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Environmental Engineering
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Bachelor Thesis

Waste Management and Recycling Study in Namibia

Case study of Keetmanshoop and Ondangwa

Supervisor
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Waste Management and recycling research of local authorities in Namibia

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ABSTRACT

The case study has been done as part of the Partnership for Local Democracy & Development and Social Innovation (PLDDSI) project that collaborate the Finnish municipalities of Kangasala and Lempäälä with the Namibian municipalities of Keetmanshoop and Ondangwa.

The case study was conducted to get more understanding about the different waste management and recycling practices in the municipalities and the social aspects that contribute and affect them, in order to provide a platform for future development, promotion and strengthen implementation of local enterprises.

The study was carried out in the cities Windhoek, Keetmanshoop and Ondangwa during a one month field work excursion during October and November 2009. The information gathered mostly by interviews of municipality authorities, national and local entrepreneurs, local residents and observations in different recycling companies.

Awareness raising and education about waste management and recycling are big challenges faced by the municipalities. Ratification and implementation of local legislative action followed a national waste management policy and promotion of professionalö skill training will promotes future investments and the development of a sustainable waste management.

Key words

Waste management Namibia, recycling business, recycling enterprises.

Foreword

Understanding the importance of social aspects regarding waste management and their importance along with the technical solutions was a very educative and open minded. It was a wonderful adventure to be a guest of a new and totally different continent.

I would like to thank the TAMK's Environmental Engineering Degree Program and the PLDDSI project for giving me the opportunity to participate in such an overwhelming experience. I would like to thank the project's development director Timo Palander for his patient and support.

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Table of Contents

1. Introduction	7
1.1 Country profile of Namibia	8
1.2 Keetmanshoop	8
1.3 Ondangwa.....	8
1.4 Previous studies and projects	9
2. Waste treatment methods	10
2.1 Glass	10
2.2 Plastic	11
2.3 Scrap Metal	11
2.4 Paper.....	12
2.5 Bio Waste	12
2.6 Hazardous.....	13
2.7 Electronic.....	14
2.8 Medical.....	14
3. Data Collection and Methods	15
4. Waste management at Keetmanshoop municipality	16
4.1 Metal Waste.....	16
4.2 Glass	16
4.3 Plastic	19
4.4 Paper.....	20
4.5 Medical Waste.....	21
4.6 Bio Waste	22
4.7 Hazardous Waste.....	22
4.8 E-Waste	23
5. Waste management at Ondangwa municipality	24
5.1 Metal.....	24
5.2 Glass	25
5.3 Plastic	26
5.4 Medical Waste.....	28
5.5 Bio Waste	29
5.6 Hazardous Waste.....	29
5.7 E-Waste	30
6. Recycling Opportunities and local opinions	31
6.1 Keetmanshoop.....	31

6.2 Ondangwa.....	32
7. Narrative approach to waste management.....	33
7.1 Narratives from Keetmanshoop.....	33
7.2 Narratives from Ondangwa	39
8. Discussion	42
9. Recommendations for future actions.....	43
9.1 Ondangwa.....	44
9.2 Keetmanshoop	45
References	46
Appendices.....	48
Appendix 1: Plan for Field work in Namibia	48
Appendix 2 – Interview example.....	51

List of abbreviations

PLDDSI	Partnership for Local Democracy & Development and Social Innovation
LDPE	Low Density Polyethylene
HDPE	High Density Polyethylene
PP	Polypropylene
PET	Polyethylene Tetrphthalate
PVC	Polyvinyl Chloride
MSW	Municipal Solid Waste
EU	European Union
E-waste	Electronic waste
UNAM	University of Namibia

1. Introduction

Lempäälä and Kangasala municipalities in Finland have a partnership with Keetmanshoop and Ondangwa municipalities in Namibia. The Partnership for Local Democracy & Development and Social Innovation (PLDDSI) project is part of a program of the Association of Regional and Local Authorities in Finland (ARFLA) and funded by the Ministry for Foreign Affairs of Finland. Waste management and recycling is one field which being researched and promoted in hope to develop and strengthen enterprises practicing waste management and recycling^{5,6}.

The waste management field work (October to November 2009) research was aimed to provide a platform for future implementation and development of waste management and hygiene impacts such as the waste management regulations, promotion and strengthening of waste recycling and awareness as part of a future solid waste management plan⁵.



Figure 1: The location of Namibia in Africa and its borders with neighbor countries⁹.

1.1 Country profile of Namibia

Namibia is located in the west of Southern Africa (Figure 1). Namibia became part of South Africa during World War I and got their independence in 1990⁸.

A population of 2.1 million people and area of 824,292 km² makes Namibia one of the less dense countries in the world with 390m² per capita. Namibia has a very strong mine and farming industries. The Namibian Dollar currency follows the South African Rand and its current exchange value in reference to the Euro stands at 9.90 dollars per 1 euro.

Namibia holds one of the highest levels of inequality in the world when it comes to different issues mainly of income and standard of living^{8,9}. Average income of middle class is N\$4,670 (472€) while rural lower class has an income of N\$1,640 (166€) per month.

1.2 Keetmanshoop

Keetmanshoop is the main and biggest town of Karas, the southern Namibian region. Karas region covers all south of Namibia from the Atlantic Ocean in the west to the east and south borders of South Africa. Keetmanshoop connected by the B1 road to Windhoek and to South Africa which contribute to the importance of the town⁶.

Keetmanshoop provides all important services to the region and provides home to the regional council and the state hospital. The population rounds around 25,000 residents region comes to Keetmanshoop for business, governmental services or even shopping⁶.

1.3 Ondangwa

Ondangwa is one of the biggest towns in Oshana, one of the regions of northern Namibia. Ondangwa connected as well by the B1 road which connects Windhoek, the north of Namibia and the Angolan border. The residents enjoy the closeness of big cities such as Oshakati and other small villages such as Oniipa⁶.

During the field work of the PLDDSI the research team was staying in the missionary house In Oniipa and visited the local hospital. Unfortunately broken and rusty garbage drums are the only reminder of a previous project⁶.

The local residents are unaware or misunderstood the idea behind the separation of waste and use all drums for any kind of waste. There is a tradition in the village of burning waste piles of any content. These piles often contain metal cans, Glass and Plastic bottles and different general waste ⁶.

Since the drums have no bottom as a result of the waste burning, animals such as cattle, goats, dogs and birds have constantly direct contact with different types of waste. While this behavior wasn't been seen in Ondangwa it is a reflection of the awareness and understanding of waste management and its influence on the way of living in Namibia ⁶.

1.4 Previous studies and projects

The PLDDSI already had baseline research in the fields of Local Democracy and water services. Other projects such the Environmental Monitoring and Indicators Network (EMIN) and the North Karelilian Development Association worked in Namibia between the years 1999 and 2001 in projects of waste management and recycling promotion (Figure 2) ⁷.

The North Karelilian Development Association promoted and established the Oniipa environmental project held between the years of 1999 and 2003 ³.

The project promoted recycling practices and established a waste management system in Oniipa and Onandjokwe hospital ³.



Figure 2: waste collection drums in Oniipa village made by the north Karelilian environmental project.

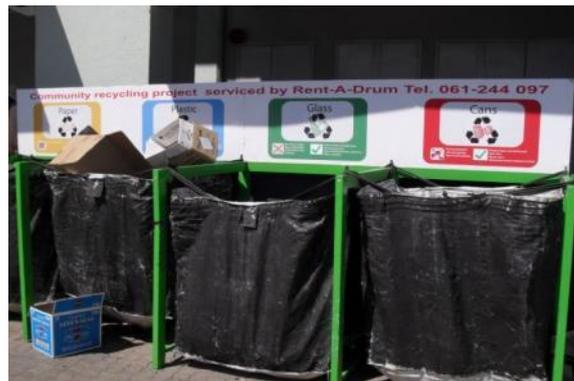


Figure 3: waste collection and separate system in Windhoek.



Figure 4: Waste collection and separation system in Swakopmund.

2. Waste treatment methods

Current practices and treatments of waste disposal, recycling and recovery in European Union will be explained in this chapter ¹¹. These solutions might not be necessarily adequate to Namibian characteristics though are symbolize the great opportunities of waste usage utilization and in some extent can be even compared.

Some countries collect different waste together and separate their waste in different stages (plastic, metal and cartons can be sometimes collected together) of their waste management system ¹³.

2.1 Glass

Beverages glass is the most collected and recyclable glass product in MSW. The glass can be break into pieces to reduce its volume and transported to recycling plants for production of new products (Figure 6). Glass wool production (Figure 5) is a new growing product which gives different solution for glass waste.

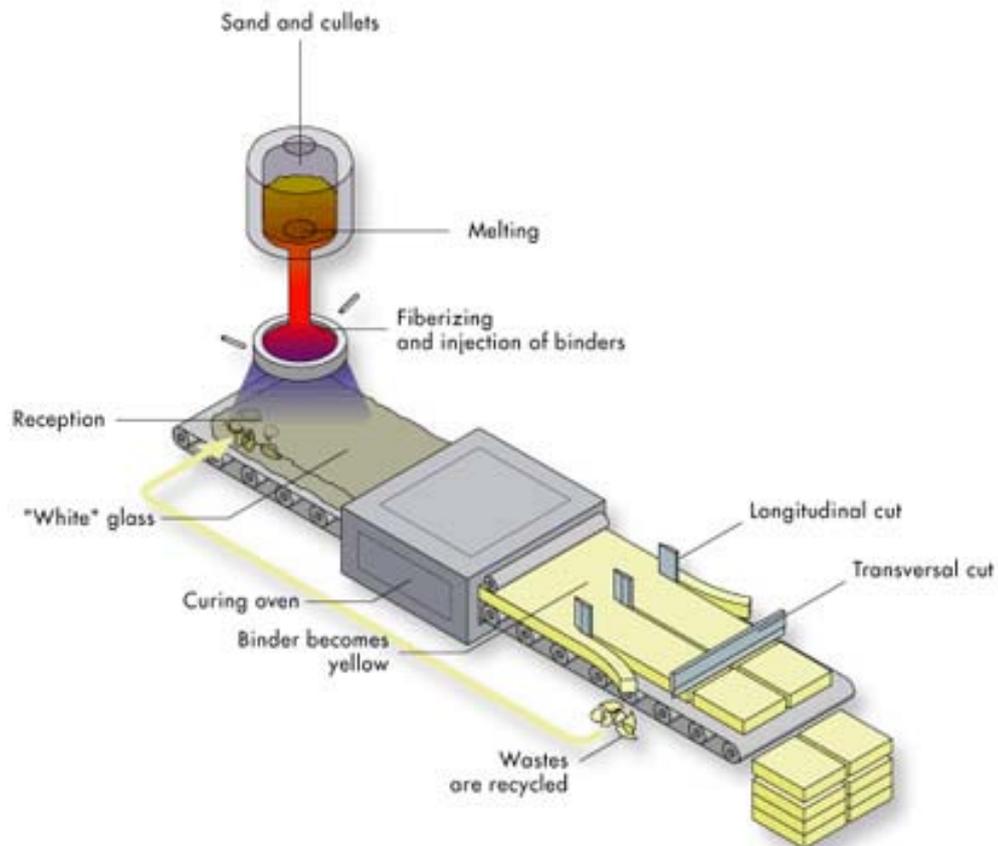


Figure 5: Glass Wool production machinery ¹⁵.

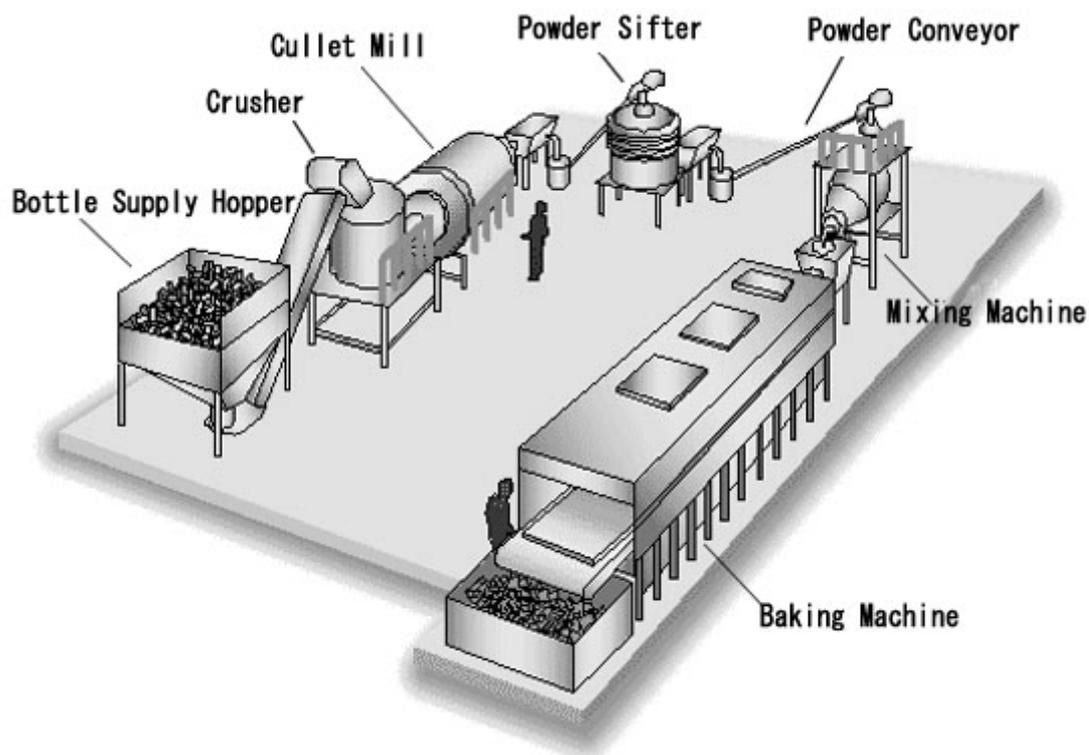


Figure 6: The common process of glass recycling ¹⁶.

2.2 Plastic

Plastic packages are main plastic source of the MSW (about 73%) while 54% used for food packaging. The plastic is being recycled (from 17% to 24%) and recovered (from 31% to 43%). LD, HD, PP and PET are main plastic products material (83%) ¹³.

Plastic recovery means the use of it in blast furnaces for energy production (44%) and in feedstock process (used for PET products) for chemical products recovery and recycling (54%) of new raw materials ¹³.

When compared to Northern Namibia which has the technology to recycle and recover all 4 main plastic materials, countries such as Belgium has ability to recover and recycle HD material only while rest is transported to different countries in the EU ¹³.

2.3 Scrap Metal

The metal contents in MSW usually refer to steel packaging (50%) and aluminum cans (18%) in food production. Incineration slag recovered as new metal raw material in

most practices. Magnets used in separation of MSW recover steel (Iron) and eddy current separation (Figure 7) system for separation of other metals such aluminum ^{1,13}.

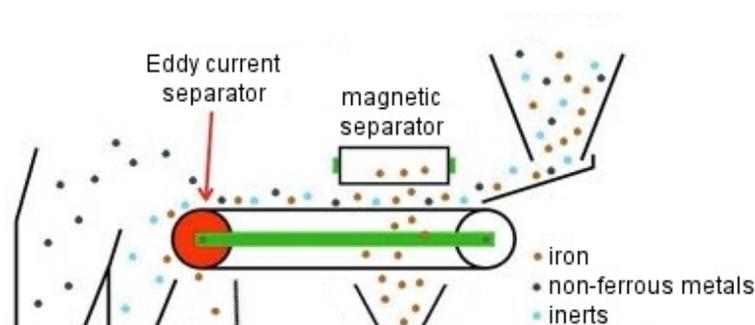


Figure 7: Eddy current separation used for separation of other metals than Iron ¹⁴.

Metal packaging is getting more and more popular in Namibia due to the space of storage and customer's demands though it is still one types of waste which are not separated or collected and often find its way to the dumpsite and burned there. While in European countries beverages cans are refundable it is not the case in Namibia and these products can be finding easily in the dumpsites as well.

2.4 Paper

Most paper waste in Namibia that been collected and recycled is Carton packaging. The waste will be sorted and separated before transported to pulp mills where it is shredded and pulped. The recovered material is used to produce new products ¹³.

Mixed carton and aluminum packages can be separated in paper mills and recover the aluminum waste to be used in aluminum production industry ¹³.

2.5 Bio Waste

Bio waste in the EU works well when regarded to kitchen waste. The bio waste often collected as part of the Municipal Solid Waste (MSW) which adds to the generation of a better quality compost and biogas productions. The waste treated mainly by Landfill after it went through the processes of Incineration and biological treatments. These can be made in different orders as the need of biogas or compost changes ¹².

Incineration is being made to reduce the volume of the waste before landfill it. This provides less occupied space in the landfill and longer production life of the landfill in

the long run. The incineration uses the waste as an energy source for electricity production mostly rather than waste ¹².

Biological treatments refer to composting and biogas production. Anaerobic and aerobic processes usage depends on the contents of the bio waste which affect the efficiency of the processes. Regarded to Namibian waste is it noted that kitchen waste is treated better with anaerobic digestion for biogas production ¹².

2.6 Hazardous

Combustion and incineration can be used as a conventional method to break up the hazardous waste and reduce its volume. Hazardous waste treated needed to be buried in a landfill that built for containing hazardous waste (Figure 8) ^{1,17}.

Since landfilling is described and used often as the ultimate method of hazardous waste disposal there are few treatments needed to be done before using the land disposal and after Incineration ¹. Liquid hazardous waste is usually disposed in underground injection wells due to their ability to prevent impacts on water resources ¹⁷.

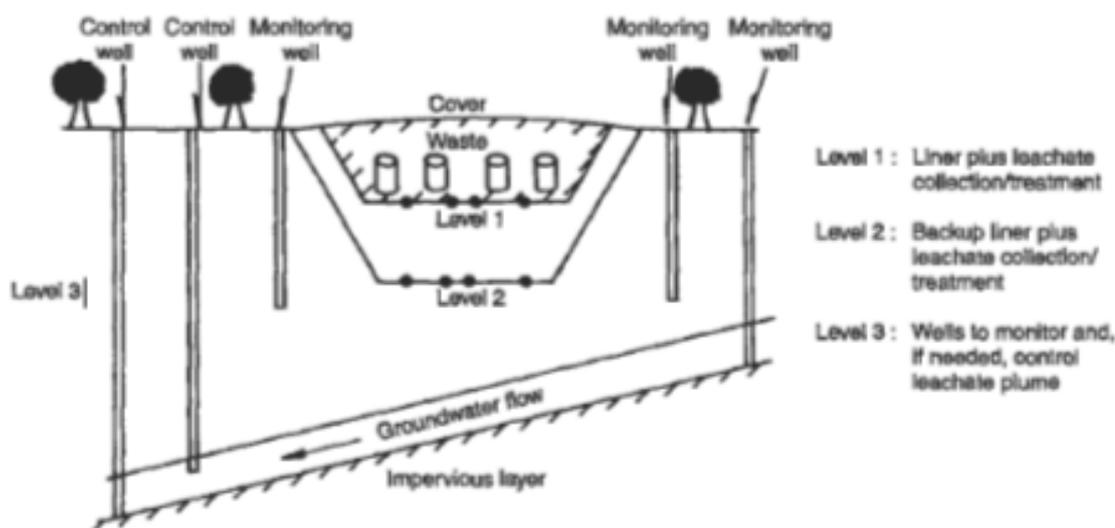


Figure 8: The 3 layers protection in Hazardous waste lanfill ¹.

2.7 Electronic

Electronic waste (e-waste) is often considered as hazardous waste though by good waste management practices it can be considered as a valuable raw material source which can be recovered and reused ¹.

E-waste is being breaking up for it's by products and valuable materials that been bought as raw material by different consumers ¹. Cadmium is often used in electronic products such rechargeable batteries and switches and is one of the most toxic metal that can be found to human however it can be bioaccumulated. Mobile phones have about 40 different by products which can be recovered such as copper and even gold and silver ¹⁸.

2.8 Medical

Medical waste is divided into 3 groups of waste: General municipal solid waste, special (usually contaminated) waste and hazardous waste. Special waste will be send to the incineration while general waste can be recovered, recycled or buried and hazardous waste will be sent to recovery plant ^{4, 19}.

3. Data Collection and Methods

When the plan was being formed in September 2009 it was focused on the materials and volumes while there was no relevance to Namibia in particular or to the different social groups living in Namibia and their culture. Waste management is influenced by social and personal behavior where culture is a major factor in any aspect of its practices and innovations. Namibian culture is very different from European countries.

Information was gathered by interviews of municipality members, businesses and household visits. Some interviews were recorded while some weren't after been cleared that it will be easier to gather information by flowing chat than in an official conversation.

Volumes and current practices of 8 different types of wastes (Plastic, Scrap metal, Paper, Glass, Medical waste, Bio waste, Hazardous waste and Electronic waste) were the main focused issues while future innovations and personal concerns also have been questioned (Appendix 1). The idea was to get a whole picture of the current flows of products and their volumes inside and outside the towns.

While visiting both municipalities the gathered data consists of conversations, interviews and group discussions (few examples can be seen in Appendix 2). Entrepreneurs, municipal authorities and workers, residents, schools teachers and principals, waste management and recycling industry workers, representatives of church, hospital managers and private clinics doctors. Some companies referred us to their main office in Windhoek where meetings with the environmental ministry, large companies and Namibian polytechnic were held. The scheduling of the meetings has been done in a snowball method as some of the meetings were planned days before though some others were referred or mentioned by one of the persons we interviewed.

The main issues needed to be answered were how to promote the local waste management policy and the innovations of current practices in Keetmanshoop and Ondangwa and find the right ways to support exist opportunities that will benefit to the long-term development of waste management in Namibia.

4. Waste management at Keetmanshoop municipality

Keetmanshoop recycling companies collect Glass, Plastic, Paper, Metal, Hazardous, Bio and E-Waste. Clinics and Hospital collect medical waste and its being incinerated at the hospital.

4.1 Metal Waste

Scrap Metal Recycling

There are 6 permanent workers in the company. Scrap metal is collected from the town's dumpsite and from different garages. The municipality used to collect scrap metal from farms in the Karas region, though stated that it doesn't worth the fuel spent on it.

- # Unloading a truck monthly (3 tones Truck).

- # Metal cans – Used to collect in the past though stopped since it wasn't worth it financially

Danny thinks to leave the business to one of his workers and go work in his farm. He felt misbehaved by the municipality and by the town residence after his trials to achieve cans collection has been treated badly by the residence and after he had problem with the municipality about his permit.

4.2 Glass

Coca-Cola

There are 12 workers in the enterprise. Glass bottles are collected and send back to Windhoek. The bottles life cycle starts at the factory, distribute to Windhoek, then to Keetmanshoop. Empty bottles transported to Cape Town and back to the factory.

- # 1000 cases = 18 000 unit per week

- # people get 1,5 N\$/bottle

Welkom Groothandel

Welkom Groothandel is a bottle shop agent of Coca-Cola and Distell. Welkom do not pay money for returning bottles and they do so by alcohol rewarding (Figure 9).

- # 17,000 of 1L beer bottles collected while 14,700 beer bottles sold (7200 Tafel Lager bottles and 7500 Windhoek Lager bottles). 13,500 of 750ml beer bottles collected while 7300 bottles (3 products) sold monthly.
- # 5000 of 1L Coca-Cola bottles and 8000 of 500ml Coca-Cola bottles collected monthly.
- # 2700 of 200ml Wine bottles collected monthly.



Figure 9: Empty used bottles collected by Welkom Groothandel

Southern Recyclers

Southern recycling collects glass from the dumpsite. The glass is crushed and put in sacks when it's separated into colors (Figure 10). Southern recycling pays 20 workers at the dumpsite that collects recyclable waste.

- # Glass –Shipped to SA (Cape Town) once a month. People at dumping site gets 1N\$ per sack.

Namibian Breweries Ltd

The manager in Keetmanshoop referred to high health and safety standards of the company that they are strict when it comes to waste management and recycling. The brewery wants to implement the system but there are no such kind of facilities yet available in Keetmanshoop. The manager had contacted the municipality twice in the past to organize a better system for recycling.

In Namibian Trade Directory it says that Namibian Breweries “*committed to reinvesting back into the Namibian Community in the areas of education, small business support, environmental protection, community based development and awareness of responsible alcohol consumption*”. According to the manager the volume of bottles are to be found in Windhoek but she estimated that they get most of the bottles back.

Castle Breweing Namibia (CBN)

The brewery started the collection and recycling practices in Namibia at January 2010. Due to the date bottles of the company mainly collected by the different bottle collectors such as Distell and Welkom Groothandel.

The company has a good communication and relationship with the municipality and experience in waste management and recycling process as known from South African companies.



Figure 10: Glass waste collected at Keetmanshoop sumpsite by workers of Southern Recyclers.

4.3 Plastic

Southern Recyclers

Southern recycling is the only company in town that collects plastic material, mainly PP material (Figure 13). The company collects plastic from other towns as well in Karas region such as Bethanie, Karasberg and Aroab. There are 9 workers working at the company that separate and compress the waste for shipment.

Plastic – Shipped to SA (Cape Town) once a month. Separated in Keetmanshoop.



Figure 11: Plastic bags before distribution at Plastic Packaging warehouse in Keetmanshoop.



Figure 12: Municipality workers collecting household plastic bags filled with garden waste



Figure 13: Southern Recyclers collected and separated plastic products

4.4 Paper

Southern Recyclers

Southern Recyclers is the only company in town that collects paper for shipment purpose. The company collects cartons from many companies in town, mainly supermarkets and retail business.

- # Cartons – being collected on Monday and Thursday from businesses around town before the municipality does.

- # Old books and paper from schools and UNAM Center

OK Supermarket

OK Supermarket is one of the biggest supermarkets in town. The supermarket collects cartons which get picked by Southern Recyclers every Monday and Thursday. The supermarket has a problem with space to store the cartons and at current situation it is making a mess.

Agra Supermarket

Agra is one of the big supermarkets in town. The supermarket sells food and agriculture products. The supermarket collects all waste in the backyard which is cartons and plastic wraps. Cartons are being collected by Southern Recyclers every Monday and Thursday.

Telecom

Telecom is the landline phones Namibian operator. They provide the phone directories and collect them as well. Due to abuse of the directories they are giving them now only by providing the old directory. These are being collected by Southern Recyclers together with the office paper waste.

4.5 Medical Waste

Clinics

Medical waste in Keetmanshoop is being collected by Willem every Friday. At the day we were joining Willem the amount was

Medical Waste -10 bags (2 municipality bins) and 5 safety needle boxes.

Keetmanshoop Hospital

Keetmanshoop hospital is the main hospital of Karas region. All Keetmanshoop medical waste is being transported to the hospital incinerator and burn at the spot. The hospital demands the departments to take their medical waste and do the same. The hospital has a clear separation process (Figure 14) and mostly it is being followed.

There is a problem with separation of medical, hazardous and general waste at the collection point where general waste, contaminated equipment and x-ray material can be found together.



Figure 5: The National waste separation system in the hospitals

4.6 Bio Waste

OK Supermarket

Expired products are being collected by the supply companies. Expired food is being collected and given to pig farmers around town.

Southern Abattoir

The abattoir has been working for 10-12 years. Municipality refuse collectors come every day once or twice to collect blood and other remains. Skins and livers are collected.

- # Monthly - 594 sheep, 32 Ox are slaughtered.

- # 7-8 drums of leftover waste are collected.

While waiting for the municipality to come the waste is being left outside the Abattoir in the sun which attracts many flies. We advised them to put it in a fridge, keep it fresh and give it to pig farmers around town.

4.7 Hazardous Waste

Wimpie garage

Wimpie garage is one of many garages in town. The garage repairs about 30 cars daily.

- # Collecting car batteries for Scrap Metal Recycling.

- # Oil remaining are being collected by the health officer and burned.

Keetmanshoop dumpsite

Lack of education and awareness causes flammable products to find its way to the dumpsite as general household waste. These are mostly spray products such as deodorant and old oil cans (Figure 15).

Since the waste that arrived to the dumpsite is being burned after recyclable products collected it is providing a great danger to the workers at the dumpsite who stated that exploded cans happened in the past.

4.8 E-Waste

All big companies send their electronic devices to their main office in Windhoek. Small enterprises are using small companies as Computech.

Computech

Computech fix broken computers brought by residence who use the insurance company system. The company uses used computer parts during their fix and stated they do not have much waste. The waste they do have is sent to the insurance companies according to the policy.

5 Laptops and 5 PCs every week.

Lewis

Lewis is a furniture shop in town though sells electronic products as well. Lewis doesn't send its electronic equipment to main office and prefer fix it in town by private company.



Figure 6: Flammable household products become hazardous when waste in being burned.

5. Waste management at Ondangwa municipality

5.1 Metal

Makalani scrap metal

Makalani Scrap Metal is the biggest collector of scrap metal in Ondangwa while another big collector located in Oshakati. Makalani benefit from the close distance to Angola by collecting Aluminum, vehicle scrap and power cables.

They transport all metal to South Africa, about 2-3 trucks (3 tones trucks). Transportation is being made in partnership with the manager's brother. Fuel transportation costs for a drive to Johannesburg are N\$24,000.

Steel – 30-40 tons a month.

Other metals – 30 tons a month.

Coca-Cola / Oshakati

Work together with Rent-a-drum for collection of metal cans. The bottles are being transported to South Africa.

4000 metal cans are being collected in a month.



Figure 7: Metal products can be found all over Ondangwa's dumpsite. Burned or rusty metal cannot compact together and therefore considered useless for metal collectors.

5.2 Glass

6000 Liquor bottle store

The bottle shop is one of many who collect glass bottles. They manage a recycling rate of 85% of them by charging N\$ 1 when buying the bottle and refunding that when returning them the bottle. They sell bottles to Namibian Breweries and Coca-Cola in Oshakati.

- # Glass – 5000/ week. Collect only 500ml and 750ml bottles for Namibian breweries and 1.5L and 350 ml bottles for Coca-Cola.
- # Carton – Collecting used cartons for customers. Torn cartons collected by the municipality.

Fasel Supermarket

Fasel Supermarket is located at the center of Ondangwa and run by two Indian brothers. The supermarket is shipping recyclable glass to India.

- # 5-6 trucks are estimation of 165tons monthly (2080 cases) with 100% of recycling.

Coca-Cola / Oshakati

Work together with Rent-a-drum on the collection of glass bottles which been crushed into small pieces and transported to Dubai in 1 ton bags (Figure 17).

- # 77,600 bottles are being collected in a month.



Figure 8: collected crashed bottles at ondangwa dumpsite.

5.3 Plastic

Scrap Salvage

Luka Mathias (pastor in the Pentecostal church called Assembly of God) has been collecting plastic for 4 years from different dumpsites in northern Namibia (Figure 18). He employs 10 workers in Ondangwa and 15 in Oshakati. Luka Mathias collects PET plastic which he sends to Cape Town and HDPE, PVC and PED which he takes to Walvis Bay.

- # 20 tons/month (Ondangwa and Ongwediva dumping sites).
- # 40-50 tons/month (all northern areas)

Plastic Technology Center

The company collects plastic bags and other LDPE, HDPE plastics materials and produce water/irrigation black plastic pipes. They collect plastic from Windhoek and Tsumeb as well. Transportation costs stands around 3 N\$7,000 for one truck a month rate. At the moment they collect plastic from 5 different collectors and from the dumping site. Manager stated that Angola is a very big opportunity for business growth in future.

- # 33 tons every 3 weeks and 10 tons in Windhoek.

Fatima Plastic Pty Ltd. /Oshikango (60km from Ondangwa)

Managed by 2 Pakistani brothers in Oshikango town and is a quite big business with 92 permanent and 12 temporary workers. They benefit from the close border of Angola from plastic material collection and by exporting 70% of their products there. Unlike Plastic Technology Center they collect the PP plastic and working on bringing machinery that will allow them to collect PET products.

They produce basins and buckets mostly though only 30% of their products sell in Namibia due to legislation.

- # Monthly export of N\$2.5million.
- # 3 tons weekly.
- # 50L bucket cost N\$40.

Pick N Pay Supermarket

PNP is one of few big supermarkets and buys regularly plastic bags for its customers.

1000 plastic bags being bought every week.

Coca-Cola Oshakati

Work together with Rent-a-drum on the collection of plastic bottles. The bottles are being transported to Windhoek.

2400 bottles are being collected in a month.

Namibian Dairies / Oshakati

Namibian dairies collect products from the whole region. The products of the company are mostly PP plastic bottles of different food products.

4-5 trucks (22 tons) every week.

Average of one truck is estimated of 15,000.



Figure 9: collected plastic products at ondangwa's dumpsite by scrap salvage.

5.4 Medical Waste

Clinic

Ondangwa has only one general clinic. There are 4 nurses working during the day with one chief nurse. All waste is collected by the municipality and transferred to Oshakati hospital's incinerator. All waste collected outside, in an open entrance yard that expose to animals.

About 20 bags daily. 2-3 needle safety boxes.

Dentist clinic

Ondangwa has 3 dentist clinics. All waste is being piled in small room and collected by the municipality twice a month and taken to Onandjokwe hospital's incinerator. The municipality collects general waste (municipality bin) twice a week and taken to the dumpsite.

4 bags in a month and big safety needle box (30cm²).

2 municipality bins of general waste.

Onandjokwe Hospital/Oniipa

Onandjokwe is the closest hospital to Ondangwa. The hospital is relatively organized and had an environmental management project before. While walking between the different buildings it is easy to notice the garbage drums located in many places even though some look in a very bad condition.

The hospital has a problem with separation of waste. General waste bags mixed with medical waste bags due to lack of colored bags. These awful situation causes health and environment problems.

The waste is being collected in a cement fenced separation points which has holes in the fence caused by dogs while there is no protection from birds either. The medical waste is taken to the incinerator while the general waste is taken to Ondangwa's dumpsite and burned immediately. During the burning some medical waste is being found which indicate the need of a better separation at the hospital.

The dumpsite is located about 10km away from the hospital which is long way for a tractor to drive while the net covering the tractor is all torn up some waste even dropped during the ride.

Medical waste - 20 bags daily.

General waste – 2 full tractor's wagon.



Figure 10: Medical waste collected for incineration (Left) and x ray hazardous waste collected at Onandjokwe hospital (Right).

5.5 Bio Waste

Ondangwa municipality tries to organize the illegal dumping of waste in public areas while most of that waste is garden waste. The municipality collects the garden waste and takes it to the dumpsite.

5.6 Hazardous Waste

Onandjokwe Hospital/Oniipa

Hazardous waste such as x-ray liquid and sheets is collected (Figure 19) and shipped to South Africa. The liquid is being collected in plastic barrels due its corrosive behavior to the floor and walls. The x-ray sheets are being collected in a small room in boxes.

Ondangwa dumpsite

Similar to Keetmanshoop situation, the lack of education and awareness causes flammable products to find its way to the dumpsite as general household and business waste. Spray products such as deodorant and old oil cans (Figure 16) can be found easily.

5.7 E-Waste

Second hand mobile shop

Ondangwa has many second hand mobile shops that fix and sell old mobiles. The lady who runs the shop stated that it is usually made as a second business.

10 phones a day.

6. Recycling Opportunities and local opinions

6.1 Keetmanshoop

Coca-Cola

Concerning environmental issues, the manager said that people have to take care of the environment. That means to educate people of reduce and recycle their waste with campaigns and workshops that will increase awareness.

Business should respect the principles and follow the standards and give training to its staff regularly to increase awareness of managers and workers. Children can learn how to recycle and reuse plastic in the school projects. There is ignorance and currently it is being totally ignored.

Ok supermarket

The supermarket tried to promote recycling of plastic and glass. The supermarket tried to help street kids by paying them for collected waste bags (N\$1 per bag). The manager stated that the trial worked though after few months the kids felt like they are doing too hard work for too less money and just stopped.

Oranje Verspreiders

Oranje's manager was very eager about transported materials or even more about recycling of paper which seems like a less collected material. He said that if it's possible he could take recycled paper to pulp and paper mill in Durban, South Africa.

We got information about transportation rates and the pay Namibian companies pay for exporting all waste to South Africa. Transportation to Cape Town, Similar to Johannesburg, will cost around N\$8000 while same material transported to Windhoek will cost N\$2500.

Southern Recyclers

Southern Recyclers stated that a pressing machine cost N\$180,000. They asked for financial help to support their collection in town around Karas region.

6.2 Ondangwa

Plastic Technology Center's manager said they owned a Glass machine before and that 2nd hand machine should cost N\$70,000. The manager stated that Angola is a big opportunity and should be invested more.



Figure 20: Hazardous products can be found all over ondangwa's dumpsite



Figure 21: Lack of monitoring at the dumpsite allow entrance of cattle and goats

7. Narrative approach to waste management

Environmental and waste management stories and problems in particular that have been collected during the field work (October-November 2009) were analyzed.

Through the years, the different environmental terms have been shaped by the change of the cultural way people used to live by such as hunting, fishing, growing and collecting food, raise cattle or even domestic animals. The modern way of living got mixed through the years with the old traditions that kept being taught and passed on. This led to a current situation where people do not understand or do not realize the consequences of their actions. Throwing garbage on the street, over the fence, on the sides of the roads or open fields was used to be done though the modern industrialized waste made these cultural practices to be unsustainable.

Waste management is being often used in the English terms rather than in the local spoken language (Nama in Keetmanshoop and Oshiwambo in Ondangwa). The practices of these foreign terms are being done on daily basis and naturally these terms do exist in Oshiwambo. *Ogalungulua* (or *Oshalongulula*) was used for recycling where new products are made from broken parts. *Ogushilonkita* used to describe the reuse of water and food.

During the field work people told about the waste management practices exist in Namibia. Windhoek was mentioned often due to its cleanness and its working landfill management. Luderitz was mentioned cause of its youth league that manages and monitors the town's landfill. Rosh-Pinah was mentioned of its collection point system operated and monitored by the mining industry. Swakopmund and Otavi are fighting for the recognition and awareness of plastic bags consumption together with entrepreneurs. In swakopmund there are many community programs such as the environmental ambassadors in schools that try to educate the community.

7.1 Narratives from Keetmanshoop

The modern life changed traditional and cultural way of living such farming. In the urban environment people got to situation where the old traditional way of living is no

longer useful and modern urbanized way of living took over. Unemployment and lack of work opportunities are the main outcome of this big cultural change.

Financial problems create other problems. In case residents don't pay their water bills (mostly happened to ones living in the informal settlement) the water is cut off. The result is that toilets are getting full of waste which leads to big hygiene problem. Reopening the water pipes will not change the situation since the toilet system is already blocked. In the hot climate the effect of smell gets to be bigger as well. Dry toilets were mentioned as a possible solution.

Childhood is the time in person's life when children learn and being taught from their parents about their values. While principles emphasized the importance of parents' education to the children's development the unemployment creates a phenomena where parents leave to work in other parts of Namibia and leave their children under the supervision of their grandparents who lack the ability to control the children and force them to go to school. The unemployment and the fact there are staying at home triggers many parents into drinking behavior and expose children to violence in worse case or simply neglected.

Stealing of recyclable items like metal from fences or railways was also common. When municipality built toilets for informal settlement, it worked for a month or two but in the end people stole the doors and pots while the municipality maintenance faced a worthless effort. One example of recycling material stealing happened when a collector of recyclable material ripped off residents buy manipulating the weigh scale and instead of 1kg it showed 500g. Residents favored him since he offered N\$0.20 to pay more than his competitors.

The town dump site is where plastic, glass, metal and wood can be found. According to one entrepreneur, there were 5 people at the dumpsite when he started the collection of waste there. *“One of them was a little boy, about 4 years old. His mother died and his father died and he stayed there, street kid. He is a big guy now. And he still comes every day, comes and sells it. So, he makes a living out of it but the other people tried to stop him each and every time. If somebody can bring it in to the heads that there is money, there is living then it will be much better but they see it as money for drinking and everything, they buy beer.”*

One stereotype of traditional Nama-people was related to development: *“they don’t see that you come to me and get 5 dollar because you want to try and reach something. Now they see, okay that guy reached something...you also must gain nothing. And that is the way they live. If one have nothing all of them must have nothing. You can name it jealousy if one person reaches something he must be stopped, don’t reach anything”*.

Most children at the dump site lives in the streets and do not go to school. *“It is very difficult, they steal other people things and parents don’t worry what happens to the kid. The morning the father go, have a lot of drinks, sleep whole day, doesn’t worry about the food for children...and the government tries It’s best but there is no way. Yeah, there are programs; one or two times they succeed, other times they just go on like that.”*

The dump site was built in the 1970’s and as a result it has no waste management. There is no monitoring on what and where waste is being dumped. Residents dump everything in the dumping site as long they do not get money for it.

As the town growth the residential houses are being built closer to the dumpsite which makes residents to complain about the smoke and the smell. The relatively short distance prevent the building of a new fence (Old fence was stolen) and allow a constant movement of residents in and out the dumpsite. The municipality burns the waste to prevent the wind blow to spread it away (Figure 22).



Figure 22: Workers and residents separating and collecting waste at Keetmanshoop dumpsite.

The relocation of the dumpsite brought up and discussed many times in the past and was even researched for possible locations. *“If you take it far away the distance will be a problem for residents who like to get rid of the garden refuse. The main problem with*

refuse removal, dumping site and recycling is one thing. And as far as I'm concerned I'd make anybody to the whole function away from municipality."

Well monitored landfill or recycling centre needs facilities: *"you need water, you need electricity, you have to fence it off, to stick with the health regulations. The only thing the municipality can do is to enforce the law and order and see that everything is clean and tidy there."* and a suggestion of building of different cages and people could sort the refuse in the middle and throw cans in one cage and bottles in one and so on came up. *"Have a small office there with the caretakers house. So they can have some municipality officers there 24 hours on the site as they are doing in Windhoek, ask for small entrance fee, when people enter the site (Figure 17).*

There is a big ignorance about separation of waste and residents do not understand how to use it. *"And expect me to beer bottles in one and beer cans in one and plastic bags in another one ...you will not educate people to do that. Privatize it, let somebody just take it away on my own expenses then so that the municipality save on vehicle, save on people workers there."* Separation might be the ideal solution of waste separation but in the current situation the solution is to throw everything in their bin, let it collected by the refuse contractor that transport all waste into the dumping site and than if anyone would like to collect any material they do it there.

The municipality has a department that responsible for collection of garden waste, maintenance of the public parks, graveyards and the town's pool. They routinely collecting waste every Tuesday and Thursday. Lack of maintenance causes long treatment periods of the vehicles and machinery mainly since the department does not have a mechanic and the one working there now is not qualified.

On Mondays and Thursdays the municipality cleans green drums (business waste). The cost of removal is N\$80 (about 8€) which is less than the work of a tipper. During August there is a lot of garden waste and the removal is made for free. Radio announcements are being used to inform all the residents who need soil for the garden. The department suffers from unskilled personnel who haven't been qualified which degrading the efficiency of the department and prevent them from providing a better service.

The lack of education can be easily shown by the residents littering in the street. The municipality provides littering bins (Figure 23) however residents keep litter and in some cases leave their bottles or paper under the litter bin.



Figure 23: Municipality collection of household waste bins in Keetmanshoop

The municipality formed cleaning groups as a solution. Unemployed residents work for 2 days in a week for a period of 1 month. Each group has 5 workers and a leader person. As result residents sees the community groups as a work opportunity and a permission to litter. In an average a group will collect 20 bags of waste. The workers get masks, vests and plastic bags although not all use these while they need to ask for gloves and pay N\$10 from their own pocket.

Household waste is being collected once a week from the residential areas however residents still dump their waste in open areas and nearby the roads. *“They find it...drive so far out town that...people are lazy. Here to establish for each suburb its own dumping site, only for garden refuse but I don’t know I’m a bit skeptical of that idea. Because you started with garden refuse but tomorrow it will be the household refuse”*. The municipality decided to form a fine system to fight illegal dumping by rewarding the reporter with N\$200 (20€) and hands fine of N\$1000(100€) in 2007 and N\$2000 (200€) in 2008 for the person who been reported though only in case when the resident who reported can provide evidence.

There is no written environmental policy in Keetmanshoop though the daily routine seems to work well. There are engineering positions unoccupied and a health officer working part time as a consultant. There are enough general workers though not enough decision making personnel to provide answers and long time solutions. *“It comes that*

you have something on a daily basis, an hour to hour, you need someone in the office to administrate and to run that division. It is quite difficult as it is now”.

“Swapo youth league took the dumping site of Luderitz. They put a fence around it, they put a security at the gate and ask every vehicle that comes in 10 dollar fee for off loading and use that money for recycling.” This management solution was offered to Keetmanshoop municipality by one of the entrepreneurs in town though was rejected.

Entrepreneurs in Keetmanshoop call the municipality permissions and transportation of waste and recycling practices as a monopoly. *“Why can’t it be done in Keetmanshoop? Last year (2008) when the price of scrap metal was high it was exported to India (every month 265 tones) while according to the entrepreneur, the company in Cape Town received 500 tons of scrap metal every month from Namibia. “The problem is that the people of Namibia and the facilities don’t allow doing recycling here”.* Entrepreneurs seem to get frustrated by the current situation and the lack of possible competition.

Southern Recyclers operates a competition of bottle collection in primary schools (Figure 24). The principles of the school see these as a helpful tool and part of the education of waste management. *“I’m happy and glad to inform you about the recycling competition that our school is part of... It is contributing to our country, the beauty and uniqueness of our town. So it is a good thing.”*



Figure 11: School waste collection project made by Southern Recyclers.

The children participating influencing their families and promote the awareness for recycling of waste though most residents are lack on that information and do not know

about waste management since they do not come across such activities. *“The households in general are not aware of the essence of this project. This project is good, but I think there is a need to educate our community, because they lack the information. If that is done, things will change.”*

7.2 Narratives from Ondangwa

Children traditionally used to be told stories about different environmental approaches which will keep the sustainability of life. The modern life has an effect on how this traditions and the understanding of residents changes.

The modern waste such as plastic is a relatively new material which traditionally has never been taught about. These days the modern waste is being collected and burned to keep the surroundings clean and reduce the danger for the cattle.

Each of the 9 settlements of Ondangwa has a committee. During the field work there was a need to understand the daily life of residents, especially ones who suffer most from hygiene and lack of waste management education. The informal settlement suffers from lack of waste management system while residents use open fields to dump their waste. *“People take it to the open space just by themselves. During the rainy season water will bring back some of the waste”*. The residents understand the need to collect waste and educate residents *“Waste is a very bad thing; It can cause disease and harm to the people”*.

There is miscommunication between the municipality and the informal settlement. It was important for residents to have a representative of the municipality at the meeting so they could hear them out however the municipality representative states it would only interrupt to hear the real problems *“Maybe we can encourage the Town Council to come closer to the people, give information to the people, change ideas. Maybe it will help”* though they are frustrated from the current situation *“They will just refer you to another person and you don’t get the answer”*.

The frustration and lack of education is a result of the informal settlement temporary status. Residents might willing to innovate and change their way of living though the uncertainty of whether they can be told to leave the next day prevent them to try *“if you*

make yourself a garden, it is of no use” and the life are based on living by the day where waste management practices naturally does not get high importance.

The municipality uses the committee meetings, radio, news papers and newsletters to inform residents. Residents can collect a refuse bin when they pay their water bill though not all of them were aware of that service *”the people of Ondangwa, majority of them don’t know whether they suppose to be part and parcel of the waste management. They think they can just clean their yard, they can cut their trees and dump it to the open space without understanding that maybe they (Town Council) will come and remove that”.*

Similarly to Keetmanshoop there are litter cleaning groups in Ondangwa as well and the municipality hires 5 workers on daily basis for that purpose. While 2 cleaning contractors (having yearly contracts) are in charge of cleaning the west and east of Óndangwa the municipality is in charge of the town council area, the center of Ondangwa (Figure 25). Waste loads changes between the beginning and middle of the month (half or one full truck) and its end (2 full trucks). There is no separation of waste and all household waste even though both municipality and collectors are aware of the electronic and hazardous wastes problematic characteristics, it is all taken to the dumpsite.



Figure 12: One of Ondangwa's waste collector's workers.

The town dumpsite was build in the 1960’s and faced floods problem repeatedly. The site is fenced and divided into 3 different areas for household waste, garden waste and

medical waste. The floods cause these to mix or being dumped at different location outside the fence.

The general medical waste transported to the dumpsite from Onandjokwe hospital suppose to contain general waste only though due to wrong waste management practices in the hospital there is occasionally contaminated medical waste found as well. The medical waste is being burned on the spot by the hospital workers.

Onandjokwe is located in the nearby village Oniipa. The hospital transports its general waste to Ondangwa's dumpsite while contaminated waste is being burned in the hospital's incinerator. The hospital has a department of waste management that responsible for the collection, burning and transportation of the waste.

The main problem regarding waste management practices was the separation of waste. The hospital follows the color separation bags though at times there are only black colored bags which causes the mixture of waste. Safety boxes and cleaning chemicals are not always available either.

The hospital's incinerator is being used by the other hospitals in the area when needed. *"...a lot of time incinerator in other places is broken, so they bring it here; like Ombalantu, Okahao, Oshakati, from all the places. Hospitals need to help each other."* After burned the waste ash is taken to the dumpsite.

The hospital had a waste management project in past and it is providing the current practices though through time some practices got neglected or just stopped being followed *"It was good and progressing but it died"*. The lack of maintenance easily noticed by the burned waste drums that have no bottom and the separation cages were torn and allowed animals (mostly deserted dogs) the access to the waste.

Composting is one practice which kept being taught through the years in primary schools all around Namibia. The compost usually contains grass, leaves, animal feces, ash, potatoes peel and old tea and coffee leaves. The dry soil need to be irrigated in first week and covered by plastic bag to prevent the evaporation and keep the compost moisture.

8. Discussion

Namibia currently is in a process of waste management policy making. Since there is no national waste management policy, each local municipality has its own laws and regulations based on the different problems and the future plans.

During the interviews there was a problem whether you could trust the answer or not. Household interviews were the best example where many answers are questionable for any type of recommendation for future steps that could be practical and work. There were just too many different answers and opposite of one another. Residents stated there is a need of separation point in the neighborhood while their neighbors thought it won't work and waste has to be collected from houses using private bins. In one case an old resident answered that he doesn't separate waste though he gives his kitchen waste to the dogs.

The current process both municipalities use to prevent illegal dumping is by giving fines for those who get reported and caught. This leads a problematic situation with wrong accusations which does more harm than good.

Routine work in environmental health sector takes a lot of energy and still some vital things remain unsolved (like the waste management and sanitation in informal settlements). There is a distance in the relationship between residents and town council officers and communication from town council towards residents is based on orders and don'ts. Residents are informed by newsletters that are sent together with the water bill. In case you don't have your own water meter (like having one together with neighbor) you miss the information given. Quite many people said also that we are not so much into readings, so the information may now reach everyone.

In some small enterprises entrepreneurs didn't have much to say about waste management or interest towards it. In one market they just wanted to help the customer by providing plastic bags, but didn't care what happens to them after use while in other place it was said that town council should provide the bins for recycling. In general it can be concluded that waste was not an issue in Ondangwa from the point of view of businesses concerning the places we visited.

9. Recommendations for future actions

In the following section recommendations that can help to the promotion and current practices of waste management in Namibia are being suggested.

During the survey it became obvious that there is a need in Namibia to update legislation concerning waste management. It seems that the waste management practices are fragmented and regulations vary from municipality to another.

The lack of national policy legislation prevents municipalities to face key challenges in waste management and recycling enforcement. Private companies and entrepreneurs need to be responsible for their products, collect used products and provide a recycling system that will help in the reduction of MSW landfilling. Producers' responsibility is a whole culture in the waste management field and understanding of that by businesses and residents is essential to the building of a sustainable system where the production of products is manufactured with the ability to be recycled and collected by the producer as a closure of the product life cycle²⁰.

There is also a need to emphasize impacts of waste in town planning, both in the field and in educational institutions. Impacts and influences of waste by the municipality and decision makers are essential for the residence health and the preventions of bigger problems in future such as the relocation and usage of dumpsite.

It became obvious that local environmental officers do not know that much about the activities of other municipalities. Therefore a network of delivering good practices to each other would be useful to improve the waste management current practices. Keetmanshoop and Ondangwa are not just different by the geographical distance but by culture and the approaches on waste management issues while cooperation of the municipalities and others can be beneficial for the future development.

Dry toilets project might be an answer to the sanitation problem in the informal settlement areas in both municipalities. The problem arises when residents do not pay their water bill (or do not have one) and the municipality has no choice but shut it down. Dry toilets will give answer to the expensive usage of water. The temporary status of the informal settlements prevents from the municipalities to provide a solid solution.

The following section will present the detailed suggestions and recommendations of future acts that might help improve the waste management practice in Ondangwa and Keetmashoop.

9.1 Ondangwa

The information given to the residents is controversial and during household questionnaire residents had mixed and sometimes contradict information of how to treat and where to dispose waste. Garden waste can be utilized in public gardens and households whether by compost or heating source other than just being taken to the municipality dumpsite. Misgav regional council in Israel ¹⁰ collects garden waste that being chopped and used as bedding covers in local public gardens. Garden waste is not typical waste and unlike plastic, glass and metal waste that have a high decomposition rate and it can be used as compost and bedding cover for public recreational areas.

Since there are no neighborhood collection points, it might be a good idea to establish ones. It might give answer to illegal dumping of waste. This will answer the problem of the informal settlement areas where illegal dumping is done on regular basis. The funding and management of the collection points needs to be discussed and decided.

Funds allocation for colored bags in Onandjokwe hospital is highly recommended. The separation of waste correctly prevents transportation of contaminated waste outside the hospital and the spreading of diseases. Fixed, clean and safe separation points of waste will reduce the danger of disease spread by animals and birds. Usage of protecting equipment as gloves will prevent harm to workers who are regularly exposed to waste during the day. Covering the waste when transporting it to the dumpsite and its maintenance regularly will reduce the spread of waste along the road ⁴.

Relocation of the dumping site to a new remote location will eliminate direct hazards as air pollution. Closed dumpsite is a good ground for recreational areas for the public benefit and is dangerous for residential purpose. Monitoring and maintenance of the dumpsite around the dumpsite will prevent the entrance of unwanted animals and residents ^{1,2}.

While collection of household waste is being done by two companies the municipality is the responsible for the garden waste collection in town. Current waste collection practices are being done by high workforce such usage of pitchforks to collect garden waste. Shovel truck will optimize time and workforce and be much more efficient.

9.2 Keetmanshoop

Keetmanshoop doesn't have permanent health officer and current situation is that waste management being postponed if there is no immediate situation to provide answers for. Permanent health officer will have more time and will give better answers to long term plans regarding waste management such as landfill relocation and waste management policy writing.

Relocation of the dumpsite already been studied and future location has been chosen. The current dumpsite is too close to the residential areas and causing a situation in which it's impossible to maintain and monitor the dumpsite correctly. The relocation of the dumpsite will answer problems of vandalism and will eliminate direct hazards^{1,2}.

The Keetmanshoop hospital is well organized and maintained though colored bags are needed to prevent general waste, contaminated and hazardous waste being mixed up. Protection equipment such as gloves and cleaning chemicals keep the health of both employees and patients. Mercury waste can be sent to treatment plants in South Africa or USA by spilt kits shipment⁴.

Fuji photo shop was positive about collection of batteries though they asked for the municipality help of collection on monthly basis.

Dry toilets project might be an answer to sanitation problem in the informal settlement areas. The problem arises when residents do not pay their water bill and the municipality has no choice but shut it down. Dry toilets will give answer to the expensive usage of water.

Environmental education can be part of holistic approach to social problems. There are examples of drop-in centers where children learn to take care of themselves, adapt skills and grow towards responsible citizens.

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Appendices

Appendix 1: Plan for Field work in Namibia

Week 44 (5.-9.October)

Arrival to WDHK (Ms.M-M.Polvinen)

Meetings

- Mr.L.Moyo and Mr.F. Petrus
- Ms.Raili Hasheela
- Ms.Dora Shivute
- Mr.F.Coetzee (Health Officer/Keetmanshoop)
- Mr.Teo Nghitila (MET/Ministry of Environment and Tourism)
- Dr. Tjama Tjiwikua (Rector, Polytechnic of Namibia)

Contacts

- Mr.Paul Njodhi (Health Officer/Ondangwa)
- Mr.Jan Venter (Chief of Health Services, City of Windhoek)
- Mr. Sap Joubert (Rent-A-Drum)
- Collect-A-Can
- Namibia Brewerie, sales&distribution (Windhoek, Keetmanshoop, Oshakati)

Visits

- Spar/Maerua Mall & recycling points in Windhoek etc.

Week 42-44 October

Monday 12.10:

- Arrival to WDHK (Mr.Y.Magen)
- Meeting with research team (Polytechnic, TAMK, UTA)
- Dinner together

13.-28.October

Case Keetmanshoop

Tuesday 13.10:

- Travelling Windhoek-Keetmanshoop
- Meeting with Mr.Rooi/Local Economic Development&Community Services, Keetmanshoop Municipality

Wednesday 14.10

- Meeting with Health Officer Mr.Coetzee
- Visits to 2 recycling enterprise: Karas Environmental Technology/Keetmanshoop waste management & recycle (Mr. B. Hendricks) and Southern Recyclers (Mr.Malcom Pieters)

Thursday 15.10

- Visit to municipality landfill and a day with waste collectors

Friday 16.10

- following LCA of plastic products: [selected local enterprises]
- discussions/mini-interviews with local residents
- visit to NGO'?

Monday 19.10-Tuesday 27.10

- Mornings: visits to selected enterprises following LCA-paths of glass, plastics etc.

-Afternoons: discussions/mini-interviews with local residents

28-30.October days in **Windhoek** (if needed)

-visits, meetings, information collection from different sources

Week 45-46

2-13.November

Case Ondangwa

Meeting with Mr.Paul Njodhi (Health Officer/Ondangwa)

Visit to municipality landfill and a day with waste collectors

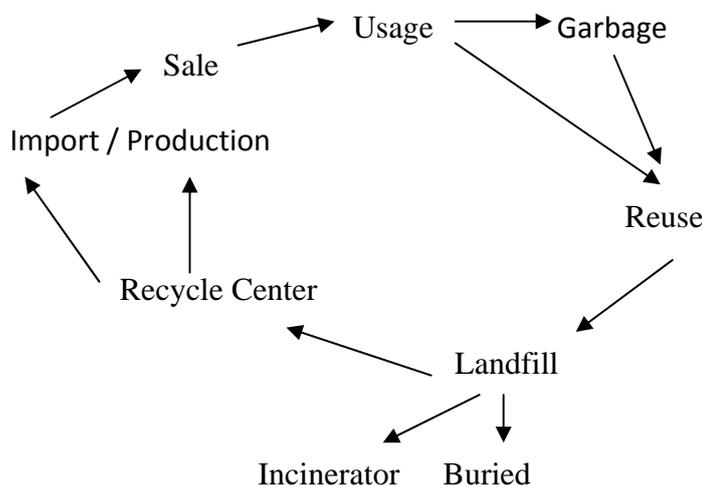
Mornings: visits to selected enterprises following LCA-paths of glass, plastics etc..

Afternoons: discussions/mini-interviews with local residents

Ondandjokwe Hospital (hazardous waste)

14.-15.November end of field work period, back to Windhoek/Finland

Life Cycle Assessments



1. Glass Bottles

1. Import / Production – Is there any production? From where bottles are being import? How many?
2. Sale – Shops only? How much? What's the price?
3. Reuse – How common is it?
4. Garbage – How many find the way to the garbage?
5. Landfill – How do the bottles arrive to the landfill? How do they get treated there?
6. Recycle Center – How many arrive from garbage collection points? How many arrive from landfills?
7. Incinerator / buried – How many bottles do get incinerated?

2. Plastic Bags

1. Import / Production – Is there any production? From where bags are being import? How many?
2. Sale – Shops only? How much? What's the price?
3. Reuse – How common is it?
4. Garbage – How many find the way to the garbage?
5. Landfill – How do the bags arrive to the landfill? How do they get treated there?
6. Recycle Center – Do plastic bags are recycle? How many arrive from landfills?
7. Incinerator / buried – How many bags do get incinerated?

3. Garden and Bio Waste

1. Amount – How much?
2. Garbage – How do garden waste being collected? Separated?
3. Landfill – How do the garden waste arrive to the landfill? How does it get treated?
4. Buried – Does it being separated at all? Does all being buried in the landfill?

4. Metal Waste (Cans)

1. Import / Production – Is there any production? From where cans are being import? How many?
2. Sale – Shops only? How much?
3. Garbage – How many find the way to the garbage? Is it being separated in Collection point?
4. Landfill – How do the cans arrive to the landfill? How do they get treated there?
5. Recycle Center – How many arrive from garbage collection points? How many arrive from landfills?
6. Incinerator / buried – How many cans do get incinerated? Buried?

5. Paper (Copy, Cartons, News Papers)

1. Import / Production – How much is being produced? How much? From where papers are being import? How much?
2. Sale – Who sale paper? How much?
3. Reuse – How common is it? Office Waste? Education Waste?
4. Garbage – How much find the way to the garbage? Does it get separated in collection points?
5. Landfill – How does the papers arrive to the landfill? How does it get treated there?
6. Recycle Center – How much arrive from garbage collection points? How much arrive from landfills?
7. Incinerator / buried – How much paper do get incinerated/buried?

6. Hazardous waste and E-waste.

1. Import / Production – How much is imported / produced? From where?
2. Sale – Who sales e-waste/hazardous waste? How much?
3. Reuse – Is there any form of e-waste and hazardous waste reused?
4. Garbage – How much find the way to the garbage? Separated?
5. Recycle Center /Landfill – How much arrives to recycle center? How does treated in the Landfills?

Appendix 2 – Interview example

Description: Interview with the health officer of Keetmanshoop during a drive at different locations and sites.

Yoav: How often they go to clean areas?

Health Officer: It depends; we have tried to do it every second to third month. It depends on the availability of the machinery and the funding and all the staff. This area here is informal settlement area. Especially for this suburb, it is a part where we make use of those community groups, just 5 or 6 groups. They are responsible of each one in certain areas. You see the areas... picking up. They are provided with these vests, masks and gloves. And refuse bins.

Petrus: And they are just on contract or...

Health Officer: Yeah they are on contract they are working two days per week in month time and then totally new group come. So basically..it is time over here, you will get, what it is 3 times 12, it is 3600 people per year from part of the community who used to clean their area.

Minna-Maarit: so you have trained quite many people.

Health Officer: yeah. Not now. On the other hand the problem we have on the other hand is, it is a good thing to do it like this but the thing is we get...? ..In town there was no refuse bins next to the street. That orange ones we have started to put up 2 years 3 years ago. Works very good, put people still drop their papers next to it. Then we started to daily cleaning, sweeping off the streets. Very good, but now we also get some people, they walk pass the refuse bin still dump their paper or empty bottles. And when you confront them they say, no man, you at the municipality are paying these guys to do clean, so they are paid to clean so we can throw wherever we want to. That is sort of... so there a positive and negative...

Health Officer: Here we have problem with illegal dumping, we have started some year or so ago, we sign some places dumping over here is illegal..and we even started with a fine system of if someone see me dumping refuse they can report me to the municipality and if I can be identified positively the reporter gets a reward of 200 N\$ and we fine the ? dumper with 1000 N\$. That worked quite well..last year one thousand dollar was increased to 2000 \$, it works good but there were also some problems like people doing people was reported but they started arguing no but something...there was some lack of evidence. These are some of the boards they are replaced now.

Yoav: What is the reason they dump it here? Is it just convenient?

Health Officer: They find it...drive so far out town that... people are lazy. Here to establish for each suburb its own dumping site, only for garden refuse but I don't know I'm a bit skeptical of that idea. Because you'll started with garden refuse but tomorrow it will be the household refuse and..

- Minna-Maarit: But if there would be somebody taking responsible of the area, hosting or something...
- Health Officer: Yeah, at every corner, previously we had had the problem with where the refuse was dump but every since we started to make use the...these groups that problem changed.
- Minna-Maarit: And it is good that they come inside from the community.
- Health Officer: Yeah.
- Minna-Maarit: and what kinds of regulations there are concerning these informal settlements? Are there?
- Health Officer: Kind of?
- Minna-Maarit: Kind of regulations?
- Health Officer: No, they are the same regulations as the rest of the town.
- Minna-Maarit: Are they paying something?
- Health Officer: They are paying something, some amount for the, tax for the earth, and for their water and sanitation and also refuse removal was also in this area. Remove refuse twice a week. They pay per month.
- Minna-Maarit: And they have some kind of sanitation?
- Health Officer: Yeah...most of it, that little * there at the corner...this area is served with sewer and water, each house has their own sewer connection point and water point but further back? Municipality has built in a block of four; in the middle of it build toilets. Which was good idea but after a month or two they started using paper? Stealing the doors, stealing the pots, systems and the time when I was within we tried to maintain it is useless effort.

Description: Interview with community workers in Keetmanshoop with translation help.

- Minna-Maarit: How are you? We are doing research in waste management. Finding out how many bags and what kind of rubbish, garbage there is...what do you find, is there like plastic, glass..?
- Worker: Twenty bags in day.
- Yoav: For the entire group or just one
- Worker: All the group.
- Yoav: What types of waste, garbage find in the fields?
- Worker: Plastic.
- Minna-Maarit: If you can translate, what is their experience of their work?
- Worker: During the days maybe collect some 20 bags with her group.
- Willem: They say the work is okay but the warmth is not that good.
- Minna-Maarit: Okay. And how do they feel, I mean, do they think that people would be able to recycle or do they have solution that there would not been, how could we like educate people that they wouldn't rubbish like this way?
- Willem: Like this way?
- Worker: They say they enjoy the work. They have no problem with the work, because in the south there is no work. That is the reason they are continuing.
- Minna-Maarit: So we come from Finland, where there is quite cold at the moment.

- Yoav: Maybe minus now.
- Willem: But how is the weather here? Is it very hot?
- Yoav: Well, I am used, I'm from Israel originally. I was just working in the desert for 6 months. It is quite the same.
- Willem: Did you like it?
- Yoav: No.
- Willem: We're here in the south, you see, the sun is...
- Minna-Maarit: And Petrus comes from Windhoek and Onankali.
- Minna-Maarit: I'd just want to make one question the traditional culture and this modern culture or modern things, so is there any connection like, I'm just looking, finding away to connect those old stories like you have cultural stories and these modern things. Like if you'd like to ...yeah.
- Willem: I don't know because the traditional leaders are not coming to us and ask for us what is our problem and like this, they are just working here.
- Minna-Maarit: Do you also have stories that you used to tell to children?
- Willem: Yeah, not yet.
- Willem: She says yes.
- Minna-Maarit: Is there anything that there is this idea of reusing things or something related to waste management..?
- Willem: The group leader says they are talking in the family about waste management. They are talking a lot of story.
- Willem: But people are not interested of these kind of things.
- Minna-Maarit: Why not?
- Willem: I don't know. Nainen ei suostu pitämään liiviä, hänen olisi käytettävä, koska se on hänen työtään ja siitä maksetaan hänelle..
- Petrus: So the young ones are not happy.
- Willem: The young ones are not happy with to pick up the waste.
- Minna-Maarit: But do they put it in the dustbin..?
- Willem: Maybe they put it in the dustbin I don't know but when I say, they, but some of them are continuing with us.
- Petrus: So there are young ones.
- Willem: Yes, there are young ones, they are coming to the group leaders and the group leaders take their name. That's how they are in.