I think she said that the total refund amounts around N$300/ month. More info → financial department.

Normally she doesn’t give refunds for the informal settlements, because:

- Lots of people use the same meter. If something was wrong with it, she should have heard it from 50 people, not 1.
- People sent their children to recharge the tag. Then, if there is no (or not enough) credit on the tag they come back and complain. But Ingrid says that she does not know what the children have done with it (maybe used it wrong?). And that the parents should maybe teach their children how it works.

**Capacity**

Two people are working at this charging station. One (a cashier) to recharge the tags and one (a supervisor (?), in this case Ingrid) to handle the refunds, new tags, and complaints. She is also helping with recharging if it’s very busy (which is usually at the end of the month – then the line could be even outside the building, which is a few meters – and on Fridays. At the satellite office only one cashier is working.

They are also open on Saturday morning (from 9 to 12). The satellite office is not open any longer on Saturday (since a few months?), because they didn’t had enough money and people. I also felt that it didn’t feel to them as if this was needed.

Ingrid told me her view on that they are open on Saturday: “In my view we are pampering these people”. She said that they have to learn to come and recharge the water on Monday-Friday.

If there are still people at the office and it is already lunchtime or the end of the day they still first have to help these people before they can go. However, this almost never happens.

**Debts**

At the beginning of the month people have to pay their debts. (Ingrid doesn’t know how it is decided how much of the debts people have to pay for every month).

If they come for water and they haven’t paid their debts usually 80% will go to their debts and 20% to water. However, it also depends on their own judgements, e.g. sometimes she changes it to 50-50, or 0-100, see above. She thinks 80-20 is a bit steep.

They can easily change this for every person and for every recharge.

Ingrid tries to teach people to first pay their debts and then buy water.

She also does this herself. (She paid about 860 debt each month, 40 sewer, 120 refuse and 350? Tax).

**Complaints**

Sometimes it appears that if the tag is putting in and out of the meter too often or too roughly water credits are lost. However, Jackson and she (?) tested this sometimes and no water was lost. So this is still unclear.

A few people came in to complain, I think two of them (I don’t know for sure, since they were talking Afrikaans) were complaining that they did not have money for water.
Prices

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Water tarrifs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water (m2)</td>
<td>14.60</td>
<td>16.00</td>
<td>9.59%</td>
</tr>
<tr>
<td>Prepaid water (m2)</td>
<td>17.30</td>
<td>38.00</td>
<td>120%</td>
</tr>
<tr>
<td>Basic charges/ month</td>
<td>20.00</td>
<td>22.00</td>
<td></td>
</tr>
</tbody>
</table>

Since last year the basic charges are included in the water price and therefore the price of water doubled.

People are told tariff increases in July.

People with their own taps also get a receipt where at the bottom is a line that warns them in June that price increases are coming in July.

However, not all people knew about this. Ingrid gives an example:

09/10 → someone could use N$50 for a month

10/11 → the same person used N$50 for only two weeks.

People didn’t understand, and thought there was maybe something wrong with the tag or meter. When they came back to ask about this, she told them that the prices went up.

Software

Every month they have to renew the license, which gives a little trouble. However, maybe this already changed and they don’t have to do this every month anymore.

The computer crashed once in the beginning, when they just activated 2000-3000 tags. There was no backup, so they had to do it all over again.

Now they are making backups (if I remember correctly everyday): IT keeps them.

Once the payments of conventional meters could not be printed at the end of the day: they then counted the money and the prepaid charges and calculated this.

APPENDIX B5: AGATHA MWETI, 13-06-2011

Divisions

Agatha is the head of community services and economic development

There are several divisions within this department:

- Environmental health
- Solid waste management
- Economic development (things like marketing)
- Housing
- Informal settlements
- Social welfare organization. Multi purpose centre. Opened in 2003

Social welfare centre
Agatha has a pamphlet from this: ask for it.

Opened in 2003

Two paid staff members and a lot of volunteers.

Lots of activities take place.

More then 100 kids (orphans and vulnerable children) get meals here. Also their school fees are paid. Two kids who started here are now already going to university.

Activities: mostly through partnership with a Dutch municipality (Heusden).

Urbanisation

There is a large migration to the city of Otjiwarongo. This is both rural-urban, but also people from other smaller cities come to Otjiwarongo (urban-urban). Agatha estimates the population growth in Otji 4.5% a year. People come her searching for work, or searching for a better life. Or because they are laid off at surrounding farms and ‘dumped’ in Otji.

These people hope to find a better future here. But they don’t have the skills and aren’t educated enough for better jobs.

Now, there is no ‘formal’ space anymore: Otjiwarongo is full.

They are planning to make more space however.

The increase in the informal areas (where most of these people end up living) puts a pressure on the municipality. And it will cost them more to still provide services here.

“People cannot afford. But there are some essential services that people cannot do without, that you need to provide them with. Regardless of how costly it is on the side of the municipality” (m 11). Services provided are the water grid, solid waste removal, road maintenance, etc.

Informal settlements

People lease a plot instead of buying it. The lease is less than N$100 a month. Not proclaimed land.

There is a standard process for applying for a place at the informal settlements. (Can ask the reception for this). This however not always done (due to ignorance of newcomers?): people settle in places outside designated informal areas that are not suitable for living. E.g. people have put up shacks in dry river beds that will flood next rain season.

“People cannot afford. Affordability is an issue there.”

“At the same time we need to provide the services, but at the same time not all of them can afford the services’ “so that’s why you find that, like with water, the easiest you can give them is prepaid” “cause if you don’t have prepaid, in the past when there were conventional meters there was a lot of vandalism, because people don’t care…” (m9-9.33). “Even the prepaid meters used to be vandalized” (m9.55) “The municipality has to heavily subsidize people in the informal area”. “You need to provide them services, without really having it in mind that you’re going to recover your costs” (m 10.10) “So when come to cost-recovery, in the informal area is more subsidization then cost-recovery”

Therefore the informal settlements are heavily subsidized. Over here they don’t provide services for the sake of recovering costs. They can never recover the costs they make here. Providing the service is however important enough to continue.

Examples are the roads that need to be maintained, garbage trucks driving around and picking up waste. They don’t earn this back.
There are not enough jobs for everyone and these people often don’t have good education. A lot of them start a small business for their own. Every third or second house is a shop. So there are a lot of small businesses, mostly selling stuff (e.g. beer, beverages).

Strange enough, most of these businesses are owned by people not living there (m31).

(m 17)“The informal settlements will always be there.” You always have a bracket of people who cannot afford to own their own land.

(m 21) ...Provisions are made to formalize the informal areas “so that when we want to formalize the area, we don’t need to move people around”

In the informal settlements it is not allowed to build formal houses. If people do this it is at their own risk. Because, once formalized, they may get another plot of land and their house needs to be broken down.

These informal settlements are put up and planned in a way that makes it easy to formalize them later (some small areas are being formalized this year). For example, the plot sizes are already big enough to build formal houses.

The municipality wants to encourage land ownership, and thus tries to formalize these areas.

People have to let the municipality know if they are moving away. Then the municipality can give the land to someone else. However, there are sometimes ‘backdoor transactions’. People sell their construction (house) to someone else, but this person doesn’t always knows that the land belongs to the municipality. Then, if they, for example, are trying to buy (a tag for) water, they cannot do this because the land is not on their name, and they still have to settle this.

Lot of business potential going around there.

Illegally settled people

At unproclaimed land there are no services.

More then 100 people settled here. However, these are not safe places. For example, some people settle in river beds that are dry now (in the winter), but when the rain season comes back their house will be washed away).

Thus, these people need to be resettled.

Housing projects

Only for formal(ized) areas.

Build Together-project: Housing loans for people earning less then N$3000?. Loans of N$40.000. Pay back over 20 years. So they pay as little as N$150 or N$100 a month (m23) (Financed with money from the national government?)

Clay house project (Peter Arndt). Sponsored more than 300 houses. People only had to pay about N$20.000 of the total N$50.000 or N$60.000. Was done with EU-sponsoring.

Shack dwellers association → people save money in groups. Then if they have enough money they will buy a house for one of them. Save again, buy another house, etc.

Disparities

This is a national problem.

It is important to narrow the gap (which is easier now, when the population is still small, then later). But this is a policy issue and must start from the national level.
In Otjiwarongo most people live in Orwetoveni. Secondly, a lot of people live in informal settlements. The minority of people stays in town.

It is hard to classify people. They can be classified by how big their business is (big business, medium, low income). No percentage. “We just know the percentage where they stay or where they live.” (m 30)

Pilot project: Basic Income Grant (BIG). This was piloted in a town in the east and it turned out that there were huge benefits.

Every member of a household received N$100 every month. This helped them for example in starting a small business.

This could, according to Agatha, be a starting point to bridge the gaps.

There are some problems with this solution however (they don’t want to promote the dependence syndrome (m37) where people stop working because they are getting money anyway, or that people start getting more kids because then they will get more money, also it has to be financially sustainable for the national govt.), so they are still looking at this.

Old people, disabled people, and orphans are getting grants already.

Money

Water is, according to Agatha, cheaper in informal settlements than in formal areas.

Otjiwarongo is a part 2 municipality. This is based on size and income. Windhoek, Swakopmund and Walvisbay are part 1 municipalities. Part 1 and part 2 municipalities don’t receive an annual amount of money from the national government.

They can apply for money for specific projects. But they have to compete for this money with other cities.

They applied for several things this year (with a total of N$40 million), one of them being a N$9.8 million application for household connections in informal settlements. They heard (last week, 6-10 June) from the ministry that looks at these applications that there is less money this year and that therefore only applications related to water and sanitation will be considered.

Hopefully they will get the money for these household connections (they will hear this probably next week). But also without the requested funds they will still continue with the project.

More than half the income of the municipality used to be from electricity. This income was taken out a couple of years ago. But they still have to pay for all services.

Last year Agatha thinks they didn’t increase the water price (although Namwater did) (m1.12).

They also assess whether it’s easy for a community to pay this price or not.

Prepaid

Because affordability is an issue in the informal settlements prepaid is the easiest solution.

Before there was a lot of vandalism, because people didn’t care.

If meter is free they vandalize it; if they pay they will be more careful ??

With the prepaid standpipes they have to wait a long time before it will get repaired (because it takes longer to get spare parts).

Also, there used to be a lot of issues with water being cut (which effected the hygienic standard) (m42).
(m1.02) “Socially also it improved. Because now many people whose water used to be cut can now afford water. For example, even with N$30 I can now buy water.”

Now it’s easier to manage, if you see that it’s still two weeks before you will get paid you get easy on your water. They may not wash clothes for a week to save water.

“But with prepaid a lot of people will be able to control their uses” (m43)

(m1.02.50) “Neighbours also used to come and steal other people water” .. “it was very common”. Now if you’re gone no-one can come and open your meter.

Another argument is to avoid people losing houses because of debts. (Although this never happened in Otjiwarongo? But it did in other cities). As long as there is movement on someone’s debt accounts, it is not possible that they are handed over to legal dept. and their houses are confisquated. Technology makes debt handling much easier.

There are/were some problems, but these are small issues, e.g. not knowing how to unblock, or children blocking it. This was however very stressful (people calling Agatha in the middle of the night, etc).

Thus, there were lots of reasons to choose for prepaid.

(m50) “Customers felt that people should be subsidized or get the meter for free, but the meters are very expensive” and we needed the money to buy them at that time... “And we know that if we give people for free they vandalize the proper(?) they don’t want, but if they buy something they own it, because they know that, I’ve bought this with my own money”

(m52) “Water is a necessity. No one cannot do without water.”

You cannot make a profit on basic services like water ??

Implementing it according to clusters (m 1.07). Sensitization. Water technicians went to each area again to sensitize again. Then installed. Then move to the next cluster.

Agatha also uses a prepaid meter: it is on trial at her house.

Debts

30-40% goes to debt, the rest goes to water.

The municipality is very flexible and they are trying to make it as easy as possible.

People are very much encouraged to come to the office and they can make an agreement. Since every situation is different, people have to come over to make their own agreement, and they shouldn’t want the same as their neighbors, who are maybe in a different situation (with less debt or more debt).

Some people came to the office and paid of all their debts at once, so now they could get 100% water if they were buying water.

Communication

Water is a necessity. People are not allowed to resell it (no vendors).

Before the meters got installed there were demonstrations on how the meters work.

At first there was resistance against the prepaid water meters. People who didn’t want it didn’t get it, it was not compulsory. Except for people who were cut off. But after six months a lot of people came back on this and also wanted prepaid water meters.
In the beginning the meters were a nightmare. People (or their children) would block meters and didn’t know how to unblock it. People then tried to justify, this is why we didn’t want prepaid meters (m 54). But they still had to grasp the technology and know how to use it.

Agatha received calls sometimes in the middle of the night of people that needed help, and than she had to call technicians (probably Jackson) to go and stop by.

There were a lot of meetings to inform people in all areas. They were prepared for the prepaid meters and informed, e.g. on the reasons to include debts. (The debt pay of arrangements that people could make already existed before).

Meters were then demonstrated house by house by technicians (Jackson?).

People are informed on price increases by meetings, news letters, and a message at the bottom on their accounts.

In general, meetings will be in the evening, because during the day people have jobs to go to. In informal settlements it is harder to find a good location (with light, and inside because otherwise drunk people will disturb the meeting), but they often take place in venues of kinder gardens.

There is a water committee (m1.18) (people nominate themselves for this committee). They help organizing the meetings. They mobilize people and can translate things.

Loudspeakers are also used to announce meetings.

A lot of people come to the meetings about water, because water is so important.

When the final details on the new water connections in informal settlements are known, new meetings will be planned (they are on hold for now to avoid confusion). Agatha’s people are ready to give them. We would like to attend one, Agatha will let us know when new meetings are planned.

Inform/ teach people about saving/ reusing water

A lot. (m 1.15)

There are articles in newsletters on how to save water.

And this is also one of the topics on meetings.

Inform people on how to use and save water

The municipality tries to provide the information to them. Mostly through meetings, since most people in informal settlements don’t read newspapers (due to literacy issues).

They can also be easily reached through school kids (1.17), who can translate the information to their family.

Inform people on hygiene

(m1.20)There are separate meetings for hygiene. In 2007/2008 there were volunteers who went to every household (in Orwetoveni and informal settlements) to educate people about clean surroundings and hygiene.

The municipality provided refreshments for them and also stuff to clean like gloves, because sometimes they also cleaned the houses right away.

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APPENDIX B6: GEORGE DIERGAARDT 14-06-2011

Mr. Diergaardt works at the Otjiwarongo office since May 2010. He has been working for NamWater longer already and has been working in a lot of different offices.
Tasks NamWater

The main task of NamWater (NW) is to ensure water supply to bulk customers (mainly towns) and individual consumers (mainly rural consumers). The Otjiwarongo office covers the Otjozondjupa province excluding Tsumkwe plus Khorixas and Outjo regions (excluding the coast). It is responsible for an array of infrastructure (big canal Grootfontein – Hochfeld, ringsystem) and water sources.

Originally NW would only be responsible for main infrastructure (branchlines), but now also for supplying to individual customers. This is something it does not actually have the capacity for. On top of that, there is N$20m outstanding debts (from these rural customers, I believe). They cannot be disconnected because water is a basic need.

Bulk customers are mostly municipalities and town councils: Otjiwarongo, Kalkfeld, Khorixas, etc. However, not all towns have NW as supplier, they arrange water supply themselves: e.g. Outjo. Sometimes towns ask to take over, but NW does not insist on this.

Departments and branches

NW has four departments:

1. Water supply – busy with operations and maintenance, based in the regional office
2. Corporate services – taking care of all business affairs (in head office Windhoek)
3. Engineering department – Planning and design for extension and big repairs (Windhoek)

The infrastructure is maintained by regional office, big problems and repairs are referred to the Engineering Dept.

Relation Namwater – Government

The Namibian government is still the owner of all water. For every water extraction, a permit has to be applied for. This goes for NamWater as well as local governments. The permit has to be renewed every five years. A permit for the abstraction of water as well as a permit for sewerage water is needed. All water is controlled by Water Affairs.

NW is a fully government owned company and has to provide accountability. Tariffs have to be approved by the government and NW submits monthly reports on water abstraction at every source. The government also controls other things like salaries and new city connections. Also, the govt has to approve water cut-offs of debtors. NW was established because of the inefficient operation of the Dept. of Water Affairs and is run as a commercial organization. This means it should be able to sustain itself. There is an annual budget earmarked for NW (N$50m) but this has never been used so far. This year might be the first time due to extensive damaged caused by extreme flooding (e.g. in the north and at Walvisbaai).

Relation NamWater – municipalities (Otjiwarongo in particular)

NamWater supplies bulk water, it is responsible for the water up to the municipal meter at the NW reservoir. Quality is guaranteed. The municipalities take care of sewage themselves, which they treat and sometimes recycle and sell again (this is claimed to be a clause in the water act, but mr. Diergaardt does not believe so) (Windhoek, Swakopmund and Walvisbay are recycling water). Regulation says that 30% of water can be recycled, the rest has to be from NW. In the future it might change and NW could also be responsible for sewage.

When municipalities are indebted to NW, NW might come in to propose an ‘intervention agreement’ recommending adjustment or temporarily take over distribution from a municipality to create enough skills and capacity to run the water supply right. Example of this was Otavi report (we have this one).

Communication
With the municipality Otjiwarongo, the contact goes mainly on a personal basis with Naude Slabbert. The future aim is however to create a forum for annual (or more) meetings to iron out differences and discussion. This more formalized way of communicating is already used with all bulk customers.

**Main issues with Otjiwarongo**

- Getting a general agreement in place about the terms of service: supply, quality, maintenance and repairs, etc. This contract is almost finalized (currently at Windhoek head office for approval).
- Water reading differences. Both parties sometimes have wrong meter readings and this has to be mutually corrected.

**Availability and sustainability water supply**

Water is mainly acquired to ‘boreholes’, which (I think?) are drilled holes were ground water comes up. The bowls supplying Otjiwarongo are to the north along the roads to Otavi and Otjo. Whenever one is put in place, geohydrology determines the sustainable yield from a source that NW can withdraw. Sometimes this is upwardly adjusted if necessary, but only after careful evaluation of the environmental capacity. In certain regions there is overpumping of resources, for example in the coastal region (Omaruru) where uranium mines are situated. Therefore, a desalination plant is constructed to generate water for the mines. This water will be more expensive, but these costs will be recovered from the mines.

NW has annual internal assessment of water needs of municipalities/regions and whether their infrastructure is still sufficient. Also municipalities can request extension of the water supply when needed. For distribution, the main priority is domestic usage. Not an issue in Otji, but Windhoek for example is more problematic. This requires a lot of planning.

There are a lot of water losses on the system. They hired some consultants to solve this problem, but it is difficult to solve it.

**Otjiwarongo**

In Otjiwarongo, mr. Diergaardt expects the current infrastructure to be sufficient for the coming 10-15 years, enough to accommodate population growth and more connections. Big projects put in place might change this, the municipality has to indicate such projects to NW and then new infrastructure can be put in place quickly (phase 5 planning’.

There are already new boreholes ready along the road to Otavi. These are not yet in use, but could be connected quickly.

Distribution of use is not very much an issue: no big industries in Otji that use a lot of water. According to mr. Diergaardt, a pharmaceutical plant is planned which might use some extra water. In the middle between Otji and Otavi, a gold mine is planned which will use a significant amount of water (6,700 m³/day compared to around 5000 m³/day for the town of Otjiwarongo. It will also attract people to Otji, so increased domestic demand.

**Tariffs**

For Otjiwarongo the tariff now is about N$7/m³. This will increase (for first time in four years) with 13%. Tariffs for industrial consumers (that are directly supplied by NW, like mines) are determined according to cost of water, which is not an issue for these industries (compared to costs of other capital inputs).

Municipalities can choose themselves if they want different tariffs for business and for domestic users or not.

**Water quality**

** Standards**

Quality standards are laid down in the New Water Act and are based on WHO standards. Mr. Diergaardt will send us the documents with the details.
Quality ensurance

NW uses different purification techniques and adds chlorine for disinfection. In general, water from bowls is easy to work with. In Otji, the municipality adds ‘Sequest’ (?) against the hardness of the water (this is better for the pipes and it feels better when you’re taking a shower). NW could also add this; George doesn’t know why Otji wants to do it themselves.

Measurements

- At the outlet of NW reservoirs, a daily test is done for NTU and chlorine residue. Residual chlorine indicates that there was enough chlorine to clean the water and can still work later on in the piping system.
- Monthly tests are done at the microbiological lab (head office Windhoek), they run a more extensive test for micro organisms in the water. (Two areas are tested more often, 3x weekly: Otjikati and Windhoek.)
- Namwater is only responsible for the water quality up to the outlet of their reservoir.
- Municipalities are responsible for quality within their system and in their reservoirs (the water goes from Namwaters reservoir to a few reservoirs from the municipality).
- NW is also available to assist municipalities in testing their water quality when requested. Water analysis is quite expensive, but they do it for free when requested by the municipality.
- Objective is to have max. 5% failure of tests. For May 2011 it was 2.7%. When a reservoir fails a test, there is no other option than to flush the whole reservoir (and thus lose the water).

Common issues

- Hardness of water, which is not dangerous but annoying, and not good for the pipes.
- Fluoride, nitrate, magnesium. These can cause health problems, this is tackled through extra cleaning facilities but this is costly and therefore goes on a project-basis.
- Contamination by flooding or pipe breaks. Therefore there is also a regular cleaning program.
- Some towns are far away from the NW reservoirs and they should disinfect the water again. But not all towns that should do that do it. (Otjiwarongo is close to the NW reservoir)

‘Visions’ of mr. Diergaardt/NamWater

Domestic water use

In mr. Diergaardt’s view, there are a lot of problematic areas for which prepayment is crucial since otherwise no one is accountable for water use (mainly in informal areas). If water is free, it will be flowing the whole night. For formal areas, the situation as it is should be maintained, because there it is easy to target debtors when they are there.

Prepaid meters are however very problematic, in mr. Diergaardt’s experience 50% is not working and the other 50% are hard to maintain due to lack of spares and maintenance capacity. Also explaining their workings is hard and people do not understand the system. There is need for a very simple system. This became very important in the NW research in Otavi, where NW is trying to reach an intervention agreement. We have this report.

(m 1.07) How should domestic use should be arrange, idea on prepaid meters. My feeling and probably also Namwaters feeling: “We find that actually within towns there are a lot of problematic areas, like the informal settlements. And those ones should definitely be become sort of a prepayment system. Cause that’s the way you lose the most of your revenue eventually, because you supply these people with free water and what do they do: taps are running for the whole night, and so on. So you have to find a way of charging them, with water use, and that for me the best system will be the prepaid system”.

Role of NamWater

The current situation is okay, but mr. Diergaardt would like a more active role in giving assistance to municipalities to become self-sustaining. This will help building expertise which is often lacking within
municipalities when it comes to water supply. In Otjiwarongo this is not an issue because the municipality employs several people with experience at NamWater (like Naude Slabbert)

➔ Social responsibility for NamWater towards their customers

Recycling
Towns should look at recycling, especially for watering sport fields, etc. In Windhoek, Swakopmund and Walvisbay they are already doing this.

APPENDIX B7: BURGERT LIEBENBERG 17-06-2011

Head (SE) of Municipality’s financial department.

Tasks financial department

Main tasks are financial management and controls. Putting all processes and instruments in place and reporting about it.

Main difference between municipality and commercial business is the mixing of political, social and commercial influences. Always balancing the political aspirations, the need of people and the sustainability of the municipality’s finances.

Overview financial situation municipality

Otjiwarongo has around 40,000 inhabitants, of which 10,000 are formally supporting the municipality through bills/taxes (this can be seen as 10,000 formal households?).

Main sources of income:

- Electricity (lost since 7 years)
  When this went over to CENORED, this was compensated by a ‘surcharge levy’. This is just a nominal sum, so in ‘real money’ this is a diminishing source of income. The first 5 years this didn’t had a large impact on the municipalities budget, because of this levy. The plan is also for REDs to give out dividend, so far this has not happened. The dividend would compensate for the loss of the income, but mr. Liebenberg does not know when this will actually be handed out. The lack of this income is putting pressure on other services.
- Rates and taxes. This is expected to become the main source of income for the municipality.
- Water revenue. This is currently a big portion of the income, just a steady growth expected. Because you cannot make it too expensive, people cannot afford that.

Otjiwarongo is currently self sustaining in its finances as are all Namibian municipalities (where only bigger cities are called ‘municipalities’, smaller towns and rural areas do receive money from national government). Since independence they haven’t received (a standard amount of) money from central government, which is a problem (m 8). This allows operating regular services, but does not leave room for any big capital project to stimulate economic development. For this the support of central govt. is needed.

The situation of municipalities not receiving govt. support was supposed to be temporary, but has been stretched up till now. No sign of this changing.

It is however hard for the municipality to collect it’s services incomes, with non-payment occurring on a large scale. The past five years, a lot of effort has been put by the town council in ‘closing the circle’: making sure income is collected.

Debt collection and prepaid water meters
Mr. Liebenberg confirms that over the years debts have run up to around N$20m, consisting of water bills and a lot of other services as well. This is the result of a ‘culture of non-payment’ (95% doesn’t pay their bill, only 5% pays), (m7.24) in the past (right after independence) encouraged by politicians arguing that services are a right and people should not pay their bills. Bill payment has been only weakly enforced in the past. Council hesitated to cut people off or to take them to court.

Household with debts have an average of N$4,000-5,000 in outstanding debts and about 70% of the households have debts. Debts are classified by age (less than 30 days, 30-60 days, etc.). A lot of these debts are much older and accumulated over the years.

Debts are mainly in residential households, but also businesses and public institutions (schools, hospitals).

To start recovering debts, prepaid meters were the first step. Furthermore, since 6 months (Jan. 2011?) a debt collection program has been put in place. This is possible, because the availability of prepaid meters gives the municipality more freedom to put additional programs in place for people who choose not to participate in PP program. If you don’t take prepaid, you have to face the consequences.

Since six months, five people are employed in finance for account and debt collection, where there was one previously. This indicates the priority given to it. (However, they could use 10 people for this job).

Households that are not paying will currently be cut off after 60 days, this is only being enforced since the program came in effect six months ago. Plan is to reduce the period to 30 days.

There is a debt collection policy.

For more information about cut-offs (like the number of cut-offs each month) ask Deon or Hoko.

Options for people are:

1. Heavily indebted people: not given a choice, prepaid meters installed (for free).
2. People with some debts: given the choice to switch to prepaid or go through the regular debt collection program (with all its possible consequences). They can get PP meter against reduced price. When the new Kent pp meters come in place, the municipality will put more emphasis on the pp option. (m 42.50. Catch 22: if I stop pay my bill I will get the meter for free). “But hopefully, within two, three years we will have the whole area prepaid.” (m42.50)
3. People that voluntarily opt for a PP meter have to pay full price for it.

Prepaid meters

The aim of the municipality prepaid meters is two-fold:

1. Create cashflow, get the accounts paid and contribute to municipality finances (short-term goals).
2. ‘Educate’ the people in responsible citizenship. Teach them that they need to ‘pay municipal bills before spending it on phones/clothes’. Because now people find it more important to own a cellphone or to dress nice than to pay their water bill. It should be a habit to pay, priorities have to be right. With prepaid you force people to pay. 10 years from now, if they take prepaid out, hopefully people will still pay. They can first test this if they take out a few meters. (Increasing job creation and standard of living will also help).

Currently of the 2000 meters installed, 80% is effective. It has had a positive effect on cash flow, but not yet on debt collection. Because of the ‘zoning’ issue, debt recovery is mainly avoided by residents. This is a technical issue due to the current meters, this will be corrected with the new Kent meters.

The old meter was a ‘problem meter’. Burgert has confidence in the new Kent meter.

In paying off debts, the ‘municipality has time’. So even if people are just paying off small bits at a time, this is fine for the municipality (although preferably in a shorter amount of time).

Factoring in replacement
For the meters, Mr. Liebenberg thinks the meters will last for 5 years maximum, and in his calculations he is assuming a depreciation of the meters over a period of three years. This is factored in the account. Exact figures might be found with Naude Slabbert and the technical department. Replacement of worn out meters is done by the municipality.

Furthermore, some kind of scheme is in place, where the old meters (the blue Tagmeter meters) will be replaced in individual households and then will be installed in the informal settlements. This is happening with 300 meters at a time. This is sort of a cross-subsidisation.

Financial figures

Tariffs: there is differentiation between conventional and prepaid. Furthermore, Mr. Liebenberg would like a different tariff for businesses as well (this is a ‘catch 22’: you want cross-subsidization from business to poor, but also you want to be attractive to businesses).

The municipality doubles the water tariff from NamWater to cover their expenses in supplying water (further purifying, delivering it through the network, etc.).

The accounting system calculates the debts people have to pay off every month. It also shows how much debt every person has.

We can see the accounts and water statistics at Laudia. She has all the data.

Economic development and vision

Economic development for Otjiwarongo is hard because there is no funding available for big capital projects. Also the municipality’s own means of generating revenue are limited, because Otjiwarongo is a small town; where in big towns like Windhoek and Swakopmund plots of land can be sold against high prices, this is not possible in Otji where the municipality is only able to asks the cost price.

In the national govt.’s Vision 2030, plans for big development projects are made. Mr. Liebenberg however believes that local initiatives will create more sustainable employment, for example through construction and maintenance of infrastructure and housing. Currently, just 4 out of 10 people have a formal job. “From the 10 people you see walking in the street, only 4 have a job”.

Current projects like the Otjikoto Gold Mine are still in negotiation over the social programs they will implement. Mr. Liebenberg’s vision is that economic investment would in the long term create more results than just social programs, although these social programs are still worth wile.

For Otjiwarongo, Mr. Liebenberg sees the location as its main asset: all transport from/to Angola and the north, and from/to the coast comes through here. Chances for Otji are therefore in logistics. Industrial manufacturing is less promising, because the resources for this (like abundant water) are not readily available. Assembly would be a promising option for Otjiwarongo, creating employment and economic development.

(Next week (20-25 June), a Dutch guy interested in maybe setting up a solar panel assembly plant is coming over.)

Mr. Liebenberg however hopes that development will not be too fast; Otjiwarongo is a nice, compact town as it is now and Burgert hopes it can keep this quiet character.

Random notes

People resist to (technology) change.

Water cost element → how cost is calculated. The accountant also has this information?

Healthcare is supported by the national government. But the municipality is also supporting some activities.

Quotes
(m5.50): ‘For us, it’s more important to own a cell phone, than to pay your water bill’. (Us, Namibians). ‘You want to dress nicely, before you pay your water bill.’ ‘You can go without a shower for a week, but you could dress nicely, then you’re okay.’ (Burgert first pays his bills, then goes to buy food, then other stuff).

(m7.20) ‘So it’s also a culture of not paying your bills. The culture of buying and not paying.’

APPENDIX B8: NAUDÉ SLABBERT 17-06-2011

According to Agatha technicians went to every house to demonstrate how the meters work. Is this true? Who did this?

Yes: sensitization. They explained how it’s working and what effect it will have on the people.

Every house earmarked to receive prepaid was visited.

People in informal areas were not visited. But they put people at standpipes to explain.

Before this meter there were (a few years before 2007) 30 meters installed from Water Master. This means, according to some calculations, that there were on average 400 people per standpipe. These meters were very problematic and were easily sabotaged (the tagslot was like a creditcard slot, which people could short-circuit by inserting a piece of metal. They didn’t get free water by doing this, but the meters were damaged).

Now, with the blue meters, they installed 53 meters, which means that there are 250 people per standpipe.

The intention to install more standpipes was stopped by council → they wanted individual meters.

All old (blue) meters now go to informal settlements. All new (Kent) meters go to Orwetoveni. This keeps the vendor stations closer.

We heard from George that some cities (like Windhoek and Swakop) are recycling their water. Are you also doing this? Are you planning on doing this? Ideas about this?

Yes, in Windhoek they have a reclamation plant.

In Otjiwarongo we have a sewerage work where water is treated that is safe to store, then chlorine is added. This is semi-purified water, it is not for consumption. The municipality uses this for parks, gardens and sport fields. There is a separate network for this, that goes to municipal properties. (In Swakopmund people can have both a clean water off take and a semi-purified water off take.)

In total, Otjiwarongo uses 100.000-125.000 m³ per month. Around 15-20 % of this is reused. (A big parts evaporates, so effectively 15-20% can be reused).

Otjiwarongo is too small to do full recycling.

We heard from George that they are testing the water quality only at the outlet of their reservoir, and cities have to check the water quality in their own reservoirs themselves. Are you testing the water quality?

From time to time we test if there’s enough chlorine in the water. However, the reservoirs are neighboring (right next to each other), so if theirs is good, so is ours. NAUDE doesn’t have any concerns about that. In case of issues, additional tests are done (e.g. contamination at military base). If the distance would be longer it would be good to test it again, but for Otjiwarongo that’s not the case. Besides, the retention time is only 4 hours. (If it’s longer there’s more chance for bacteria).

Sometimes they look at Namwater test results.

To make the water softer they add a phosphate (Albaphos). The municipality adds this at Namwaters site, before the reservoir.

Do you have information on water losses?
Yes, there is data from ’02-’03 until now. (This is the difference between the amount they buy from Namwater and the amount they sell again). This data will be emailed to us.

Main causes losses are:

1. Difference meter readings NamWater – Municipality (due to discipline: incorrect reading, reading on different days of the month).
2. Pipe breaks (happen quite often).
3. Old (conventional) meters that measure incorrectly (too little most of the time). This issue occurs frequent.

The target is to keep losses below 10%. When this is exceeded, extra attention is paid to it. Otjiwarongo is doing relatively well, other towns might have ‘losses’ up to 80% due to abovementioned causes.

We understood from George that some cities are self-providing their water. Does this benefit them a lot?

Some self-providing cities are Tsumeb, Grootfontein, and Outjo. This is a big advantage, their water tariff is much lower (Outjo probably around N$4/m3, compared to Otji N$16/m3). Buying it from Namwater cost double as much as to do it ourselves, because you pay for overhead costs twice.

Otjiwarongo, however, cannot do it their self because the boreholes are further away (there is a total pipeline network of 180 km from the sources to Otjiwarongo). It already cost N$160.000/ month on energy costs, for pumping the water to Otji, when towns provide their own water, they have to pay the electricity bill themselves.

APPENDIX B9: MR. BRINKMAN, 01-07-2011.

Prepaid meters in Windhoek

They have been in use since 1998. Mr. Brinkman: It’s a good idea, but the hardware is troublesome. In Windhoek, prepaid meters have only been installed on standpipes, not on household connections. There are some 700 meters in use, serving about 15,000 inhabitants in informal settlements.

Over the years, four types of meter have been tried and installed:

- **Bambamanzi meter** [I believe the company is currently called **Conlog**]
- **Efteq Teqnovo** (first version)
  This is a South African brand.
- **Tagmeter**
- **Kent**
  Has been in use since 2003, and has provided the best results. Pro: easy repairable. Con: expensive (twice the price of Teqnova meter).
  The problems with the Kent meter were first thought to be a design problem, but it turned out it was a vandalism problem (people were punching the valve so water would run). This could be solved and is no longer a problem.
  The Kent meter existed already for a longer time, but in 2003 their backup service was not good. Now it’s much better.
- **Efteq Teqnovo** (new, improved version)
  This one was chosen after looking for experience in Johannesburg (where 100,000 are installed of these). The technology was deemed acceptable and it was half the price of the Kent meter. However, also more negative reports were heard and at the moment they prove to be very high maintenance: faulty displays, valve failures, problems with tags.

Soon a decision will be made with which meter to go ahead. Mr. Brinkman feels the Kent meter could be the one.
Before the installation of prepaid meters, communities had to pay a collective bill. This meant that when only a percentage defected from payment, the water bill could not be paid and the whole community was cut off (also problems with ‘representatives’ disappearing with the money). This has led to a lot of communities requesting prepaid meters be installed, since this solves that problem.

Sometimes other cities come and ask about their experiences.

**Tariffs**

At the standpipes, there is a fixed tariff per m³ only for cost-recovering, without a basic charge. For the households there is a block tariff (rising price with higher consumption) and a basic charge for the service. They introduced this block tariff in 1996. At present there are no prepaid meters in households, this could change. A possible reason could be collection of arrears.

Communities in Informal settlements can themselves decide whether other charges should be included in water price. This has been tried in a couple of neighbourhoods and worked well.

According to mr. Brinkman, there have been no complaints about the affordability of water: A low minimum credit purchase is possible so people can buy small amounts at a time. The minimum amount is N$ 5 or N$ 10.

**Water use and consumption**

In the informal settlements water consumption is low, around 40 L per capita per day. It is hard to say if this is enough for healthy and hygienic living. It seems to be on the low side. Ideally this would be more, but at current there are no apparent health issues due to too low water consumption.

Water points are opened 24/7. For charging of their tag, people have to go to one of three municipal offices in that area. The possibility of mobile charging units also exists, that could be used by local vendors (at small shops). This is possible with the Kent Meters. The municipality first wants to agree on prices with the vendors (to make sure the water price is not inflated to much by the seller’s premium on top of the municipality’s price).

In general, the main instrument to steer Windhoek’s water use is the increasing block tariff system, where the tariffs can be adjusted in times of scarcity. There are also additional restrictions possible, that are more strictly enforced when water is scarce (for example that you’re not allowed to water your garden between 10am and 4 pm, etc.).

Citizens are allowed to reuse/recycle water, but there are some conditions. Mr. Brinkman notes that one always has to be careful with grey water and possible (health) risks involved. We encourage water reuse as much as possible.

**Water availability**

In general there have not been problems in the last twelve years, before that serious droughts have occurred.

Windhoek’s water consists of reclaimed water (max 35%), dam water and borehole/bowl-water (latter are used in time of water scarcity). The municipality is busy ensuring the availability of water, but this expensive (water reclamation, artificial aquifer recharge).

Information from ms. Monde Lubasi

**Contactgegevens:**  
* mml@windhoekcc.org.na  
* office #: 081 2902097, cell Phone #: 081 1400499

She is busy with prepaid meters as well. Her experience is that new technology always needs acceptance.

Kent you can manage, you can deal with the problems. Kent meters are user-friendly for customer and technician: it is easy to use, easy to replace parts [emphasis on this by both Monde and mr. Brinkman]. When it
is opened in an illegitimate way, it goes into ‘tamper-mode’ which means it cannot be sabotaged (but also that no one can use it, even in emergency). A technician then has to reset it.

The Tagmeter meters worked, but when the battery is finished, the water just runs.

The Efteq Teqnovo is not improved at all in Monde’s view and does not work very well. It is a headache.

APPENDIX B10: HILDA JESAJA 05-07-2011

05-07-2011, Mayor’s office

The organization of municipality and council

There are 7 councillors in Otjiwarongo from different parties. Most are from SWAPO, just like ms. Jesaja, but according to her there are not many big differences between the parties on municipality issues. In total there are four parties in Otjiwarongo. From these councillors, there are a mayor, deputy mayor and chairman of appointed on a yearly basis.

The council is elected every 5 years. In the election issues are people that provide shelter and care and promote development. Water and electricity for the informal settlements are a big issue as well. There is the promise to deliver individual water and electricity connection. Electricity has to go through CENORED, but the municipality has subsidized half of the ‘high masts’ (the big lighting masts) and people can get individual connections for a connection fee (this used to be N$500). CENORED doesn’t have funds to bring electricity to everyone.

The council meets every month. All councillors are part-time officials, they all work other jobs as well. Ms. Jesaja works a job at the Ministry of Home Affairs for example, she says it is sometimes hard to divide attention. If needed, the council can meet more often for urgent matters. The CEO (mr. Uxamb) attends these meetings as well, and the mayor and the CEO are in close contact and meet almost every day. Furthermore, council meetings are normally preceded by a management meeting where all the heads of departments report on their activities.

Also the regional council meets the first Thursday of every month in a meeting for all stakeholders, so this is attended by town councillors as well. In cooperation with the regional council, they try to get more companies here, which will bring more jobs.

Visits to other municipalities are done regularly, who goes depends on the invitation and the budget, most of the time the CEO, the mayor and maybe one other councillor will go. Other towns also come to learn from Otjiwarongo on different issues, e.g. Otjiwarongo is the first town to provide everyone with household connections.

Why council decided on individual connections

Decision was made aug-sept 2010. Main reason was that the people had to walk a long distance, and in the case of a broken standpipe even very far. Not all people will be able to afford it, probably less than half, because 80% of people in informal settlements is unemployed (and a lot of old people are living there). The municipality has been looking for sponsors to support the project: the government and different companies have been contacted. The first 50 meters were ‘sold’ for N$500, after this people will have to contribute N$1000 for a connection.

Pre-paid meters

At first reaction were problematic, people did not understand the system. For example they were saying that they bought water for N$50 and they only received N$30, but didn’t understand that the rest of the money went to debt pay-offs. This was addressed through sensitization. Also there were some technical difficulties, which have been solved.
Currently, people are appreciative of the prepaid meters and no more complaints are received by the council.

Debts and affordability

The main reason for debts, according to ms. Jesaja, was the fact that people make little money and were not able to pay the (whole) bill. Also in Orwetoveni people had trouble paying their bills. After the introduction of the prepaid meter, this has improved.

According to ms. Jesaja, the prepaid water is affordable for people because they can buy in small amounts. Even if you only have N$10 or N$20 you can still buy water. The price of water is reasonable.

Debts have been reduced already and more income is generated through water, which is the only (according to ms. Jesaja) source of income, now they ‘lost’ electricity. The generated money is invested back in water and maybe other projects. Like in sanitation, which is an issue of its own. There are plans to provide more Otji toilets, but money is again an issue. This year there has been budgeted for 250 Otji-toilets.

Standpipes

First there was only one standpipe for the whole informal settlement. Payments were hard to collect and the connection could not be closed off. People that did not pay could still get water, you could not control this, and the municipality has to pay Namwater. When more standpipes were installed, they were fitted with prepaid meters.

Cooperation

Otjiwarongo has sister towns in Namibia and outside of it. For example Windhoek is sharing a lot of information of unemployment reduction, technologies they use. Most towns in Namibia deal with the same problems (unemployment, etc.).

With Heusden there is a lot of cooperation. They mainly help the Multi-Purpose Help Centre and the milk powder project associated with that. Other things are learned as well (the open office space, the front office system). Ms. Jesaja has not yet visited Heusden.

Social and economic issues in Otjiwarongo

- **Unemployment:**
  A lot of people are unemployed and it is hard to reduce this. Municipality is looking at projects to work on this. **Water is crucial** for people to be able to employ themselves in gardening projects. The new water connections are therefore also helping in

- **Poverty:**
  For projects, the municipality is working together with the Regional Council to attract investors to settle in Otjiwarongo, raise employment and reduce poverty. An example is contact with a steel company that might open a plant in Otjiwarongo, which would create a lot of local jobs (estimated around 300 jobs).

Other information

Ms. Jesaja thinks it is important for us to hear from users how they feel about the system.

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**APPENDIX B11: WATER COMMITTEE 12-07-2011**

The committee consists of about 18 members from all over the informal settlement. They are elected by the community and their main task is to help educate inhabitants how to use prepaid water meters. When the blue (Tagmeter) meters were installed, the committee has been working house-to-house at first (which took about 1 week) and after that at the standpipes, standing there the whole day, ready to assist people. They did this for two or three weeks. They were making sure that everyone now is aware on how to use the card. For this they were trained by the municipality. All committee members were working in the whole settlement.

The tasks now are mainly to report when taps are not working. New people in the settlements easily learn how to use the system from their neighbours or so, it’s not a problem, because the new system is easier.
Experiences prepaid meters

In general, people were happy to have the meters installed. They replaced the ‘black meters’ (previous prepaid meters, probably the Water Master meters – FvH) which was having a lot of technical problems and many taps did not work very well.

Some people are still living quite far away from the meters.

Some challenges at first were the different speeds with which the people would learn how to use the meter. But in total the learning period did not take very long.

Individual connections

Individual connections are seen as a way to connect people that live far away from taps. They are seen as the biggest wish of the inhabitants. The committee members think the subsidized rate of N$500 is affordable for most people. N$1000 will probably be too much for most inhabitants.

The committee members see the individual connection also as a way to better be able to control and plan water usage (because the meter also exactly shows them their usage over a period of time).

Water usage and tariffs

A small family uses about N$20/month for water, a larger N$40/month and if they have a small business they will use about N$100/month. These businesses mainly consist of making local wheat liquor (‘Tombo’) and running small bars.

The tariffs are considered affordable, mainly because of the small amounts (N$5 or so) that people can purchase. Tariffs for the informal settlement do not include basic charges. Water is the only thing people have to pay. They used to also pay lease for their plots, but this is no longer being charged separately. It could be that this is incorporated in water prices, but we should check with finance people. Prices have not changed since last year.

When it is not possible to purchase water (e.g. office not open on holiday), people can lend their neighbours’ tag. According to the committee, people change their water use pattern when their expenditure runs up too high, for example by washing all clothes just once a week [how true is this in practice? – FvH].

Water is collected by all people, but not young kids because they do not know how to operate the prepaid meter. Most people go in the mornings or afternoon, but there are usually no lines at the tap. Some people use wheelbarrows which can carry three containers (‘Godena’?). In that case, one has to go to the tap once a day.

In rainy season, the rain water is sometimes collected in drums and used for washing etc., not for drinking. Water is sometimes reused if it’s still clean enough, for example if people have a garden or a floor in their house it is used for cleaning the floor or watering the garden.

Sanitation and hygiene

The ‘Godena’ is cleaned once a week, using clean pebble stones that are shaken around in the container to clean it. (This is at least how Sippora cleans them, and probably also how others clean them).

People are taught about hygiene along with the polio-vaccination program from the Ministry of Health, for example to wash their hands and only drink safe water (or boil it before drinking). Also in the kindergarten the kids are taught about these issues (and other things, like healthy food).

When people are not sure their water is clean, because the container has been standing open for a long time for example, they boil the water. This happens a lot for drinking purposes (but not for other water uses). Babies, according to Sippora should only drink water that was boiled first. The heating is done mainly on wood fires in outside kitchens; some people also have gas-fuel stoves. In general wood is used, which is available cheaply. Now it’s winter time and cold many people use warm water also for other uses like bathing. Jephta Kasuto: Especially the children are very taken care of.
For sanitation, some people have the Otji-toilets from the CHP and the municipality. Other people dig deep holes and sometimes use some kind of pot. The committee points out that there are not many hygiene-related diseases in the settlement.

People do sometimes have animals around the house, but certain kinds of animals are not allowed (goat, cattle, horses, donkeys). Jephta Kasuto: people are warned not to keep animals in the house.

Vandalism and emergencies

In case of fire, availability of water is an issue. There is a fire department available and they also teach people how to deal with fire. (In the winter, there are many more problems with fires in DRC and the location). In case of a fire this fire brigade will immediately be called.

Vandalism used to be a problem, because people broke the meters when they did not know how to operate it or became frustrated with them. Currently it is not a problem anymore. When vandalism occurs, the committee reports these cases of ‘devil work’.

“Where you find people, you find problems.” (Jefta Kasuto)

Communication

For communication with the municipality the committee has the phone numbers of all the different departments.

Inhabitants report problems with committee members, examples: blocked tags, rubbish dumping (not water related) or when the taps just keep running.

Meetings with the community are announced through loudspeakers or are set up (on short notice) through the committee members. Meetings are called when they are necessary, because of changes by the municipality that affect the inhabitants. There are however not enough meetings in the view of the committee, there should be more meeting to let people know what’s going on, every change must be informed.

The community can also call for a meeting for certain issues. They can call for certain officials or councillors to attend.

Recommendations

- “We expect water to reach everyone, water is life”. Therefore, it needs to be close to people.
- A good price is needed for people to be able to afford the individual taps. (Earlier: N$500 is fine, N$1000 too much).
- Committee members would like some appreciation at the end of the year or so. (There used to be a yearly meeting with some food and a speech by the CEO).

Contact

Sippora L. Kamati 081 6580943
Daniel Simon 081 2185025
Serelia Joseph 081 2774936
Kristine Simon 081 6910375

We could contact Sippora and make arrangements on a Saturday or so, to also talk to people who are working during weekdays.

APPENDIX B12: HOKO 03-08-2011

Financial/Debt collection department
Senior executive: Burgert
Manager: Laudia
Accountant: Hoko
Creditor: Lerry
Three clerks: Deon (conventional meter customers in town), Kandume (prepaid customers with debts), Maniki (conventional meter customers in Orwetoveni)

Daily tasks Hoko

Hoko is busy with the bank accounts, trying to balance the account on a daily basis. An important task is also looking at the payments done that are not clearly marked for someone. By finding out from who the payments are, they can be deducted from their debt accounts.

Registering deposits (N$1500) to make sure renters do not leave Otjiwarongo with unpaid accounts. The municipality started asking for deposits 5 years ago.

Debt collection system

The computer system (Finstel) generates an automatic disconnection list of everyone who is more than 30 days behind on their payment. In practice, the municipality uses the 90 days list. Disconnections happen on a daily basis, around 50/day in town. These are done per block, so the meter readers (Ivan and Theodore) go around one block per day. They spend around 3 or 4 hours each day on cutting people off.

People that get disconnected have to come into the office to make arrangements. These arrangements can also be put into the system (so if they make an arrangement that they will pay off a little later or a little less than normal, they still will not show up on the new disconnection list, at least if they pay according to the arrangement). They also have to pay a N$100 reconnection fee (to cover the costs of the seals used to disconnect, and some other small costs like petrol).

Service charges are divided in four parts: water costs (variable), sewage (N$43?), sundry (=overig, diversen), refuse (N$120?), tax (variable). On top of this, debt repayment can be added.

Hoko says that they thought that prepaid would solve the problems. That people with prepaid water meters first had to pay off their monthly charges before paying for water. And that they could pay off debts with a 80-20 ratio (80% debt, 20% water). This didn’t work out, because there’s no zoning. People are bypassing the debt and service payments they have to do by using other people’s tags. It is hoped that the new meter will solve this. Also at first not much attention was paid to the prepaid system in administration, but due to technical issues (tap keeps running when battery is empty) a lot of water was wasted and unpaid. This still happens (some people are lucky and get free water), although the taps are checked more often now. The new meter could also solve this. This new meter is currently being tested by municipal employees.

History and issues

This debt reduction only became a serious issue after electricity revenue was lost. Some households have run up to N$35,000-N$40,000 in debts. At the moment there is around N$25M in debts, consisting of water bills, rates and taxes. No interest has to be paid on debt.

It is hard to collect the debts because of the affordability, which is a big problem. Some people have to pay N$400/month service charge and N$200/month debt repayment, while living on a N$400-N$500/month government pension. People that never pay are being visited, and the municipality tries to convince them to at least pay a little. Hoko tells that a typical reaction is people asking “where do you think I should get this money from?”

Debt collection therefore is moving slowly, last year N$600,000 was collected, but in the mean time people are also running up debt so the overall total debt is increasing.
First, Hoko was the only one busy with this, but now the manpower has increased. So there are enough people to do the work, but the inhabitants just cannot service their debts. It is hard to find a solution for this. Hoko shows us various cases in which people have been cut-off of water, but debts keep running up because basic taxes and sewage charge keep being billed (and not paid). Some already stopped paying years ago, and consequently they have also been disconnected for water for years. In these cases, there is not much that can be done. The municipality has refrained from evicting these people so far, but it is hard to find a way out. Also because national/regional government keeps stressing the collection of all debts. At current there are more than 100 customers in a situation like this.

Politics also plays a role in this, with politicians asking municipality to go easy on debt collection and disconnection in election time and to step it up again after elections. (They received a letter from the government that they should disconnect people that are not paying and that they should recover debts). Hoko says that in this case the support and motivation by the CEO (mr. Uxamb) is very important.

Advice to some of the people (pensioners) that cannot afford their services and debt repayments was to move to the informal settlements and rent out their house, so they can use the collected rent to pay their bills and keep some to support themselves. Although this way the debt is reduced, this is a big decline in quality of life, Hoko confirms.

There are also people that just don’t understand that they have to pay, who think that water should be free of charge. What they don’t understand is that the municipality also has to pay Namwater. They talk to them on a man to man basis to try and convince them that they should pay.

At current, even prepaid meters are being disconnected, because they are bypassed, also physically by people digging holes and tapping the pipes. This happens a lot. Some people will do this under the ground so it cannot be seen.

There has been a demonstration at the municipality, where people asked to send Hoko home (he’s not originally from Otjiwarongo).

Note: if someone with debts dies, it is the responsibility of the family to pay off the debts.

Some people are asking for prepaid water meters now, but the municipality won’t give it, because it’s not a solution. (However, the new meter might be a solution).

| APPENDIX B13: INHABITANT 07-08-2011 |

**Washing clothes**

She was washing her clothes carefully in a big tub (photo), hanging her clothes on a line afterwards. She does her laundry once a week (mostly on Saturday, but this Saturday she had to go to a funeral, so she’s doing it on Sunday).

After she’s done she throws the water on the stones that are on the plot to build a house from (photo), because this will make the stones stronger.

**Getting water**

Together we went to the water tap, with a wheelbarrow, one bucket (25l) with cover, and little boy (apparently her neighbor), which is around 100 meters away. On our way, we see a girl with a wheelbarrow also walking to the tap (photo). We have to wait for one other person before we can get the water, but this doesn’t take long. She puts her jerry can on her head (photo) and walks away. However, she tells me that the lines can be very long some times, especially in the early morning and late in the afternoon. The reason is that some of the other meters are broken, so more people have to use this meter.

I walk back with the wheelbarrow and this 1 25liter bucket; it’s heavier than I thought. When I get the bucket out of the wheelbarrow and put it on the ground I can’t believe that some people are carrying this home without a wheelbarrow, it’s heavy!
Toilet

There is an Otji-toilet on the plot, which looks pretty okay and smells just neutral. They say it doesn’t look that good, but I don’t know if they think I have very high standard or that they really think it’s not that good.

The woman thinks a flushed toilet would be better, but as long as she cannot have that, this is fine.

During the five hours that I’ve been there, no-one uses the toilet. The neighbor boy pees in the corner of the plot though.

Food

The woman tells me she cooks on average once a day. When she cooks she uses gas, because it’s cheaper than buying wood. For wood she thinks she would need N$5 for each time she wants to cook, while the gas only costs N$27 and last for months.

If she is a little bit hungry she makes some kind of drink (photo), which is a little nutritious (it kind of looks like pap with a lot of water). It tastes a little salty.

She makes this in a 1 liter jug (kind of like the picture, but blue). Everyone drinks from this: she, the guys, the neighbor kids.

Bathing

When asked how often she washes herself she tells me ‘only in the morning and in the evening’. She does this in a big tub. In the winter, she will use warm water.

Hand washing

Since no-one used the toilet or prepared any food during the time I was there I cannot say for sure that they will wash there hands on those times. However, the men very carefully wash their hands after they’re done working (they are going to make a brick house, so they moved some stones, and measured some things).

They put some of the water from the bucket into a small tub (same as used for washing the clothes, see picture, but smaller). They rub there hands a lot, also using soap. They wash their hands so carefully that I think it took them almost a minute each, and also their forearms are being washed.

When I ask (afterwards) if soap is expensive and if it’s always being used, she tells me that it’s not expensive and that she can always use it, she always has soap. One block of soap costs on average N$5. She buys dettol soap, because she think this is better than some others, which is N$6 a piece. The cheapest one would be N$3 a piece.

She tells me that if she buys 4 blocks, it will last for a month (note: this seems like she uses a lot of soap, not sure if she really buys 4 blocks a month).

Household taps

She doesn’t have a household tap, but would like one. She tells me that first a household tap would cost N$500, then it cost N$1000 and now it already costs N$1700. She cannot afford this. N$1000 is still expensive, but much better than N$1700.
She tells me the pipelines are already there (pointing to the ground, 2 meters away). She doesn’t understand why it is so expensive to put in the tap, while the distance is so short.

*Note: the guys where talking about this, she translated it for me, and she agrees with them.*

**Informal settlement**

It turns out that she is not unhappy with how she lives (and she’s a great fan of the song that plays all the time: “I just wanna live my life, my life, the best way I can”). She tells me that people in the formal settlements (‘over there’) are less satisfied, because they have to pay rents and taxes, etc, which she doesn’t have to pay.

**Garbage disposal**

Every Friday the municipality comes to pick up garbage bags with paper (she cannot put other things in here). She has to buy the garbage bags herself, but she doesn’t pay for the garbage disposal. Because a lot of people don’t clean there plots and the wind will blow their garbage around (indeed I saw quite some paper in the air) she has to clean her plot every day, picking up the papers and putting them in the garbage bag.

**Fire hazards**

This morning there was a fire hazard near her house and she went to take a look. One baby boy died in the fire. The police and the fire brigade had been called. The police was there very quick, but couldn’t do anything. The fire brigade took too long to get there (because they had to get water first?).

Sippora tells me this already happened two other times.

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**APPENDIX B14: JEPHTA KASUTO 05-09-2011**

**Jephta’s work**

Both people from Orwetoveni and from the informal settlements come to Jephta with problems. Especially in the informal area he is the only one working on this.

“To work with the people is so difficult”.

“I’m just working according to my experience”.

Jephta has always worked with the people, so he has a lot of experience.

He started working for the municipality in 1996.

**The situation before**

When he started working for the municipality people were living everywhere, it was chaos. The municipality prepared land and plots for the people. They also built some houses for people that used to live with many in one room, they now each got their own room.

It was a very difficult time.

They put in street taps. It was only a tap, you could open it and take the water home (no electronics yet). The water was free of charge, and only N$12/month had to be paid for rent. Some people didn’t pay this. Jephta had a list of who paid and he would visit the houses that didn’t pay to collect the rent. But people were wasting water too much: sitting under the tap to bath, or children open the tap and run away.

That’s why they put in the prepaid water meters.

**Problems reported**
If people have problems they will come to Orwetoveni office to report any problems they have to Jephta. Examples of problems that people are coming with are: taps are not working, they need plots to stay, problems with neighbors, roads are not good, waterpipe broken, chickens eating flowers.

If there are problems with taps or waterpipes Jephta will report this to Jackson or Lazarus (from the technical department) and they will fix it.

**Look for problems**

Sometimes Jephta drives around to see if there are any problems.

For example, some people are building at illegal places (close to the river). He informs them that they should move. If they’re not listening he will call the police, and they’ll try to solve the problem.

He also tells Jackson and Lazarus if there are broken meters (note: it didn’t sound like he was carefully looking at broken meters or checking them regularly).

Now it’s warm, so there are less problems with the meters than in winter times.

**Internal communication**

They used to inform me about changes in town. Now, Jephta is not being informed any more. He doesn’t know why.

**Broken meters**

I told Jephta that people were telling me that meters had been broken for a couple of months and I asked him how this could happen. He told me that first of all if they are not telling him this he cannot help them, and it is possible that he didn’t see it himself. Secondly, people are probably exaggerating.

**Other information**

The clinic we visited was in DRC east, Ombili. They also tried to put one in another location (DRC south), but they could not find a good plot available.

The state hospital is very good. Provides people with help and medicine.

Floods in Otjiwarongo are not a problem. But due to a shortage of plots people are now building close to the river, which is a problem.

**APPENDIX B15: DEON 05-09-2011**

What kind of questions/ complaints do people ask/tell you?

They come to make arrangements (about debt pay off).

Ask why water consumption is so high.

Ask why rate changes.

Ask who should pay certain things (owner/ tenant): owner has to pay rents, taxes and sewerage.

Front office answers most of the questions.

Sometimes they want to see the CEO. Then Deon tries to talk to them first, and most of the time he can answer all their questions.

Do you know the water tariffs for different uses?
Yes. Shows me a document with all prices for 2012 (the book year “2012” is from July 2011 till June 2012). Laudia has this on her computer.

APPENDIX B16: RECEPTION 05-09-2011

Do people often come here with questions about water services/ water meters/ water costs?

Yes, put them through to technical department.

What kind of questions do you get?

About meter readers, meter leaking, debts, payments. Often send them to Deon.

Do you know the water prices for different users?

Ask Deon

How often do people come here with questions?

People come every day.

If people have simple questions, do you answer them yourself?

Yes. They often ask from which date to which date the account runs. This is from the 16th to the 15th the next month.
Note: There were four separate surveys, one for each group, that did not all had the same questions. Therefore, after each question it will be written at which groups this question was asked:

- Group 1: prepaid users Orwetoveni
- Group 2: conventional meter users Orwetoveni
- Group 3: prepaid household connection users informal settlements
- Group 4: (prepaid) standpipe users informal settlements

### BASIC INFORMATION
Date:
Name interviewer:
Plot number of the household:
Type of house (brick, clay, shack):
   - Group 1, 2, 3, and 4

### 1. OPINION ON PREPAID
1.1 When did you get the prepaid water meter? ........../....... month/year
   - Group 1, 3

1.2 What kind of meter did you use before you got the prepaid water meter?
   - Group 1, 3

1.3 What do you think are the positive aspects of the prepaid water meter?
   - Group 1, 3

1.4 What do you think are the negative aspects of the prepaid water meter?
   - Group 1, 3

1.5 Has the prepaid water meter improved your situation?
   a) [ ] Yes [ ] no.
   b) Why (not)?
   - Group 1, 3

1.6 Do you think water is affordable? [ ] Yes [ ] No
   - Group 1, 2, 3, 4

1.7 What do you think the municipality could do to improve the water supply?
   - Group 1, 2, 3, 4

1.8 Do you think prepaid water meters are a good intervention?
   a) [ ] Yes [ ] No
   b) Why (not)?
   - Group 2, 4
2. COMMUNICATION WITH THE MUNICIPALITY

2.1 Do you think the communication with the municipality is good?
   a) [ ] Yes [ ] No [ ] Don’t know
   b) Why (not)?

   Group 1, 2, 3, 4

2.2 Open question: If you have any complaints or questions, how do you communicate this with
   the municipality?

   Group 1, 2, 3, 4

2.3 Do you feel the municipality listens to complaints/ suggestions?
   [ ] Yes [ ] No [ ] Don’t know

   Group 1, 2, 3, 4

3. DEMOGRAPHIC INFORMATION

3.1 Number of household members: ……

   Group 1, 2, 3, 4

3.2 Ages of household members:

<table>
<thead>
<tr>
<th>Age</th>
<th>0 – 5 years</th>
<th>5 – 18 years</th>
<th>18 – 50 years</th>
<th>&gt; 50 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   Group 1, 2, 3, 4

3.3 Number of household members with a job: ……

   Group 1, 2, 3, 4

3.4 What is the total spending of the household per month? N$ ……/ month

   Group 1, 2, 3, 4

3.5 How much does the household spend on water each week? N$ ……/ week

   Group 1, 2, 3, 4

3.6 What are the biggest expenses of the household, and how big are they?

   Group 1, 2, 3, 4

3.7 Is the income sufficient to afford the basic needs of the household?
   [ ] More than sufficient [ ] Just sufficient [ ] Not sufficient

   Group 1, 2, 3, 4

3.8 Does it ever happen to you that there is not enough money left for buying water?
   a) [ ] Yes [ ] No. If yes:
      b) How often does this happen?
      c) Where do you then get water from?

   Group 1, 2, 3, 4
3.9 Do you have debt?
   a) [ ] Yes [ ] No. If yes:
   b) How much debt do you have? N$ …….

   Group 1, 2, 3, 4

3.10 What kind of sanitation do you use?
   Group 1, 2, 3, 4

3.11 Have you sometimes been cut off from water?
   a) [ ] Yes [ ] No
   b) If yes: On average, how many times a year is your water cut off?
   c) If yes: How long has your water been cut off in total?
   d) If yes: Where do you get water if your water is cut off?

   Group 2

4. CHANGES SINCE USING THE PREPAID WATER METER

4.1 Do you pay more, less, or the same for water than before you had the prepaid water meter?
   a) [ ] More [ ] less [ ] the same
   b) If more or less, how come?

   Group 1, 3

4.2 Did your water use increased, decreased, or didn’t change since the prepaid water meter? [ ] Increased [ ] Decreased [ ] Didn’t change

   Group 1, 3

4.3 Before the prepaid water meter, has your water ever been cut off?
   a) [ ] Yes [ ] No. If yes:
   b) On average, how many times a year was your water cut off? …… times/ year
   c) How long has your water been cut off in total? …… Weeks

   Group 1

4.4 Before you had the household prepaid meter:
   a) How often did you go to the standpipe to get water? …Times/ day
   b) How much water did you (on average) take each time? …Liters
   c) Who was getting the water?
   d) How much time did you spend daily on fetching water? … Min/ day

   Group 3

5. WATER QUANTITIES AND COSTS

5.1 What is the total amount of water you use each week? …… Liters. Or [ ] Don’t know
5.2 Frequency of different water uses:

<table>
<thead>
<tr>
<th>Use</th>
<th>Multiple times a day</th>
<th>Once a day</th>
<th>Multiple times a week</th>
<th>Once a week</th>
<th>Multiple times a month</th>
<th>Once a month</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washing clothes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bathing</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Cleaning</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Food harvesting</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Flushing toilet</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business *</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other: ......</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Business can be: water used for irrigation, cattle, car wash, bar, etc.

5.3 Would you like to use more water?
   a) [ ] Yes [ ] No
   b) If yes: what holds you back on using more water?

5.4 Do you reuse water?
   a) [ ] Yes [ ] No
   b) If yes: For what uses?

5.5 Do you use rainwater in the rain season?
   a) [ ] Yes [ ] No
   b) If yes: For what uses?
5.6 How often do you go to one of the municipal offices to pay for water (to put more credits on the tag)? ……times/ month

5.7 Do you know what the price of water is?
   a) [ ] Yes [ ] No
   b) If yes, fill this in: For N$ ……., I can get around ……..liters of water

5.8 Do you have to pay for other services before getting water, or that are included in the water price?
   a) [ ] Yes [ ] No
   b) If yes: what else are you paying for?
   c) If yes: how much are you paying for this? N$

5.9 Questions about going to get water at the standpipe:
   a) How often do you go to the standpipe to get water? … Times/ day
   b) How much water do you (on average) take each time? … Liters
   c) Who is getting the water?
   d) How much time do you spend daily on fetching water? … Min/ day

6. HEALTH RELATED QUESTIONS

6.1 Did you receive any information on hygienic behavior and the prevention of diseases (like when to wash your hands, how to store food, etc)?
   a) [ ] Yes [ ] No
   b) If yes: where did you receive this information?

6.2 Open question: On what occasions do you wash your hands? With soap?
   [ ] After defecation (going to toilet) [ ] Yes
   [ ] Before eating [ ] Yes
   [ ] Before feeding children [ ] Yes
   [ ] Before preparing food [ ] Yes
   [ ] After preparing food [ ] Yes
   [ ] After changing nappies [ ] Yes
6.3 Where do you wash your hands?

6.4 When do you do the dishes?
- [ ] Each time right after using them
- [ ] Within an hour after using them
- [ ] At the end of the day
- [ ] Other: ……………………………

6.5 Do you store water somewhere?
- a) [ ] Yes [ ] No
- b) If yes: Where do you store it?
  - [ ] Open bucket
  - [ ] Bucket with cover
  - [ ] Jerry can (small opening)
  - [ ] Other: ………………………
- c) If yes: Do you ever clean this? [ ] Yes [ ] No
- d) If yes: How do you clean it?

6.6 How and where do you store food?
- [ ] Open [ ] Cooled
- [ ] Covered [ ] In the shadow
  - [ ] In the sun

6.7 Are there animals walking inside the house?
- a) [ ] Yes [ ] No
- b) If yes: what kind of animals?
## APPENDIX D: Calculations

### Who is Paying for the Water Supply

<table>
<thead>
<tr>
<th>Costs/Actor</th>
<th>Conventional meter user</th>
<th>Prepaid users</th>
<th>Municipality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair and maintenance costs</td>
<td>N$42,008 (€4,200)</td>
<td>N$225,000 (€22,500)</td>
<td>N$220,239 (€22,023)</td>
</tr>
<tr>
<td>General (basic) costs</td>
<td>N$324,424 (€32,442)</td>
<td>N$480,574 (€48,057)</td>
<td>N$1,718,010 (€171,801)</td>
</tr>
<tr>
<td>Water costs</td>
<td>N$16,838,632 (€1,683,863)</td>
<td>N$1,172,073 (€117,207)</td>
<td>-N$7,279,104 (€727,910)</td>
</tr>
<tr>
<td>Other services</td>
<td></td>
<td>N$147,181 (€14,718)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>N$17,205,064 (€1,720,506)</td>
<td>N$2,025,428 (€202,542)</td>
<td>-N$5,340,855 (€534,085)</td>
</tr>
</tbody>
</table>

### Information used

Repair and maintenance cost conventional meters:

N$ 42,008

From Water June 2011 (Municipality Otjiwarongo f).

Repair and maintenance cost prepaid standpipes + prepaid household meters:

N$ 185,000 + N$ 40,000 = N$ 225,000

From Water June 2011 (Municipality Otjiwarongo f).

Other repair and maintenance costs:

N$220,239

From Water June 2011 (Municipality Otjiwarongo f).

Amount on water paid by conventional meter users:

N$ 16,838,632


Total amount paid by prepaid users:

N$2,025,428


Total costs on water for 2011:

N$ 3,010,855

Total amount paid by municipality to Namwater for water, in 2011:

N$10,731,601


Price per m³ paid by conventional users and prepaid users:

N$16,00/m³ for conventional meter users

N$25,64/m³ for prepaid users

From Water Tariffs 2012 (Municipality Otjiwarongo d)

**Calculations**

The repair and maintenance costs are literally from the data.

The general (basic) costs for conventional meter users are calculated as follows:

N$22/month/household basic charges is paid * 12 months/year * 1388 households in Otjiwarongo (based on detailed map Otjiwarongo) = N$366,432

From these basic charges also the repair and maintenance costs are paid, so they are subtracted from this amount:

N$366,432 - N$42,008 = N$324,424

The water costs for conventional meter users are also literally from the data.

The total sums up these three costs.

For the prepaid water meter users, the total amount of N$2,025,428 was known, just as the repair and maintenance costs. The water costs were calculated by multiplying the amount of cubic meters water sold by N$16.00. The rest of the costs are divided between ‘general (basic) costs’ and ‘other services’ based on estimations.

For the municipality, the repair and maintenance costs were known. Furthermore, the general (basic) costs they have to pay are calculating by subtracting all repair and maintenance costs and the general (basic) costs from the total on water for 2011:

N$3,010,855 - N$42,008 - N$225,600 - N$220,239 - N$324,424 - N$480,574 = N$1,718,010.

The water costs for the municipality are calculated by subtracting the income they get from the conventional and prepaid users by their expenditures:

N$10,731,601 - N$16,838,632 - N$1,172,073 = -N$7,279,104