

**Perceptions of Waste Management in Different Income Households in Cosmo  
City, South Africa**

by

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## DECLARATION

Student Number: 3098785

I declare that \* Perceptions of Waste Management in different income households in Cosmo City, South Africa is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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SIGNATURE

(Mr D.L. MPHAKA)

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DATE

## **DEDICATION**

To the memory of my late father and sister, Abram Malatse and Pinkie Makgobela, who continues to inspire me. To my mother, Tselane Rosinah, who taught me to pray and believe in God. To my kids Tshogofatso Ramathudi and Kgalalelo Constance who inspires me every day. To my lovely wife Makgomo Rebecca who is the pillar of my life, for her support, advice and understanding.

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## ABSTRACT

Cosmo City was established as a pilot project to integrate the low, middle and high income communities to live together and share common resources like schools, medical facilities, churches and shopping centres. Over a period of seven years, waste management has become a problem leading to littering, illegal dumping and overfilling of skips. Perceptions of waste management in different income households were studied. The specific objectives were, willingness of households to separate waste from source, health concerns emanating when one interacts with waste at the sources, effect of incentives on household's willingness to separate waste from source, household's opinion on including the waste pickers in the formal waste management system. Data was collected using structured questionnaire and interviews.

The results indicated that 30% of low income households, 23% of middle income households and 10% of high income households recycle waste. The study revealed that 78% of low income households, 78% of middle income households and 80% of high income households were willing to sort waste from source. Overall results showed about 20% drop when sorting waste without incentives was suggested. 52% of low income households, 55% middle income households and 48% high income households rated hygiene as the major health concern on sorting waste from source. 85% of low income households, 77% of low income household, 71% of middle income and 78% of high income households support the incorporation of waste pickers in the formal waste management system.

The results related to perceptions of the community on waste management suggest that the three different communities are willing to participate in waste management and support the incorporation of the waste pickers in the formal waste management system.

In general this study should serve as a guideline for legislation, policy and regulations formulation. Integrated solid waste management that involves waste pickers and separation of waste from source can help with job creation, boosts the economy and deviate waste from landfilling to recycling.

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## **GLOSSARY OF TERMS**

**Compost** – is a method of waste disposal whereby waste is discarded on the ground and can be covered by soil or grass.

**Domestic waste** – waste that is produced by households and this includes hazardous.

**Dumping site** – a piece of land where waste is disposed of illegally and without authorisation from the municipality.

**Hazardous waste** – waste that potential to cause harm to men or the environment e.g. toxic, flammable or oxidising e.t.c.

**Incineration** – combustion of waste in the presence of oxygen, this process produces ash and other gases such as carbon dioxide, sulphur dioxide, carbon monoxide.

**Landfilling** – a process of waste disposal on a site that is engineered or not engineered to reduce the release of greenhouse gases like methane and carbon dioxide by burial of waste..

**Qualitative research methods** – Research approach that focuses on collecting descriptive data of a particular phenomenon or context to formulate understanding of the observation or study.

**Quantitative research methods** – Objective and systematic approach of collecting numerical data from a sample in order to generalise the results to the study population.

**Recycling** – a process of collecting waste/used material and processing them into new products.

**Sampling** – A process of selecting a small representative group for a study to represent the study population.

**Waste pickers** – People who search and collect recyclable materials and sell them to buy-back centres.

**Solid waste management** – A system that manages the collection, transportation, treatment and landfilling of solid waste.

**Waste classification** – grouping wastes according to their characteristics and compositions.

**Waste collectors** – People employed by the government or private sectors to collect and remove waste from homes and businesses to the disposal site.

**Waste generators** – People or entities that produce waste as the output of their activities.

## **ACRONYMS AND ABBREVIATIONS**

CSIR – Council for Scientific and Industrial Research, South Africa

DEAT-South African department of environmental affairs and tourism

DWAF – South African department of water affairs and forestry

EPA – Environmental protection agency

IDP-Integrated development plans

ISWM – Integrated solid waste management

MSW- Municipal solid waste

NGO- Non-government organisation

NWMS – National waste management strategy

RCRA – Resource conservation and recovery act

SWMP-Solid waste management strategy

USEPA – United States environment protection agency

WTE – Waste to energy

# CHAPTER 1: INTRODUCTION

## 1.1 Background

Solid waste refers to all waste generated by animals and man which is disposed of as useless or unwanted (Mbiba, 2014). In the earlier days of mankind waste was never a problem as the waste generated did not pose environmental problems as the amount of waste generated was small due to the small population/land ratio. Urbanization has led to an increase in population/land ratio and this was accompanied by waste management problems. There's an urgent need for proper waste management plans for municipal, hazardous, medical waste and public awareness on waste minimization and recycling (Tchobanoglous *et al.*, 1993).

## 1.2 Problem Statement

Some members of the community are ignorant about how they can contribute to sustainable waste management within the households. The concept of managing waste according to its hierarchy is not well understood, hence there is minimal involvement by members of communities. Waste management hierarchy recommends the following steps: avoidance or prevention, minimisation at the point of generation, recovery or reuse or recycle, treatment to reduce volume and toxicity and final disposal at a landfill site (USEPA, 2003).

The natural environment is deteriorating due to illegal dumping. Blocked drains are common in most areas and produce bad smell which is a nuisance to most residents. The four communities residing in Cosmo City are faced with different socioeconomic challenges and background.

Perceptions of the community on waste management could vary depending on their education level, income, social status and their historical background. Hence the objective of this study is to collect, document and analyse this information. Sorting

solid waste from the source requires residents to be willing to take their time, effort, space and change their life style. The willingness of the community to sort waste from the source and interest is not known. From the results of this study proper intervention could be established. The high level of unemployment is a clear indication that the municipality will have to come up with initiatives to create job opportunities and support programs for SMME in the area. Some of this unemployed people collect recyclable waste to earn a living, however there are various challenges related to this initiative. Most of waste scavengers cannot get access to the household waste. The community does not know them and it leads to resistance. The waste pickers collect recyclable waste a few minutes before the waste collection company collects it. This gives waste pickers only a few hours (less than six hours) a week to collect recyclable waste. The amount of money they make a week is not known at the moment and hence one could only speculate depending on the hours they work a week. This study will collect information on the perceptions of the community about waste pickers. If the community support the idea of waste picker's initiatives in the area, it could help to minimise the amount of waste dumped illegally and minimise the unemployment rate in the area. This study will document the community perceptions on waste pickers and offer recommendations on incorporating waste pickers into the municipality waste management system.

### **1.3 Rationale**

Cosmo City was established as a pilot project to integrate the low, middle and high income communities to live together and share common resources like schools, medical facilities, churches and shopping centres. Over a period of seven years waste management has developed into a problem, that is, littering, illegal dumping and overfilling of skips have increase. Relatively few members of the community participate in waste management (Lebeta, 2009). There is little attempt from the community to reduce, reuse and recycle waste. All waste collected by the collection company is dumped in landfills that have a very short life span. There is a waste recycling company (Remade) on the nearby industrial area which is underutilized. Waste pickers operating in the area are operating informally and inefficiently. The

study compared the perceptions of the community in implementing a project for sorting waste from the source. The findings of the research could be useful to:

- Members of the community by creating job opportunities and incentives.
- Investors who have interest in waste recycling projects (e.g. generation of bio fuels and energy generation)
- Waste collection companies by redirecting waste from landfills (this will increase landfill life span and reduce maintenance cost)
- National, regional and municipal policy makers who design waste management policies.
- Incorporation of the Waste pickers in the formal waste management system.

#### **1.4 Aims and objectives**

The purpose of this study is to compare the perceptions of waste management in different income households in Cosmo City, Gauteng Province, South Africa (GPS 27.9307566 -26.021935).

The specific objectives of the study were:

- To investigate if the community is willing to sort waste from their households/source.
- To evaluate the health concerns of the community on sorting waste.
- To investigate if the community expects to get incentives per household for sorting waste from the source.
- To establish the opinion of the community on including the waste pickers in the formal waste management system.
- To assess if the households willingness to sort waste from the source depend on the type of dwelling.

## 1.5 Research Questions

The critical questions of this research study are:

1. Is the community willing to sort waste from their households/source?
2. What are the health concerns of the community on sorting waste?
3. Do the community expect to get incentives per household for sorting waste from the source?
4. What is the opinion of the community on including the waste pickers in the formal waste management system?
5. Does community willingness to sort waste from the source depend on the type of dwelling?

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## CHAPTER 2: LITERATURE REVIEW

### 2.1 Introduction

Waste management system in Cosmo City can be described by the following elements:

1. Waste generation by households and temporary storage in Bins for one week
2. Collection of mixed waste by waste collection company (Pickitup).
3. Temporary storage by waste collection company
4. Landfill disposal of waste

The current system in Cosmo City does not encourage households to reuse and recycle waste before disposal. Illegal dumping in the area is increasing. According to EPA waste management hierarchy Cosmo city's waste management model uses the least preferred model (landfilling without Incineration). According to EPA waste management hierarchy model illustrated in figure 2.1, source reduction and reuse is most preferred because no waste is generated, all emissions associated with recycling, composting, combusting, or landfilling the material. Source reduction involves creating products and using them in a way that reduces waste generation. Composting of grass and other plants by households can reduce waste. Recycling of municipal waste involves, sorting, transportation, processing into new products, sale of products from recycled material to consumers. (USEPA, 2003). Communities can benefit from recycling programs as more job opportunities will be created such as, composting of yard and food wastes, curbside collection and drop off centres. Food, plants and organic waste can be packed and allowed to decompose, the process is called composting (Cherubini *et al.*, 2009). Compost is used as a soil fertilizer. The process of composting can play a major role in managing municipal solid waste. Another alternative to managing municipal solid waste is through combustion of waste with energy recovery and a closed and controlled environment. This energy can be used to produce steam and electricity. Recycling requires less energy and time than producing the products from raw

materials. The most common way of managing solid waste is landfilling (Tinmaz and Demir, 2006). Landfills next to residential areas raises concerns from the residents due to the smell and potential risks associated with landfills. Guidelines from EPA on Solid waste landfills can serve as a good reference for standards that landfills should meet (USEPA, 2003).

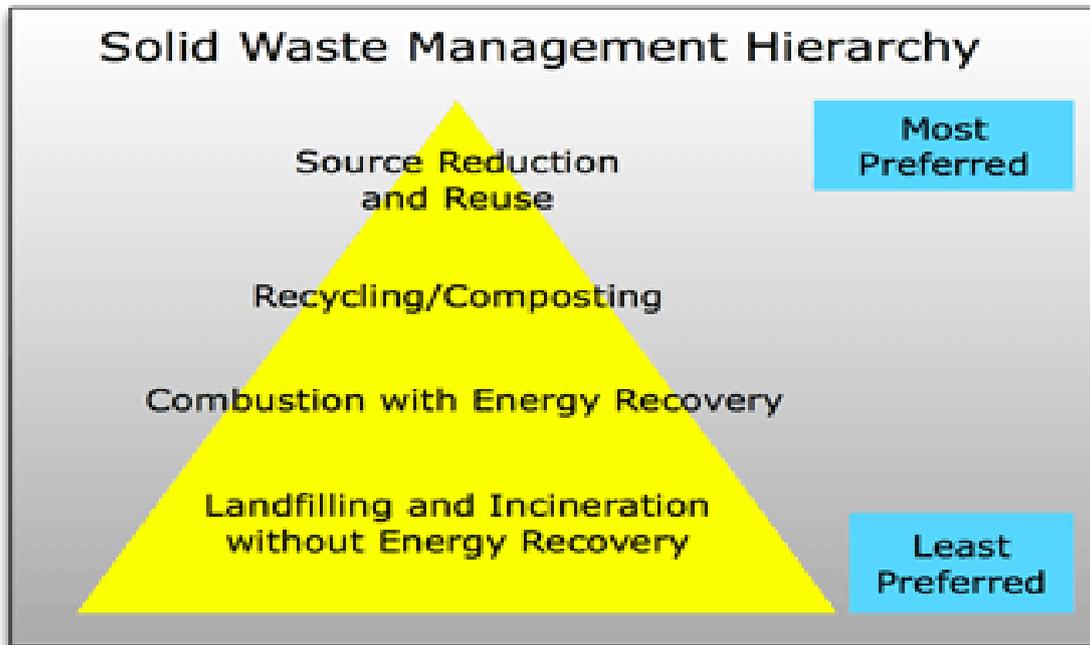


Figure 2.1: Solid Waste Management (USEPA, 2003)

Most developed countries have adopted waste management hierarchy (Figure 2.1) since it provides a guideline to ensure that waste management systems do not cause harm to the environment (Lim, 2011). Implementation of waste management hierarchy in the EU by policy development stabilized the per capita generation of waste (Wagner *et al.*, 2013). Source reduction changes the way products are made instead of managing waste after it is generated to reduce waste generation (USEPA, 2003).

## 2.2 Waste management

Solid waste management officials are constantly developing improving strategies to manage waste influenced by the growing amount of waste generated (USEPA,

2003). USEPA (2003) defines solid waste as industrial wastes, garbage, sludge, refuse and other discarded material.

According to USEPA (2003) solid waste includes semi-solid and liquids. The term solid waste as defined by RCRA defines solid waste as including both non-hazardous solid wastes (industrial waste and municipal wastes) and hazardous waste (USEPA, 2003). USEPA (2003) further defines municipal solid waste as nondurable goods, durable goods, packaging materials, containers, food wastes, plant trimmings and grass.

According to CSIR (2011) Municipal good practices success of waste management system depends on the following important issues:

- Motivated and dedicated employees.
- Integrated planning process that is functional
- Political stability and support
- Procurement and financial management
- Good understanding of waste management issues by councillors and senior managers
- Implementation of innovative schemes including reward schemes by dedicated and competent waste managers

Good municipal service delivery is influenced by a stable political conditions. (CSIR, 2011).

### **2.3 Legal framework**

Regulatory programs were developed for public health safety, water and air protection and environment from contaminants and hazardous waste (USEPA, 2003). Department of environmental affairs, South Africa has legislation to protect air, water resources, as well as public health (Table 2.1).

Table 2.1: Waste related legislations in South Africa.

Legislation	Objective
Environmental Conservation (Act 73 of 1989) and regulations	There are sections which are still applicable although the act has been replaced by NEMA
National Environmental Management: Waste Act (Act 59 of 2008)(NEMWA)	<b>Section 26</b> Prohibition of unauthorised disposal of waste and Section 27 Littering. Regulates waste management in order to protect human and environmental health by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecological sustainable development.
National Environmental Management: Biodiversity Act (Act 10 of 2004)(NEMBA)	<b>Section 65-69</b> This act is deals with restricted activities involving alien species, restricted activities involving certain alien species totally prohibited, and duty of care relating to alien species.  <b>Sections 71 and 73</b> These sections deal with restricted activities involving listed invasive species and duty of care relating to listed invasive species.
National Environmental Management: Air Quality Act (Act 39 of 2004)	<b>Section 32</b> Control of dust, <b>Section 34</b> Control of noise, <b>Section 35</b> Control of offensive odours  <b>Schedule 2</b> Ambient air quality standards
National Water Act (Act 36 of 1998) and regulations	<b>Section 19</b> Prevention of and remedying the effects of pollution of a water body  <b>Section 20</b> Control Emergency incidents

	<b>Chapter 4 Use of water and licensing</b>
Hazardous substances Act (Act 15 of 1973)	Provides for the definition, classification, use, operation, modification, disposal or dumping of hazardous substances.
Municipal systems Act (Act 32 of 2000)	To provide for the principles, mechanisms and processes to ensure equitable and essential services are provided to all social and economic groups.
National waste policy	Provides for the identification of and governance arrangements for priority initiatives and measures for performance assessment. The national Waste Management Strategy (NWMS) seeks to systematically improve waste management in South Africa. Therefore, a legislative requirement of the NEMWA, the NWMS seeks to ensure sustainable design, resource efficiency and waste prevention practices are implemented (DEA, NWMS draft, 2010)

## **2.4 International Experience in Waste management**

### **2.4.1 Waste management system in Corlu Town of Turkey**

Turkey like other developing countries is faced with waste management issues (Tinmaz and Demir, 2006). According to Tinmaz and Demir (2006) insufficient information about financial restrictions and regulations leads to lack of planning and organisation. Turkey has 16 metropolitan municipalities from a total of 3215 municipalities. Solid waste management services are only found in 2984 municipalities. Solid waste control Regulation (1991), Hazardous waste control regulation (1995) and medical waste control regulation provides a basis for the management of industrial, medical and municipal waste in Turkey. Principles of disposal of industrial waste, medical, hazardous waste, collection, transportation, recovery, recycling and reuse are addressed by this regulations. It is clearly defined in these regulations that waste have to be disposed in sanitary landfills. Non-hazardous waste have to be discarded separately from hazardous wastes in sanitary landfills according to these regulations. Leachate and gas control practices are also well defined, a leachate collection system should be operated and Percolation from the landfill should be prevented by linear system, through a leachate collection system as defined by gas and leachate control practices.

Tinmaz and Demir (2006) found that in Corlu Town of Turkey all solid waste is disposed in unsanitary landfills, this approach is in violation to the solid waste control regulation (1991) of Turkey. From the two unsanitary landfills in Corlu, there's only one landfill that is operational after the older one was closed after reaching its life expectancy. The location of the new unsanitary landfill is less than 1 km from the community. The landfill not properly managed, waste is not covered regularly with cover material, waste disposal, spreading and compacting is conducted in an uncontrolled manner. There is no treatment of hazardous waste and medical waste before disposal, these wastes are disposed together with municipal and industrial waste. There is no provision for collection of the leachate due to lack of landfill liner (Tinmaz and Demir, 2006). According to the records of the Municipality of Corlu

Town (2000) records, waste generation rate is 1.15 kg per capita per day and daily collection 170 tonnes. Each year 31.78% of plastic wastes and 31.36% textile from the 4100 tonnes of industrial waste are disposed in landfills (Tinmaz, 2002).

Tinmaz and Demir (2006) stated that it is essential to determine regulations to comply with, environmental protection, conservation of resources, reliable information about quantities, types of materials, recycling and reuse quantities, demand for raw material by local businesses and job creation in order to plan appropriate type of waste management system. The following recommendations were made by Tinmaz and Demir (2006): waste should be separated into paper and cardboard, recyclable materials and organic materials when stored in containers. Containers should have identification colours. Blue container should be used for paper and cardboard should be stored in blue containers, recyclable material in a separate blue container from paper and cardboard and organic materials in brown container. Waste should be stored in containers without using plastic bags to reduce generating more waste. Plastic bag waste can be reduced if waste is stored in containers without plastic bags. Batteries, ash and hazardous waste should be stored separately from each other and the rest of municipal waste (Tinmaz and Demir, 2006).

#### 2.4.2 Waste management in United States of America

According to Greene & Tonjes (2014) around the early 1970s USA's concern about the environmental effects of associated with increased waste generation and shrinking landfill space led to increased public interest in recycling. Local municipalities supported the initiatives by implementing waste reduction and recycling programs. Environmental policies worldwide are focused on effective waste management influenced by knowledge on environmental impacts of waste. The main purpose of waste management technologies and policies are to reduce negative impacts of waste in order to protect the environment and humans (Greene and Tonjes, 2014). United States (U.S.) like other National administrators and environmental agencies primary focus is on solid waste reduction (Court, 2012).

Environment and human health are the major motivators for developing regulations and minimisation strategies on hazardous waste generation (Wang *et al.*, 2015).

#### 2.4.2.1 Waste production and disposal

In 2010 United States (U.S.) generated a high amount of municipal solid waste of about 34.1% of total municipal solid waste (US EPA, 2011). Increasing costs models of waste disposal were linked to changes in the nature of production. The cost of disposing municipal solid waste in developed countries is high. Disposing waste directly in water, air, or land is regulated strictly. The problem was increased by the introduction of e-waste (White, 2008). Principle of proximity dictates that hazardous waste must be disposed next to their source of generation. Disposal and cleaning up costs have influenced the development of European environmental laws to draw strict and expensive laws to encourage polluters to take responsibility for their actions. This high costs of disposal led in some cases, to waste been transported illegally to other third world countries (White, 2008).

#### 2.4.2.2 Conventional Handling of waste

One of the serious disadvantages of landfills is pollution of underground and surface water by release of leachate. The release of greenhouse gas like methane is another major problem of landfills. Presence of inorganic metals, organic matter and nitrogen higher than the acceptable level. Landfill gas generated from landfill through the degradation of organic matter yields hydrofluorocarbons (HCFCs) and Chlorofluorocarbons (CFCs) which may contribute to the depletion of ozone layer. Landfill gas is a hazard to local residents and can increase the risk of cancer (Wang *et al.*, 2015).

#### 2.4.2.3 Waste to energy Technology

Alternative ways of treated Municipal Solid Waste had to be explored. Technology to convert waste to energy provided a better and environmentally friendly means of processing waste into different environmentally friendly forms. Biological conversion and thermo-chemical technologies are options for the waste to energy technologies (Wang *et al.*, 2015). There are three thermo-chemical conversion methods, incineration, pyrolysis and gasification. Incineration involves direct combustion of municipal solid waste to produce heat for the generation of electricity. Pyrolysis process involves heating municipal solid waste in the absence of oxygen, products are bio-oil, char and gas. Gasification process is enhanced by plasma heating of municipal solid waste, breaking it up into gaseous form that is cleaned through a number of scrubbers to produce syngas (Nan *et al.*, 1994; Purohit, 2009).

Biological conversion produces biogas and alcohol which can be used as fuel for generation of electricity. The process involves anaerobic digestion of municipal solid waste using bacteria. All these options have advantages, disadvantages and limitations. Thermo-chemical conversion methods are fast efficient compared to biological alternatives. Biological conversions are cheaper to set up compared with thermo-chemical alternatives. Thermo-chemical options can help divert MSW from landfills since they can handle larger volumes of waste per day compared to the biological conversion methods (Wang *et al.*, 2015)

#### 2.4.3 Waste management in European countries

Over a period of ten years from 1998 to 2008 waste management system in European countries have improved. Municipal solid waste which was previously sent to landfills was redirected to recycling and incineration with energy recovery. In 2012, 60% of waste was recycled, stored for composting or channelled for incineration with energy recovery (EEA, 2012; Manfredi and Goralczyk, 2013).

Historically most of municipal solid waste was landfilled. Landfilling has many disadvantages ranging from leaching to emission of greenhouse gases. In

European countries about 40% of waste was still sent to landfills in 2012. Sewage sludge is mainly used in agriculture, this approach contributes to the surface and underground water contamination. Landfilling and incineration are the major options rather than agricultural applications (Righi *et al.*, 2013). Reducing the amount of solid municipal waste landfilled is the goal of the directive 1999/31/EC (Council of the European Union, 1999).

According to the World Health Organisation (WHO) medical waste (MW) includes waste from medical facilities, pharmacies and radioactive waste, pathological waste and sharp objects (Komilis *et al.*, 2012). Yong *et al.* (2009) mentioned that in China medical waste are grouped into tissues, infectious wastes, chemical wastes and medicine wastes. Medical waste is generally generated by various institutions like laboratories, various types of hospitals (clinics, veterinary *et.c*) and medical research institutions. Poor health care waste management could contribute to the negative public health and environmental impacts. Disposal of infectious waste if not properly managed and regulated results in the spread of infections which will affect the environment, public, aquatic species, surface and underground water bodies. Infectious waste could also affect the waste handlers, waste scavengers and recyclers (Ananth *et al.*, 2010). Medical personnel and other general workers, patients and visitors who come in contact directly or indirectly with infectious waste, sharps, radioactive waste could be infected (Arab *et al.*, 2008).

#### 2.4.3.1 Health care waste separation

In a study conducted in Tumpat, Taiping and Batu Pahat it was reported that separation of health care waste was implemented with success. The approach involved the use of different coloured bins. In order to control the risk of spreading infections, infectious waste was autoclaved before being packed for disposal. Preventative measures to reduce the risk associated with sharps, puncture proof sharp bin were used. The system was found to be functional in most hospitals. Few hospitals had challenges with compliance. Challenges were associated with

disposal of sharps in the wrong containers, incubation plates were found in sharp bins. Waste handlers were at a high risk of needle prick as a result of improper disposal practices. Some of the challenges were associated with shortage of waste containers to handle the amount of waste generated (Omar *et al.*, 2012).

#### 2.4.3.2 Transportation and disposal

According to Omar *et al* (2012) the health care waste transportation trucks had licences from the department of environment of Malaysia. Waste was collected four times a week. Waste which was not collected from the day get stored in a cold storage for collection the following day. The transportation of health care waste from cold rooms of the hospital were transported with special vehicles to the incinerators. The ministry of health regulates the collection of waste from the hospitals. One of the key regulations requires hospital staff to perform verification process on waste sorting, collection and disposal. According to this regulation hospitals must have subcommittees to monitor how health care waste is disposed. Some hospitals did not have subcommittees to monitor the final disposal of health care waste. Hospital personnel were involved in the verification process of collection at the hospitals as required by the ministry of Health. Incineration is the final step in health care waste management. It takes the truck only one hour to transport the waste from the hospital to the incinerator. It was found that the hospitals did not have a subcommittee to monitor how the final disposal of health care waste is done and where the appointed waste collection company treated disposed of the waste (Omar *et al.*, 2012).

According to Mosquera *et al.* (2014) in Spain there are different treatment and disposal options from health care waste separation. General is disposed in controlled landfills. Infectious waste is treated through autoclaves to disinfect it and then compacted for disposal in controlled landfills. Genotoxic, pharmaceutical, and chemical waste are sent to incinerators where they are burned into ash. The ash from incinerator is a public health and environmental hazard. The ash contains particulate matter and chemical compounds which could affect the environment and public health in a negative way. Particulate matter when inhaled can be absorbed into

the blood stream when it can cause various ailments depending on its composition. Some particulate matter could be carcinogenic, radioactive or toxic. The negative public health and environmental impacts of incinerators have led to a common understanding that incinerators have to be discontinued as treatment option for health care waste (Mosquera *et al.*, 2014).

#### 2.4.3.3 Incorporation of waste pickers in the formal waste management system

##### Philippines

In Philippines the municipal solid waste management system was studied with the objective of finding out if the merge of small informal recycling businesses into the waste management system is feasible. In most of the developing countries the responsibility of waste management is the responsibility of the municipality. Most municipalities in developing countries lack the knowledge, funds and resources to manage waste adequately. Small informal recycling businesses can reduce the amount of waste sent to landfills and hence a reduction in costs of managing landfills. Over a period of years this sector have created job opportunities for many unemployed and unskilled poor people in various cities. This unregulated sector though providing many benefits to municipalities are not recognised and hence receive no support from municipalities. There are various challenges facing the small informal business sector, abuse by the middle man (buy-back centres), low exchange rates for recyclables materials, poor working conditions, injuries, infections and exposure to toxic waste, rejection from the community and harassment from police. Buy-back centres often pay lower rates for recyclable materials, since the small informal recycling businesses have no say on the prices of recyclable materials. This small recycling businesses often have to travel longer distances to buy-back centres that offer better rates. This small recycling businesses work in isolation and as a result have no bargaining power. Small informal recycling businesses are often run by women, children, and elderly. Communities rejected by the community since some community members associate them with crime and consider them unhygienic. In Philippines waste picking is not allowed by the law and as a result waste pickers find themselves on

the wrong side of the law and are harassed and sometimes arrested by police. Most of this small informal recycling businesses are conducted on the bases of survival. Small informal recycling businesses have no legal right and hence do not get any protection to run their businesses (Paul *et al.*, 2012).

Occupational safety of this sector is a major concern. Waste pickers are exposed to risky and hazardous working environments. They work on landfills and open dumpsites that have various combinations of hazardous materials (toxic waste, infectious waste and corrosive waste). Lack of enough working space and resources prevents them from working in a safe and hygienic environment. The activities of this small informal businesses reduce costs for municipalities and waste collection agencies due to reduced collection waste volumes, reduced treatment costs and reduced landfill management costs. Small informal recycling businesses provide a free service to municipalities and deserve recognition for that. Iloilo city incorporated the Informal waste pickers into the Municipal waste management system. Waste pickers formalised themselves by forming an association which secured a partnership between the municipality and the informal waste pickers. This initiatives united the former unorganised waste pickers into formal business partner. The payoff was the improved work environment, regular income, availability of facilities, basic conditions of employment, acceptance by the local community and hygienic, safe working environment and access to medical facilities (Paul *et al.*, 2012).

#### 2.4.4 Waste management in Asia

The increase in the number of cooperatives in Philippines is evidence of the success of waste picker cooperatives over the years. Examples of this successful cooperatives are reported in various cities in Philippines like Manila. Cooperatives that started as formalised system of waste pickers are today successful cooperatives. The program introduced sorting of waste from source by households. Waste pickers were organised and allocated service areas. Each waste picker in their respective service area would buy source separated waste from households. Waste pickers were given distinctive uniform to easily be identified by the

community. They were provided with green uniforms and can easily be identified by the community. The same waste pickers will service a certain area and that helped the community to know them accept them. To help waste pickers with transport they were provided with green pushcarts and bicycles. The system accommodated cooperatives, organised middleman and individual waste pickers (Medina, 2007).

In India an NGO called EXNORA introduced a program to collect recyclable materials in the low-income community. The program gave waste pickers a legal recognition and formalised them. Waste pickers were tasked with a responsibility of waste collection and cleaning of streets. Through this legal recognition waste pickers managed to apply for loans to buy the tools and resources needed for business. Waste pickers managed to buy tricycle carts for transportation of waste. The community paid for the waste collection service and job opportunities were created for the poor and unemployed. Part of the waste collection service fees was used to pay back the loans and salaries. Streets were clean, solution for littering and illegal dumping were implemented, community was happy and families received regular income (Medina, 2007).

Recognition of waste pickers in Indonesia was introduced at national level. The president of Indonesia facilitated the process to formalise waste pickers operations. Legislation that acknowledges and support waste pickers was developed. According to the legislation waste pickers are recognised as an integral part of the economy and environmental management. The government of Indonesia encouraged and supported the formation of waste picker's cooperatives. This cooperatives were allowed to operate at landfills and also on the street collecting recyclable materials. As a result of this recognition banks provided this cooperatives with loans to purchase the necessary to tools and equipment (Medina, 2007).

#### 2.4.4.1 Household waste separation experiences from Dhaka Bangladesh

The city of Dhaka in Bangladesh has a population of 7 million. This population generates waste of 3000-4000 tons per day. The City does not have enough

resources to collect and manage the waste generated. It was estimated that about 40-50% of solid waste is not collected. In some other areas households have organised and formed private societies or welfare organisations. The sole mandate of these organisations is to deal with challenges of solid waste collection and management. One of the achievements of these organisations was the hiring of cycle-van drivers to collect solid waste from households. Households are charged a fee for this service of waste collection. Households were happy to pay for the service. The initiative has reduced the amount of littering, illegal dumping. The streets of Dhaka were cleaner and beautified as a result of the implementation of this project. The areas that are serviced by the municipality unfortunately did not benefit from this initiative. Solid waste is not collected regularly leading to littering, other public health and environmental impacts associated with uncollected solid waste. The municipality lacks capacity to resolve the irregular waste collection issues (Matter *et al.*, 2013).

Some households separate their waste and sell the recyclables to the buy-back centres. Waste collectors hired by private societies/welfare organisations collect mixed waste from households. Mixed waste is then later sorted and recyclable materials sold to buy-back centres. This process generates extra income for waste collectors in addition to salaries paid by private societies/welfare organisations. The other non-recyclable waste is then sent to a central location, from where it is then transferred to a landfill. Waste pickers collect their recyclables by sorting waste from transfer points and landfills (Matter *et al.*, 2013).

A study conducted in Bangladesh showed that waste storing and collection is mainly administered by maids and caretakers. Influenced by the low income they receive maids and caretakers have keen interest to receive extra income and are likely to accept the responsibility of source separation of waste. Income received from selling recyclables although small, it's enough to convince maids and caretakers to recycle household waste and engage in source separation. Contrary to other family members with higher income, are likely to be receptive to any possibility of earning extra income. Furthermore household family members also accept and understand the typical practice to allow maids or caretakers to earn additional income by

recycling waste. Incentives that can be received from recycling household waste are not enough to convince high income households to separate waste from source in order to recycle it. When households were asked about willingness to separate waste from source they responded positively in support of the idea (Matter *et al.*, 2013).

#### 2.4.4.2 Waste picker cooperatives

In most developing countries there is no municipal solid waste collection services for low income residential areas and informal settlements. Solid waste collection is conducted by informal solid waste collectors in some of these areas. Informal refuse collectors collect solid waste, sort it into recyclable and non-recyclable waste. Recyclable waste is then sold to the buy-back centres. Informal solid waste collectors in some areas charge a collection service fee. These initiative created employment for some unemployed residents. Many low income areas in Asia and Latin America are serviced by informal waste collectors. Informal waste collectors use donkey/horse/pushcarts to collect waste. The initiative of informal waste collectors show that low income households and informal settlements are willing to pay for waste collection service. In most of the low income residential areas and informal settlement the street are narrow, not paved and have a lot of potholes. The conditions of the roads makes it impossible for the municipal collection trucks to collect waste in low income residential areas and informal settlements. If the municipality trucks can be used in these areas they will break down frequently costing the municipality more repair costs. Informal waste collectors can easily collect waste in these areas due to the mode of transport used (Medina, 2007).

Waste pickers are the major role players in recycling of municipal solid waste in developing countries. Waste pickers are commonly referred to as scavengers relating to how they recover recyclable materials. Waste pickers are mainly from the poor and disadvantaged communities. The day to day operations of waste pickers expose them to health hazards and various problems ranging from harassment to

rejection by the community. Waste pickers income can be estimated by the low income paid by the buy-back centres. Households view waste pickers as a sign of shame and disgrace and hence in certain countries there are policies that declared waste picking illegal. Waste picking was declared illegal in Colombia, Philippine and India. The formation of cooperatives brought a lot of success in a field of waste picking, acceptance by the community, high income level, improved working conditions. Successful waste picker cooperatives were reported in Latin America (Colombia, Brazil, Argentina and Mexico) and Asia (Philippines, India and Indonesia) (Medina, 2007).

## **2.5 Regional Experience in Waste Management**

### **2.5.1 Household waste separation experiences from Ethiopia**

A study on perceptions of hazardousness of municipal solid waste conducted in Ethiopia showed that level of education and participatory behaviour are positively correlated. Highly educated people with a broader knowledge and concern about hygiene cleanliness and knowledge of waste disposal good practices. Separation of waste from source was found to be conducted mainly by respondents with higher level of education. Another positive correlation was found between employment status participation in solid waste disposal. The study also found that women are more likely to participate in solid waste disposal than males. In India males holds the perception that cleaning homes is for females. From that perception most males expect woman to clean the house, take out trash and ensure that solid waste is disposed timeously and .in accordance to the municipal guidelines. This perception cannot be generalised as it was found that in Palestine males participate in solid waste disposal than females. Age was also found to be correlated with solid waste disposal. Collection of waste was reported not to be consistent and this creates various public health hazards. The lack of consistency was linked to the lack of capacity and resources (Al-Khatib *et al.*, 2015).

## 2.5.2 Waste management in Ghana

Ghana's municipalities manage the collection, treatment and disposal of solid waste. In Ghana, privatisation of solid waste is increasingly becoming more attractive to local governments. The first city to privatise household solid waste collection was in Accra. In Ghana 90% of solid waste generated is not collected by the municipality. Residents dispose solid waste in open spaces and illegal dumpsites. In Accra most of the households do not receive solid waste collection service from the municipality, only 11% of these community receive solid waste collection service. Residents who do not receive solid waste collection services are not regulated on solid waste disposal. Solid waste from the communities that do not receive solid waste collection service dispose their waste at illegal dumps, in unoccupied municipal land, in rivers and dams, and some of the waste get to the storm draining system during rainy seasons. The limited waste disposal capacity of the urban authority has worsened the cumulative deposition of solid waste in the metropolis; roadside dumps can be found at most parts of the city (Mariwah, 2012). Some households in greater Accra region (mostly poor households) resort to burning of waste as the best alternative for managing solid waste. The leachate from the illegal dumps and ash from burned waste is transported by rain water and finds its way into the main water streams like rivers, dams and underground water streams (Thompson, 2012).

### 2.5.2.1 Health care risk waste

Health care facilities in Accra have a system to manage health care risk waste. Waste is separated from source into two categories, infectious waste and non-infectious waste. Some hospital use different coloured bins to separate sharps, infectious and non-infectious waste. All hospitals have clearly defined written and documented procedures for collection and storage of health care risk waste. Private and public hospitals have secured temporary storage area. The standards for health care risk waste are adhered to by both private and public hospitals (Abor, 2013).

### 2.5.2.2 Recycling

Ghana has a poor recycling capacity. The formal recycling facility of Ghana recycles only 2% of solid waste generated. Poor households do not dispose recyclable waste but recyclable material are reused for domestic purposes. Common recyclable materials reused are Plastics, paper, cardboard, bottles, cans and glass. Maids in high income areas play a major role in managing solid waste and recycling. Maids separate waste from source into recyclable and non-recyclable waste. Recyclable waste is sold to buy back centres to generate an extra income. The two recycling plants in Accra are not operating optimally since less waste is collected from households. Unlike other developing countries, Ghana have a small number of waste pickers and as a result this buy back centres have a shortage of recyclables supplies. formation of waste picker cooperatives and more unemployed people should be advised and trained on waste recycling business (Thompson, 2012).

### 2.5.2.3 Household's perceptions on separation of waste

The study that was conducted by Owusu *et al.* (2013) in Ghana investigated the household willingness to separate solid waste at source when economic incentives are provided. It was found that persons tasked with responsibility of solid waste disposal at the household-level are critical for households to participate in separation at source. Statistically, the variables representing the mother, children and household helpers all have statistically positive significant effects on the willingness of the households to accept cash and non-cash incentives to participate in separation at source. It was found that when cash and non-cash incentives are provided, the willingness of men to participate in separation of waste at source is negative. The willingness of households to participate in source separation was statistically positive for the high income households when cash incentives are proposed but negative for low income households. When free storage bins were proposed as non-cash incentive high and low income households were not willing

to participate in separation at source. The low income households often stay in crowded areas where there is no space to keep an extra bin (Owusu *et al.*, 2013).

The positive effect of the health-related perception index indicates that participation increases in households where separation at source is perceived as hygienic and environmentally healthy. The positive impact of the sorting perception index also clearly suggests that households would be unwilling to participate if they perceive solid waste separation as time consuming and difficult. Low income households were less inclined to accept cash incentives than middle or high income households. This unexpected finding is evidence that other factors than purely costs for waste management are important for household's willingness to take part in separation of waste at source. Especially the perceptions on health and on sorting and the availability of open space in the households were important for the willingness to accept incentives for source separation. Households with an open space were inclined to participate in separation of waste at source. These results indicate that there are two aspects that are more important than economic incentives to consider for practical implementation of separation at source: attitudes and physical infrastructure of waste within and near households. The benefits of separation at source in terms of health and environmental aspects should be communicated to the households. The waste storage and collection system should be developed in collaboration with households, with feedback on problems and possible improvements as part of the development process. Informal waste pickers, who are well-informed about the market for recyclables and the local conditions for waste collection, especially in low income household areas, maybe key stakeholder group to involve in the development of an efficient and functional separation of waste at source system (Owusu *et al.*, 2013).

### 2.5.3 Perceptions of households on separation of waste at source in Zimbabwe (Bulawayo), Zambia (Lusaka) and Kenya (Mombasa).

A study was conducted in three cities of Zimbabwe (Bulawayo), Zambia (Lusaka) and Kenya (Mombasa) by Mbiba (2014) to determine the household's interest for separation at source. Waste collection service from the three cities was found to be

inadequate. Waste was not collected on a regular basis either due to lack of resources or capacity. Most households were found to use alternative methods for disposing waste, burying waste in their yards, burning or resort to illegal dumping. Separation of Solid waste was supported by most households from the three cities Bulawayo, Lusaka and Mombasa. The majority of households from Mombasa indicated that they were willing to separate solid waste from source if encouraged to do so by authorities (see Figure. 2.2).

Most of the households were willing to separate waste from source in Lusaka except in Kabwata. Residents of Kabwata were not willing to separate waste mainly because of their perceptions and what they associated source separation of waste with. Majority of residents from Kabwata thought that separating waste from source will result in extra charges on their collection tariffs. Some residents indicated that they can only sort waste from source if rewards were offered.

At Bulawayo most residents separate waste from source before collection. In Bulawayo waste is not collected regularly, residents have to find alternative ways of disposing waste and most of them burn, bury or dispose it in illegal waste dumps. Most residents separate waste into dry waste and wet waste (organic waste). Residents mentioned that separated dry waste was easier to burn in cases where waste was not collected. Wet waste is buried since it releases a bad smell if not collected over a longer period of time. Majority of residents were willing to separate solid waste from source for recycling. Since most residents already separate waste for burning and burying if it's not collected by waste collectors, it will be easier for them to separate waste for recycling and composting. Residents mentioned that they are willing to separate waste for recycling and composting if this initiative will be accompanied by incentives (Mbiba, 2014).

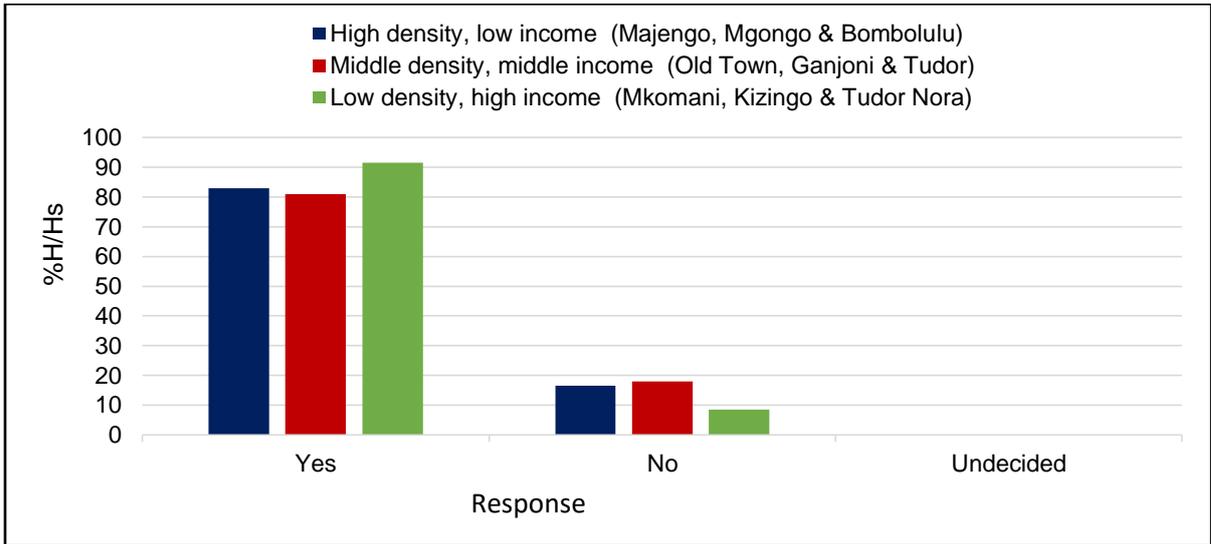


Figure 2.2: Willingness of households to separate waste at source, Mombasa (Mbiba, 2014)

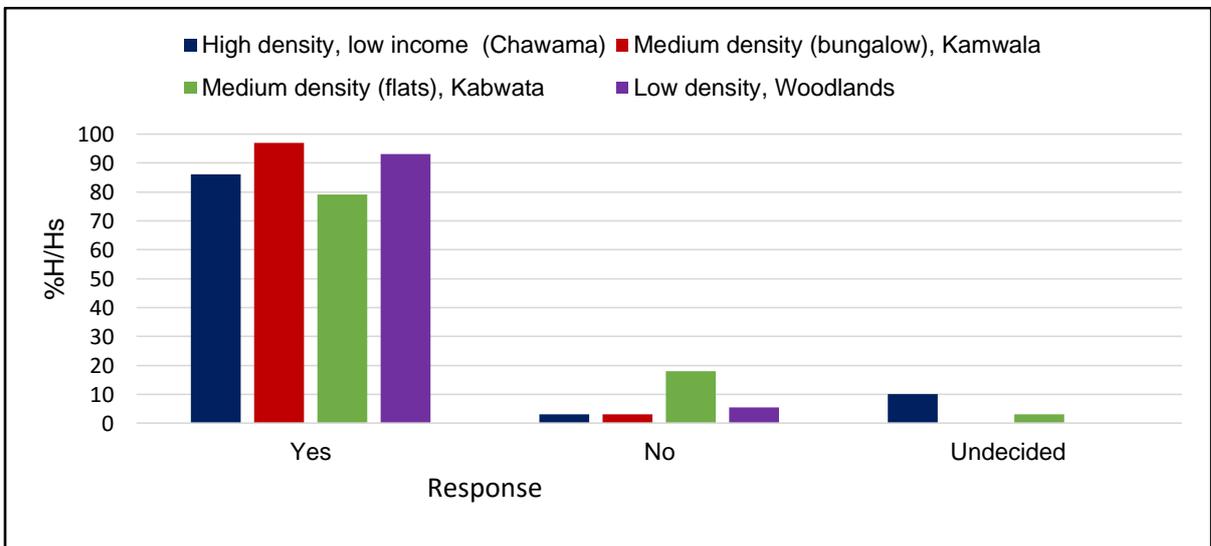


Figure 2.3: Willingness of household to separate waste at source, Lusaka (Mbiba, 2014)

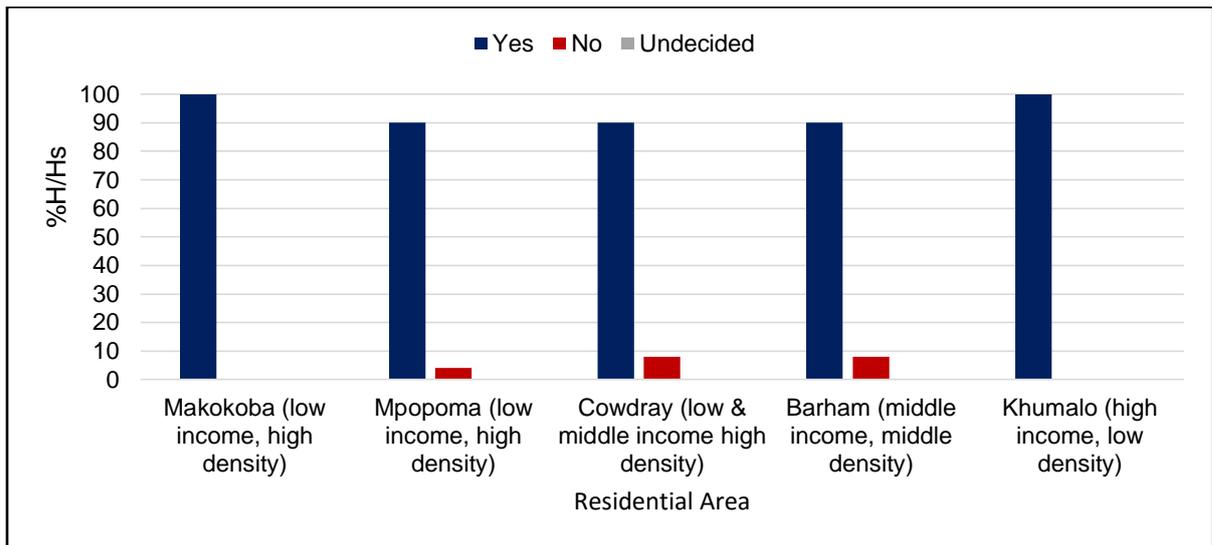


Figure 2.4: Willingness of households to separate waste at source, Bulawayo (Mbiba, 2014)

Bulawayo implemented a program to allow waste pickers in the formal solid waste management system. Waste pickers were formalised through a tendering system to work on formal landfills to separate waste for recycling. Formal waste pickers who won the tenders could only recover a small amount of recyclables due to lack of capacity. Informal waste pickers had enough capacity to recover more recyclables than formal waste pickers. Informal waste pickers remained the major role players in recovery of recyclables from landfills.

#### 2.5.4 Household's perceptions on separation of waste from source in Uganda.

A study conducted in Uganda highlighted revealed some important factors that influence household perceptions on waste management. The study was conducted in a peri-urban and urban areas. The results showed that in Uganda peri-urban areas made up of an average of seven members. Urban areas were found to have an average of five members. Household size have an impact on the amount of waste generated, it is expected that households with more members will generate more waste. From the results of the study it was reported that peri-urban areas were found to generate more waste. Peri-urban areas were found to generate an average

of 16.5kg of solid waste and 24kg of solid waste was generated from urban areas. Waste generated from peri-urban areas comprised mainly of fresh unprocessed foodstuffs.

The results further showed that 73% of households never separated waste at source. For the majority 46% that never separated waste complained about lack of time to do so and the other 36% mentioned that they were not willing to sort waste as they saw it as useless and time consuming activities. Results from regression analysis show that the variables Separation of waste from source was found to be statistically significant to gender, area of the property, peer influence, household size, environmental concern, income, time and location of the household. Separation of waste from source stimulates the reuse and recycling of waste, job creation, generate income for the poor and low raw material supply to the local businesses (Ekere *et al.*, 2009).

## **2.6 Local experience in waste management**

### **2.6.1 Waste management in Cape Town**

Cape Town is situated in the Western Cape and is South Africa's third most populous city. Cape Town also has the second largest city economy in South Africa, and currently produces approximately 2.45 million tonnes of solid waste per year. Cape Town currently makes use of six landfills to dispose of waste generated in the city. The Vissershok Waste Management Facility (VHWMF) is the only operational landfill that is privately owned by the waste management company Enviroserv, with the rest of the landfills being owned and operated by Cape Town Municipal Council. The Municipal landfills include Bellville South, Coastal Park, Faure, Swartklip and Visserhok, which is adjacent to VHWMF (Stotko, 2006) .

#### 2.6.1.1 Waste collection

There is variation in service delivery specifically in the Town of Lwandle. Solid Waste is collected by a private company on behalf of Cape Town municipality. Solid waste is collected daily in some areas, weekly in others and twice a month in the none-renovated hostel area. The frequency of solid waste collection is prioritised according to the type of area. In towns solid waste was collected daily, weekly in urban areas and twice a month in rural areas. The waste collection plan was influenced by lack of capacity and rate of solid waste generation. Use of alternative waste collection methods could create employment opportunities thus reducing the quantity of waste sent to landfills and creating minimum income. (Puling and Van der Merwe, 2004).

The categories of waste generated is mainly kitchen waste followed by plastics then paper. Perceptions of households, knowledge on waste management, environmental awareness were found to be influenced by economic conditions. Other factors that were found to negatively affect perceptions of the community were insufficient handling of kitchen waste, the use of skips and the associated negative impacts. Households believe that solid waste collection is the sole responsibility of municipality. Households do not participate in any process of waste management. Feedback from some households indicated that communication from the authorities, waste collection team and municipality on waste management can improve community participation in decision making and waste management. Opportunities for Job creation will increase if community can have knowledge and participate in waste separation at source, reuse and recycling (Puling and Van der Merwe, 2004).

#### 2.6.1.2 Waste reduction and waste Reuse schemes

A company called Beco facilitated the formation of waste minimisation clubs. These clubs exist in several industries, namely the plastics, meat products, retail motor and textile industries, among others. Cape Town implemented an integrated waste exchange (IWEX) website with the aim of listing wastes that companies either

produce or require as a raw material and then trying to link the companies that require a particular waste as a raw material with a company that may produce that particular waste material. Waste material can be diverted and reused as raw materials (Stotko, 2006).

#### 2.6.1.3 Recycling

City of Cape Town implemented the two bag programme in Muizenburg. The programme involves the use of yellow plastic bags for recyclables and black bags for non-recyclable wastes. The programme received a high participation rate from the community but it was found to be economically unviable. The yellow bags are collected by a contractor, namely Enviroglass, and the black bags are collected by the City Council. The use of a single Council truck with a separate compartment for recyclables to collect both the black and yellow bags. The yellow bags will be placed in the recyclables compartment while the black bags would be placed in the truck compactor (Stotko, 2006).

Many schools in Cape Town operate recycling depots, some of which also collect recyclables from restaurants, a large number of buy-back centres also exist in Cape Town, with the majority accepting only paper and cardboard. The Bellville South, Coastal Park and Visserhok Waste Disposal facilities allow landfill recyclers from the landfill during the operating times of the landfill. The recyclables collected are sold to a contractor, Interwaste, that manages the landfill scavenging operations (Stotko, 2006).

#### 2.6.2 Waste management in Kwa-Zulu Natal

Durban is the city Kwazulu Natal in South Africa and has a population of 3.5 million. Durban has four landfills which are operational and two hazardous waste sites that are owned privately (Trois and Simelane, 2010).

The Durban Metropolitan Area produces waste, which can account for 1.8 million tons of waste per year. Affluent communities dispose 13 times higher waste than poor communities. Of this waste about 1.4 million tons are disposed on landfills, but this includes only 25% from informal settlements and excludes a large amount of liquid waste that is disposed on pipelines (Trois and Simelane, 2010)

Table 2.2: Waste generation in Durban

Population and income level	Waste generation (m <sup>3</sup> /person/year)	Estimated average mass (kg/person/year)
Higher income	2.70	540
Middle income	0.75	150
Low income, formal	0.24	48
Low income, informal	0.20	40

Source: [www.durbansolidwaste.org.za](http://www.durbansolidwaste.org.za)

All waste that is generated by people in Durban, including Umlazi is disposed off on landfills as per table 2.2 and a very small amount is taken to recycling companies because people are not aware or are not educated about recycling. The noticeable issue is that rich communities produce more waste compared to poor communities that is up to 13 tonnes per person per year (Njoko, 2003).

The study by Njoko (2003) suggested that income status, employment status, level of education, number of people in a property or house have consequences on people's reaction or attitudes to waste. People in low-income communities care much of their survival which is difficult than focusing on waste they don't even understand its detrimental impact to their lives. Solid waste management solutions can be through transferring waste collection to members of the community. There is a need for greater consideration of solid waste management in Umlazi, focus should be on storage, collection and transportation and to disposal (Njoko, 2003).

### 2.6.3 Waste management in Gauteng

Industrialisation in Gauteng has increased quantities of hazardous waste generated and disposed of by industries. An increase in population results in high consumption of raw materials and higher solid waste generation. Major generators of Hazardous waste are industrial activities. Exposure to dumped or poorly managed hazardous waste and untreated hazardous waste are: contamination of underground and surface water, health risk, air quality, soil contamination, environmental degradation (CoJ, 2010).

Most of Industrial hazardous solid waste is disposed of in landfills without any form of treatment in Johannesburg. Most of industrial hazardous waste is landfilled due to the shortage of treatment facilities and lack of capacity. The few treatment facilities used by some industrial, mining and pharmaceutical companies are located outside the City of Johannesburg. Transportation costs and high costs for waste treatment are some factors that encourages some companies to cut costs by disposing their hazardous waste at landfills. There are three treatment plants used by the city of Johannesburg two are in Olifantsfontein and the other is in Germiston. The first treatment plant handles selected organic chemical waste, the second plant handles Chemical waste, metal and oil treatment and the third plant handles carbon-rich material from mining. Hazardous waste is generated in city of Johannesburg are generated by mining, Chemical, Metallurgical, paper and pulp and manufacturing industry (CoJ, 2010).

#### 2.6.3.1 Waste composition

Three year historical data of Gauteng showed that percentage of solid waste collected from households is the highest waste stream contributing about 55% of total municipal solid waste. The second highest waste stream was found to be waste collected from the illegal dumping sites contributing about 17% of total municipal

solid waste collected. The other waste stream was builder's rubble, garden waste and waste from cleaning of streets contributing 12%, 10% and 6% respectively. The second highest waste stream is illegal dumping, this indicates that illegal dumping of waste is a major problem in Gauteng. The city of Johannesburg spends about R80 million a year on cleaning up illegal dumping areas. The city of Johannesburg believes that awareness campaigns and education can help communities to understand the negative economic and environmental impacts of illegal dumping (CoJ, 2011).

#### 2.6.3.2 Waste minimisation

There are 37 centres in Gauteng where waste can be dropped off 18 buy-back centres and 19 shopping centres. The common materials recycled in Gauteng are paper, Plastics, glass, metals, and aluminium. Most of the households are not recycling their waste. Training, awareness and infrastructure should be provided to stimulate household recycling including source separation of waste. The Waste collection contracted company Pikitup have recently implemented waste minimisation programmes in a few areas in Gauteng and based on the success of this programmes more areas will be covered in future. The programme includes:

- Separation of waste at source
- Organic waste composting
- Recycling of builders waste
- Formalisation of recyclers through formation of a representative committee to improve communication lines between the City and the recyclers.

Gauteng province, and increasing health care waste generation rates. Health care waste is sub-classified into infections waste, chemical waste and radioactive waste.

Gauteng has the capacity to treat some of its local health care risk waste and waste from other provinces. Waste Health care risk waste (HCRW) that cannot be treated in Gauteng due to lack of technology or capacity is exported to other provinces for

treatment (GDACE, 2004). Figure 2.5 shows Gauteng health care risk waste generators.

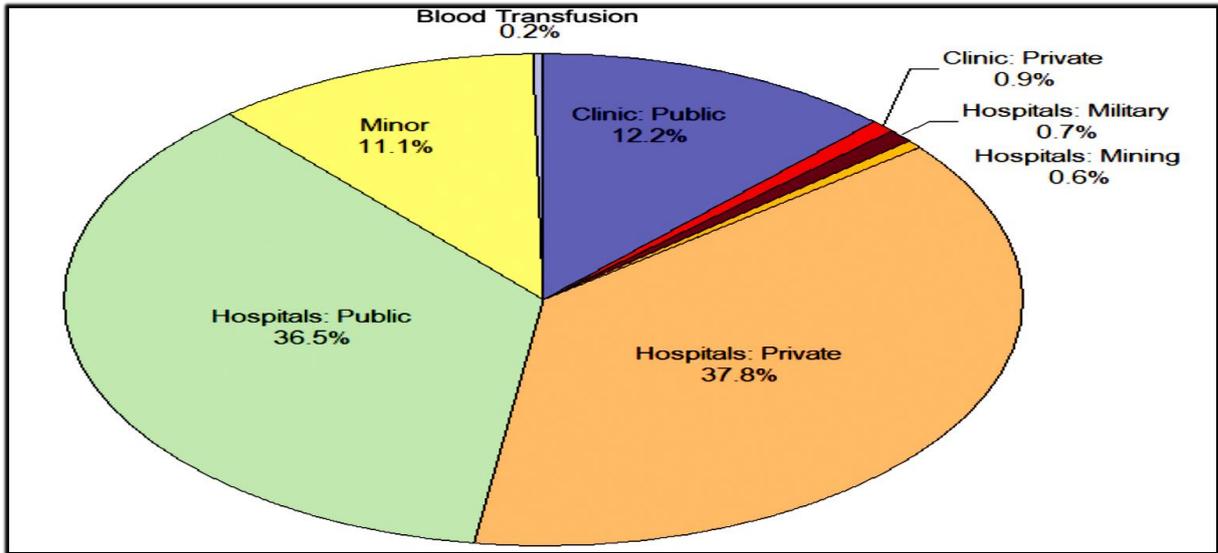


Figure 2.5: Gauteng health care risk waste generators. (GDACE 2004)

Training and development of health care risk waste handlers can improve the compliance on regulation of health care risk waste. Collection and transportation of health care risk waste is regulated and to ensure compliance training of all stakeholders is important. (GDACE, 2004).

City of Johannesburg have insufficient/limited disposal facilities for health care risk waste as a result of population growth and increased waste generation rate (CoJ, 2010). Major health care risk waste generators produce approximately 89% of the total volume, while the remaining 11% are generated by minor generators. Health care risk waste in South Africa mainly treated through incineration. Gauteng can process a maximum of 652 tonnes/month of health care risk waste from the five treatment plants in Gauteng province, additional waste is processed in Benoni plant.

In Southern Africa, health care risk waste management has many challenges, medical waste is managed in an improper way. Waste managers, collectors, handlers and treatment centres lack capacity and are not compliant (Abor and Boucher, 2008). Abor and Boucher (2008) conducted a study in one of the hospitals

in southern Africa focusing on management of health care risk waste. It was found that the hospital basically separates health care risk waste from general waste stream at the source. Both wastes were found to be stored and disposed of separately. Which is acceptable practice according to health care risk waste regulations. However, the hospital did not separate health care risk waste (HCRW) into different categories. During the interview it was revealed that non-infectious and infectious waste is not separated properly. It was found that the rules and standard for separating waste were not followed. Infectious waste as required by rules and standards must be labelled with biohazard label. It was found that infectious waste was not labelled appropriately. It was found that infectious waste was not managed according to rules and regulations of the hospital (Abor and Bouwer, 2008).

Problems faced by some Hospitals in managing health care risk waste ranged from lack of rules and regulations, mixing of general waste and hazardous waste, no record keeping, use of one single colour bag, shortage of capacity, lack of waste manager, absence of training and development programmes for waste handlers and generators, absence of waste management committee (Abor and Bouwer, 2008).

Department of Environmental Affairs in its 2014/2013 annual reported mentioned that it facilitated the development of the Health care risk waste management regulations and non-combustion efficacy standards. The aim of this intervention was to improve the regulatory framework for the management of health care risk waste and to address the negative threats and impacts which healthcare waste places on humans and the environment (DEA, 2014).

#### 2.6.3.3 Incineration

Most developing countries dispose their waste by open dumping, incineration or landfill (Hossain *et al.*, 2011). Incineration is used world-wide as the preferred method for treating health care risk waste. Incineration is a thermal process of

treating waste and the products are ash and gases. The method is used for treating many types of medical waste from pathological waste to sharps (Hossain *et al.*, 2011). Most of the incineration facilities that existed in South Africa around 1997 estimated at 300 did not comply with the emission regulations and posed hazards on the environment and human health (Fiehn *et al.*, 2005). Gases released from incineration are harmful pollutants, carbon monoxide, metals (mercury, lead, arsenic, and cadmium), hydrogen chloride, furan and dioxin. Many of these pollutants, dioxins can be transported over a longer distance, pollute the soil, water and food source (Hossain *et al.*, 2011)

#### 2.6.3.4 Waste pickers work and lives

A study conducted by Schenck & Blaauw (2011) profiled the lives and work of waste pickers. The study was conducted in Gauteng, City of Tshwane. The focus was on the socio-economic status of waste pickers.

Most waste pickers were found to be males (97.2%) and were all black. Most waste pickers (49%) were aged 41 to 50. The study revealed that most waste pickers' school level was low and that affected their opportunity to get employment. Most waste pickers attributed their low level of education to poverty and lack of money as their main reasons. Most (90%) of the waste pickers had been in the business for five years. New entrants into the business of waste picking indicated that a trolley is the first thing they have to get to start collecting recyclables. Those without trolleys normally would rely on collecting boxes which they would carry on their heads.

The results also indicated that waste pickers collect what they can sell and use. Waste pickers sell the recyclables to buy-back centres. Recyclables sold to buyback centres are paper, plastic bottles, metals and cardboard. Waste pickers collect valuables from dustbins on waste collection days before the municipality empties them. The waste collected by these waste pickers would then be sold at set prices

decided by the buy-back centres. The study revealed that waste pickers worked for 12 hours a day starting at 06:00 am until 18:00pm and some of them had breaks in between.

Waste pickers working conditions are not favourable and they use trolleys which at times are old and not in good working conditions. The waste pickers also cited that the most common injuries they experience will be in the form of cuts as they mainly collect paper and plastic bottles. The study also revealed that waste pickers earn little money and not enough to support their families. Waste pickers earned income of between R19 and R97 per day. Waste pickers earn an income of between R100 to R156 per week (Schenck and Blaauw, 2011).

The Households perceptions of the waste pickers was one of the aspect recorded during the study. Household's perceptions are completely different from what waste pickers think of themselves. Waste pickers face a lot of rejection and victimisation from households who do not understand who they are and the positive contribution they do. Some households are sympathetic towards waste pickers and give them food and money and clothes. This is evidence of a healthy relationship. Police were reported to be understanding and never harass waste pickers (Schenck and Blaauw, 2011).

## **2.7 Summary**

### **2.7.1 Solid waste management in developed Countries**

A research was conducted in Turkey on solid waste management system, to evaluate the system of maximizing recycling and minimizing land filling of municipal solid waste. The results showed that the system will reduce required landfill volume up to 27%. The profit of the recommended system was estimated to be about 80 million US Dollars (approximately 800 million Rand). The system consisted of separation at source, collection, sorting, recycling, composting and sanitary land filling (Tinmaz and Demir, 2006). Knowledge, concern for environment and public

health can influence waste minimisation behaviour. Waste minimisation is also influenced by household's perceptions. If holds think that waste minimisation inconveniences them or they lack of time and knowledge they will not contribute towards waste minimisation (Tonglet *et al.*, 2004). Some of the factors that could influence the perceptions of the community on waste management are gender, age, level of education and economic considerations (Longe *et al.*, 2009).

A similar study was done in Israel and the focus was on the cost of transferring municipalities to separation at source system. Additional costs identified were for the purchase of extra waste containers and transportation costs. The overall costs of separation at source system was found to be less than the overall cost of mixed waste system (Lavee and Nardiya, 2013). The suggested separation at source in Israel is divided into two waste streams, wet waste and dry waste. Separation at source puts a strong responsibility on the waste producer, instructing them to manage their waste (Huss, 2007). Municipalities can benefit from separation of waste at source. Separation of waste at source can stimulate a supply of materials to composting facilities and other recycling industries, reduced disposal costs, possibly reduced waste collection costs, reduced environmental impacts from the extraction of natural resources, reduction of leachate and landfill gas emissions by reducing organic materials in landfills (Owusu *et al.*, 2013). In a survey conducted in Bangladesh the households showed concern and awareness about waste management. They fully supported the idea of separating waste from the source. Households participation was found to be low when results from the existing implemented projects were analysed (Matter *et al.*, 2013). A similar study in Abuja, Nigeria showed that households had poor attitude towards waste management/separation from source despite the government, private sector and the media's efforts on public awareness of waste management issues (Imam *et al.*, 2008). Both studies conducted in Abuja and Bangladesh revealed that households feel that waste management is the sole responsibility of the Municipality (Imam *et al.*, 2008; Matter *et al.*, 2013). A case study from Ghana, highlights the importance of recognizing the innovations of informal waste pickers and suggest that they need to be legitimized with the formal waste management system (Oteng-Ababio *et al.*, 2013). It will cost municipalities no extra costs for including the waste pickers in the

formal system as they draw their income from revenue they make from selling the recyclable materials to the buy-back centres. Informal and formal sectors may work together by employing the waste pickers who make their living on collection of recyclables (Zhang and Wen, 2013).

This study will give an indication on the approach to be followed from the perspective of the households. Socioeconomic conditions play a major role in implementing a new system, if there is no support for the system it will collapse. It is important to have community participation for the waste management system to be successful (Schenck and Blaauw, 2011).

#### 2.7.1.1 Household hazardous waste

Hazardous Waste is any waste which is can cause danger to public health or environment, when in contact with other wastes or substances or on it's own (Selvi *et al.*, 2013) . There is a concern over the disposal of municipal solid waste, which contains small amounts of hazardous wastes from households and commercial facilities. Municipal waste contains (5% - 7%) hazardous waste which is a concern, since this waste is disposed with the non-Hazardous waste in landfills. The disposal of household hazardous wastes is not regulated in many countries including South Africa (Tchobanoglous *et al.*, 1993). There are three categories of hazardous waste, (namely listed wastes, characteristic hazardous wastes, and other hazardous wastes) as defined by Resource Conservation and Recovery Act (RCRA), U.S. EPA. California is the first in US to implement the retail take-back program. Study conducted in Sweden on source separation of hazardous waste found that households willingness to separate hazardous waste at source can be improved by increasing the accessibility of recycling centres (Bernstad *et al.*, 2011) Hazardous waste is mixed with general waste and disposed without any form of separation at source by most households. Waste disposed at landfills contains hazardous waste which can contaminate surface water, soil, underground water and air. Hazardous waste and toxic waste from household waste is of smaller quantities. There is a

need to separate waste at source in order to avoid the negative impacts on the environment and public (Aprilia *et al.*, 2013).

### 2.7.2 Waste management in South Africa

South Africa, as an emerging nation, is facing the challenge of meeting high standards in service delivery with limited resources (Matete and Trois, 2008). In South Africa and other developing countries Municipal solid waste is still landfilled without any form of pre-treatment (Trois and Simelane, 2010). Trois and Simelane (2010) in a comparative study of South Africa, Austria and England suggested that South Africa needs to implement a simple wet and dry waste collection. Simple wet and dry collection model promotes recycling, treatment of biological waste before landfilling, resource recovery, labour intense jobs and sustainable landfilling (Trois and Simelane, 2010). There is an increased demand for waste service provision emanating from increased population growth, urban and industrial development (GDACE, 2004). Gauteng Department of Agriculture , conservation and environment (2004) further states that this demand is in terms of storage and collection facilities and services, handling and transportation, treatment and ultimately disposal services and facilities.

#### 2.7.2.1 Waste collection

According to Stats SA (2014) Waste management service is not provided to all households, only 8.41 million South African households have access to waste collection service. Compared to other basic services provided by municipalities waste collection is ranked the least, 9.99 million households have access to sewage and sanitation, 9.98 million households have access to electricity and 11.79 million households have access to water (StatsSA, 2014). It was reported in Stats SA (2014) report on non-financial census of municipalities that South Africa offers 2.5 million households from the total of 8.41 million households free basic solid waste management services. The number of households receiving waste management

services from municipalities increased by 5.1% between 2012 and 2013 (StatsSA, 2014).

#### 2.7.2.2 Waste Classification

In South Africa Waste is classified into two categories, public health risky waste and environmental risky waste (GDACE, 2004). GDACE (2004) in the Gauteng state of environment report classify waste as General waste, Hazardous waste, Health care risk waste, mining/Metallurgical and power generation waste,

#### 2.7.2.3 General waste

Waste generation depends on the economic status of society, high income communities produce greater waste per capita (GDACE, 2004). General waste generated within a municipality is usually the responsibility of the municipality to collect, transport and dispose. In South Africa most of the population do not receive regular waste collection service (Department of Environmental Affairs and Tourism, 2006). Municipal mixed waste is landfilled without any form of separation and treatment in South Africa (thick grey arrow in the waste flow diagram, Figure 2.6a & b). Reduce, reuse and recycling activities should be encouraged (the green arrows), which will lead to less waste send to landfill (the black arrows) (CSIR, 2011) . Household store waste temporarily in receptacles for collection with our any form of source separation. Waste is then collected by the contracted collection company from households or commercial units and transported to transfer stations. At the transfer stations waste is transferred to different vehicles which transfers it to the landfill without any form of treatment or sorting.



Figure 2.6.a: Waste flow diagram (CSIR, 2011)

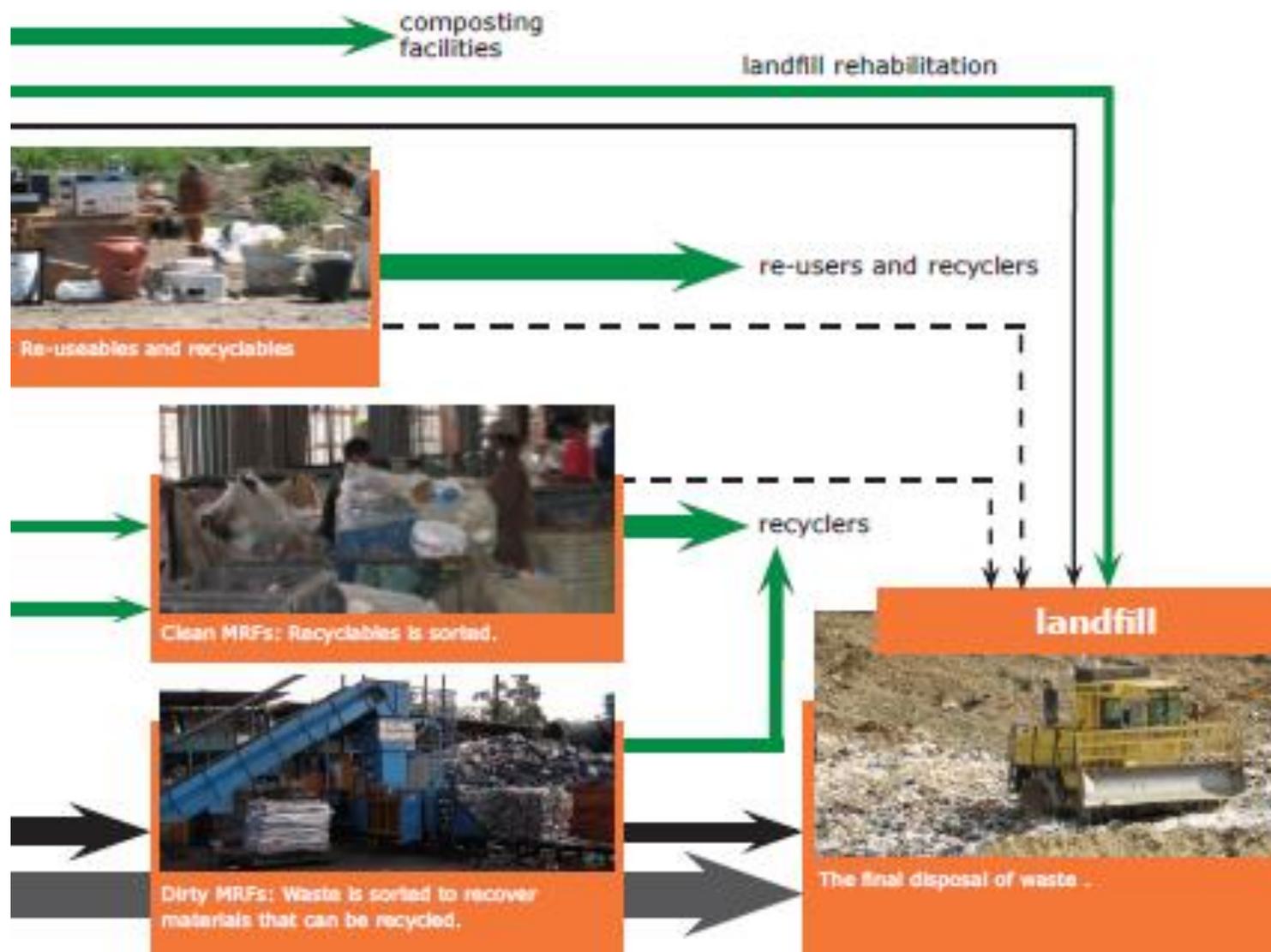


Figure 2.6.b: Waste flow diagram (continues) (CSIR, 2011)

#### 2.7.2.4 Perceptions of waste management

Actual behaviour was found to be best predicted by competencies and perception of behaviour or desired action were more indicated by beliefs (Corral-Verdugo, 1997). For households to recycle wastes they need to fully understand the proper way and the reasons to do it as opposed to simply desiring to recycle (Troschinetz and Mihelcic, 2009). According to Troschinetz & Mihelcic (2009) there are three factors that influence households interest in recycling, gender, age and household income. In South Africa the waste act 2008 clearly stipulates how solid waste should be managed and the implications for offenders (Oelofse, 2010). Participation of all relevant stake holders is crucial for successful implementation of the Waste Act. Perceptions of waste management has a major impact on the implementation of waste act and participation of all stake holders. Promotion of waste reuse and recycling can be achieved through awareness campaigns and education at all levels (Oelofse, 2010).

#### 2.7.2.5 Source reduction

Source reduction involves the design, manufacture, or use of products and materials to reduce the amount of waste. Source reduction can be a successful method of reducing waste generation if manufacturers could take into consideration the environmental and public health impacts of their products. A change in the design and type of materials used could result in products that generate less waste. A huge benefit have been noticed in many towns with an increase in waste pickers conducting recycling. Glass recycling, two-sided copying of paper, compost, packaging have shown major waste reduction at source. Improved public health and environmental conditions can be achieved by source reduction. Products shown be designed to reduce emissions of greenhouse gases, amount of waste, pollutants, amount of waste send to landfills and incinerators (Ogola *et al.*, 2011).

The Polokwane declaration addressed the important and urgent aspects in waste management waste reduction, reuse and recycling. The Polokwane declaration took a waste management system approach, where all stake holders from producers to end users had a role to play to ensure that the waste management goal is reached. The goal of the declaration was to minimise waste generation by 50% and disposal by 25% in 2012 and the development of a zero waste plan by 2022. National waste management strategy was then developed to deal with waste management aspects identified Ogola *et al.* (2011). Environmental Conservation Act 73 of 1989 was amended by the development of plastics regulations in terms of section 24. There are various problems related to collection and disposal of plastics in South Africa leading to pollution and degradation. Low income areas were impacted by the pollution and degradation caused by inadequate waste collection service. The production and disposal of plastics was expected to be reduced by regulating it (Ogola *et al.*, 2011).

Waste pickers initiatives can stimulate economic growth, job creation and can reduce illegal dumping of waste, prevent pollution and reduce degradation (Ezeah *et al.*, 2013). Recycling processes of municipal solid waste reduces the greenhouse gas emissions. Local and international literature suggests that informal waste pickers should be recognized, supported, incorporated and offered financial support to achieve sustainable waste management in developing countries. To achieve formalisation of waste pickers in the formal waste management system literature suggests the six important aspects to be considered are: acceptance by households, political support, formation of cooperatives, support from private enterprises, training and development and legal protection measures (Ezeah *et al.*, 2013; Friedrich and Trois, 2013).

The literature does not provide any information on the perceptions of waste pickers about being included in the municipal waste management system. This study will also give waste pickers an opportunity of providing information on their perceptions on being included in the formal waste management system and their choice of working conditions. The success of waste models in South Africa depends on the

household's perceptions and participation (Matete and Trois, 2008). Separation of waste at source can reduce the amount of waste sent to landfills, create jobs, and promote recycling. Waste can be separated into recyclable waste and non-recyclable waste or dry waste and wet waste in developing countries (Trois and Simelane, 2010). Literature thus not take into consideration the perceptions of communities in a mixed income level suburbs. Perceptions of the community can differ based on their level of education, type of suburb, size of yard, size of the family and level of income. This study will provide information on the perceptions of the community on waste management.

#### 2.7.2.6 Household hazardous waste

Cadmium is widely used in NiCd batteries which represents a potential resource and a hazardous waste. A study from Cape Town found that large amounts of cadmium are found in municipal waste streams of Cape Town as well as in landfill (Mason-Jones and von Blottnitz, 2010). Total mercury emissions (both air and waste) in South Africa have increased by 47% from 43 tons in 2000 to 62 tons in 2006. Of this 25% is estimated to be general waste. Knowledge and perceptions of the community on handling household hazardous waste will be determined in this study. Cosmo City does not have a policy or system of handling hazardous waste and it is mainly disposed with general waste at landfills.

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## **CHAPTER 3: RESEARCH METHODOLOGY**

### **3.1 introduction**

Studies on mixed-income housing initiatives were guided by the general hypothesis that enhanced neighbourhood conditions-physical, political, and socioeconomic translate into public goods that were broadly distributed across households (Onatu, 2012). This chapter outlines the methodology used in the study. It describes the study area, quantitative methods, qualitative methods and the field survey conducted in the study to collect data. The perceptions of households are compared in three different household types, low income, middle income and high income. The perceptions of households are compared through the waste management system, from separating waste from source to perceptions of households on waste pickers and recycling.

According to Haferburg (2013) the initiative for the development of Cosmo city was implemented to deal with the housing backlog through public-private partnerships, while, at the same time promoting socio-economic integration by offering the low income, middle income and high income low-cost and middle-class housing within a single suburb. The concept was to cater for people across class, social and racial lines. The original idea of Cosmo City goes back to the 1970s and 1980s (Murray, 2011). There was a plan to create a “Black African” township at the north western edge of Johannesburg. This Project was called NOWETO (an analogy to SOWETO, which stands for South Western Township), but the plan was dropped in the mid-1980s. Finally in 2004 the plans to develop Cosmo City were approved by the courts after some resistance from the residents of the northern suburbs (Haferburg, 2013). Ruiters (2009) mentioned that land which covered an area 1200 hectares, previously belonged to Absa Bank, which it has obtained through repossession. The land was then sold to the government and the Gauteng provincial government put it to tender to develop the first integrated housing development.

Lebeta (2009) reported that land use management by Cosmo Environmental Control Officer revealed that there are 206 informal land uses in Cosmo City. 171 informal land use were in the low income household area, 24 were in the high income household area and 11 in the middle income household area. Summary of these activities is shown in Table 3.1 below.

Table 3.1: Illegal land uses in Cosmo City (Lebeta, 2009)

<b>Summary of illegal land uses</b>	<b>Frequency</b>	<b>Percentage (approx.)</b>
<b>Spaza Shop</b>	60	29
<b>Shebeen</b>	37	18
<b>House extension</b>	85	41
<b>Car wash</b>	3	2
<b>Tyre shop</b>	1	1
<b>Public phone</b>	8	3
<b>Container</b>	11	5
<b>Caravan</b>	1	1
<b>TOTAL</b>	<b>206</b>	<b>100</b>

Lebeta (2009) further explained that Cosmo City's implementation has been informed by housing Act of 1997, DFA of 1995 and the 1996 Constitution. Physical implementation went according to plan, although there have been some delays due to budget constraints in the Local Authority. These land uses are due to absence of trading facilities and unemployment. It is provided in the General Principles of the 1997 Housing Act that housing should reduce poverty and create wealth. However, plan of action in this regard has not been adequately explored. Resident's survival strategies are not sufficiently taken into consideration before and after relocation, hence the unexpected outcomes (in a form of informal land uses) in the implementation of Cosmo City Project. The Project Manager stated that the inability to deal with the unauthorised land uses is due to lack of capacity in the council (Lebeta, 2009).

## 3.2 Study area

### 3.2.1 Location

Cosmo city falls in City of Johannesburg (CoJ) under Region C, which covers the greater Roodepoort area, parts of Randburg and north-western suburbs like Olivedale, Northriding, and Jukskei Park. Cosmo city emerged as result of the need to provide accommodation for the informal settlers of Zevenfontein and Riverbend who had been illegally occupying privately owned land, there were no basic services and residents were living under substandard living conditions (Onatu, 2012).

### 3.2.2 Topography

Figure 3.1 shows Cosmo City and the surrounding areas. The residents who received the fully subsidized houses were from Zevenfontein and Riverbend. The transition from the informal settlement to a more urban settlement had its challenges for some residents.

Waste management was never prioritized to most of them and now they have to ensure that they keep their Environment clean. The subsidized houses (Figure 3.2) improved the living conditions of the community and most of them are starting to show environmental awareness by having vegetable gardens. The vegetable gardens provide the household with healthy fresh home grown vegetables.

The partially subsidized houses (Figure 3.2) are mainly occupied by people who are earning between R3 500.00 and R10 000.00, whereas the fully subsidized houses are occupied by those who are earning below R3 500.00. In Cosmo City residents are separated according to their income levels. Residents who are earning over R10 000.00 are mainly found in the fully bonded houses (Figure 3.2).

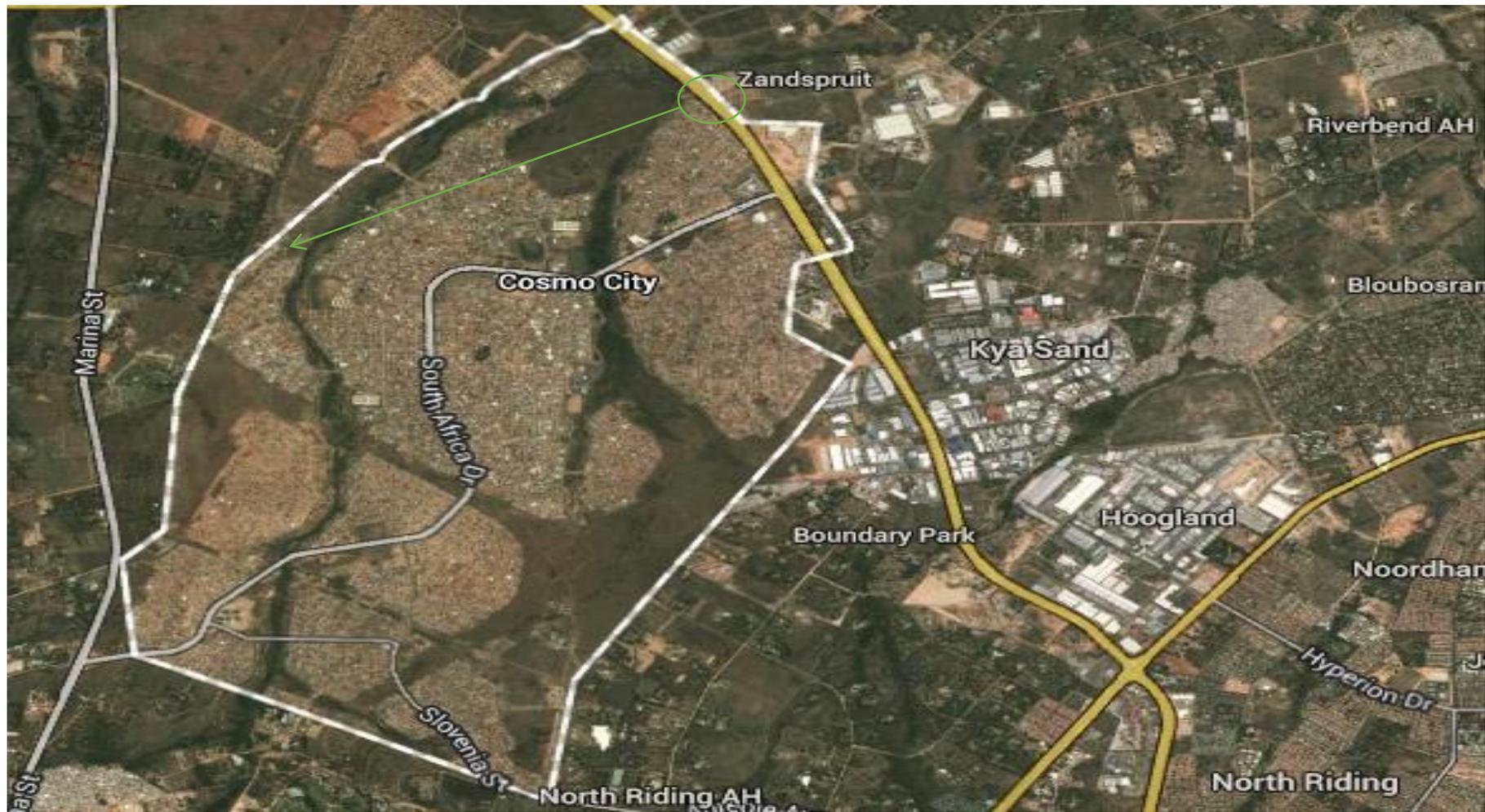


Figure 3.1: Cosmo City aerial photograph (Google maps, 2010)

The social housing apartments (Figure 3.2) are mainly occupied by residents earning above R6 000.00 and have a proper waste disposal and collection system, no illegal dumping and the vegetation is maintained by the body corporate. Waste collection is the responsibility of the municipality within Cosmo City.

### 3.2.3 Soil and geology

Cosmo City has steep slopes and very sandy soils, one of the essential requirements is the proper storm water management plan to prevent sand and silt from entering the streams during construction stage. Cosmo city was developed on a 1150 hectare farm which is divided by the sandspruit River as well as pristine spruit springing on the land (Van der Merwe, 2001)

### 3.2.4 Climate

Cosmo City through the City of Johannesburg is part of the city's flagship projects on climate proofing. The aim of the project is to reduce the greenhouse gas emissions by installing solar water heaters. Overall total of 700 households and seven schools were identified for this project. A total of 400 solar water heaters have been installed so far (Coj, 2010).

### 3.2.5 Water and air quality

The environmentally sensitive areas within the land on which Cosmo City is being built, include large wetlands and two perennial spruits that run through the site. 400 hectares of land was demarcated as conservation area. To ensure the integrity of the conservation area, it was enclosed with a 2.4 m-high concrete palisade fence

that runs a total length of 42 km. Johannesburg City parks manages the area (Van der Merwe, 2001).



Figure 3.2: Mixed housing types in Cosmo City (Google maps, 2010)

### 3.2.6 Environment

The beneficiaries of the 5000 low income houses (RDP) were indentified before the project started and before moving on site, every family attended an operational environmental management plan induction course at their previous residence. A detailed brochure was compiled, stressing the environmental importance of Cosmo City and all municipal services and why rates and taxes must be paid (Van der Merwe, 2001). An important aspect of the Cosmo City development is emphasis that is placed on the conservation of the environment. Johannesburg City Parks developed a total of 8 parks within Cosmo City for the benefit of the community (CoJ, 2010).

### 3.2.7 Population size

Cosmo city is a multifaceted mixed urban development with four different housing types, 5000 fully subsidized units, 3000 partially subsidized (credit-linked) units, 3300 fully bonded houses (market-rate housing) and 1000 social housing apartments for rent. The community in Cosmo City shares the same municipal services and social facilities (such as schools, crèches, clinics, parks, large conservation area) (Landman, 2012; Lebeta, 2009).

### 3.2.8 Economy

A survey conducted by Landman (2012) showed that 35% of respondents in Cosmo City earned less than R 2 500.00 per month, 16% earned between R2 501.00 and R5 000.00 per month, 19 % earned between R5 001.00 and R10 000.00 per month and 22% earned between R10 001.00 and R20 000.00 and 8% earned a household income of over R20 000.00 per month (Landman, 2012). The study conducted by Lebeta (2009) revealed that the level of poverty and absence of trading facilities are responsible for 206 informal economic activities in Cosmo City. It was found that the illegal activities in the low income household's area (RDP) are due to the fact that residents have been engaged in this kind of activities as their survival strategies

even before they were relocated. In contrary, the main reasons why residents occupying middle income households and high income households engage in informal trading was that there were no facilities for such activities. This was an extra income to their households, not necessarily the main income like for the low income households (Lebeta, 2009).

Cosmo City can be divided into 13 sections depending on the household income group. These sections are represented in Figure 3.3 with Orange Circles. Within each circle there's a Triangle, Square or a Cross representing the household income level, a Cross represent the high income household area, Triangle Middle income households area and a Square low income households area. From Figure 3.3 it can be clearly observed that residents in Cosmo City are separated according to their level of income. This separation was influenced by the qualifying criteria that used to own a house in Cosmo City during the implementation phase of the project. The qualifying criteria is outlined in the following Table 3.2.

In a closing statement Haferburg (2013) makes a controversial statement that Cosmo City represents the urban ideal of old South Africa within the new South Africa: it combines different housing types and income groups in a single suburb (new), but keeps them apart in their own neighbourhood (old). The combined parts of the development seem to be integrated, but disintegrate along the lines of their various social, economic, physical and symbolic properties if examined closely. State driven segregation along "racial" lines has been replaced by market-driven internal segregation along "class" divisions (new) (Haferburg, 2013).



Figure 3.3: Number of participants by location and type of dwelling in Cosmo City (created by Epi info. Version 7 Statistical Software)

Table 3.2: Housing types in Cosmo City and Qualifying Criteria (adapted from Ruiter, 2009)

Housing Types	Description
Low Income houses (Fully Subsidised)	<ul style="list-style-type: none"> <li>• 36 sq.m, two bedroom, living room and bathroom</li> <li>• Additional capital subsidy (as pilot project)</li> <li>• Household income from R0 – to R3,500</li> </ul> <p>Free house</p>
Middle Income houses (Credit Linked)	<ul style="list-style-type: none"> <li>• 45 sq.m and greater, higher spec, bond-financed</li> <li>• Government provided a R30 000 collateral deposit per house (initially R25 000)</li> <li>• Household income from R4 000 to R7 500 (initially 3 500 – R7 500 – but needed to be increased)</li> <li>• House price from R184 000 – R250 000</li> </ul>
High Income houses (Bonded)	<ul style="list-style-type: none"> <li>• 50 sq.m minimum</li> <li>• All banks were consulted</li> <li>• Minimum house spec set by PHUMA</li> <li>• Architectural guidelines were set out</li> <li>• All stands were allocated to developers</li> <li>• Household minimum income as set by most commercial banks was R15 000 jointly income (Haferburg, 2013).</li> </ul>

### 3.3 Methods and Materials

Fouche & Delport (2002) pointed out that in real life, human sciences research uses both quantitative and qualitative methodology. This research followed both quantitative and qualitative methodology to explore and describe the perceptions of the mixed income households on waste management in Cosmo City. The methodology included structured interviews, secondary literature analysis, field observation and questionnaire survey.

#### 3.3.1 Quantitative method

According to Creswell (2003) a quantitative method is one in which the investigator primarily uses post positivist claims for developing knowledge (i.e., cause and effect thinking, reduction to specific variables and hypotheses and questions, use of measurement and observation, and the test of theories), employs strategies of inquiry such as experiments and surveys, and collects data on predetermined instruments that yield statistical data (Creswell, 2003).

Quantitative data was collected by means of a survey design, from a sample implementing a standardised questionnaire. Questionnaires started with an opening statement to address the why, what and how of the study and assurance of confidentiality. Questionnaires were formulated according to the recommendations of Mvuma (2002) to cover:

1. The policy – legal related institutional issues
2. The waste generating entities- household
3. The recycling activities
4. Waste scavenging activities

The survey was administered by the researcher and four trained enumerators, who were trained to help with administration of the survey. The survey was conducted for an estimated period of five months. A random sampling method was used to

select households/participants for the survey, Excel 2013 was used to generate random numbers for household selection based on their household stand numbers. From a total population of 12 300 households, a total of 500 households were selected. A sample size was calculated using Epi info version 7 statistical analysis software. At 95% confidence interval the sample size of a population of 12 300 was calculated to be 387. The response rate was 81% with a total of 404 respondents. The distribution of the participants according to their type of dwelling and location is shown in Figure 3.2. The distribution shows that all household types (low income, middle income and high income) were well represented. All extensions in Cosmo City were represented and the response rate per area is in line with the population distribution.

### Field Inspection

The field inspection was conducted to assess and evaluate the illegal dumping sites and the types of waste disposed, the sizes of the illegal dumping sites and the effect on the environment and the nearby communities.

### Literature review

The literature on waste management in Cosmo City is limited since the area is still new. However a review of the waste management situation in Johannesburg (South Africa), Zambia, Zimbabwe and Kenya was compiled including the published government materials as discussed in chapter 2 (literature review). On waste management in Cosmo City there were no relevant studies found. There were four studies found about Cosmo City but none of them focused on waste management.

### 3.3.2 Qualitative Method

A qualitative method as explained by Creswell (2003) is one in which the inquirer often makes knowledge claims based primarily on constructivist perspectives (i.e., the multiple meanings of individual experiences, meanings socially and historically constructed, with an intent of developing a theory or pattern) or advocacy/participatory perspectives (i.e., political, issue-oriented, collaborative, or change oriented) or both. It also uses strategies of inquiry such as narratives, phenomenology, ethnographies, grounded theory studies, or case studies. The researcher collects open-ended, emerging data with the primary intent of developing themes from the data (Creswell, 2003). Qualitative research emphasizes words and meaning rather than quantification in the collection and analysis of data (Zou *et al.*, 2014). Qualitative data was collected by means of interviews with key stakeholders.

#### Structured interviews

Structured interviews were conducted with the Councillor and Environmental Officer for the ward. Depot manager of the nearby recycling company (Remade) was also interviewed. The waste pickers operating in the area were interviewed. The interviews were made up of open ended questions to allow the respondents to provide more information about waste management practices, expectations and recommendations. Interviews were conducted throughout the data-collection period, allowing enough time for clarification of observed aspects of waste collection.

### 3.3.3 Data analysis

Data analysis is explained by Mayan (2001) as the process of observing patterns in the data, asking questions of those patterns, constructing conjectures, deliberately collecting data from specifically selected individuals on targeted topics, confirming or refuting those conjectures, then continuing analysis, asking additional questions, seeking more data, furthering the analysis by sorting, questioning, thinking, constructing and testing conjectures, and so forth. Both quantitative and qualitative data were interpreted together after data was collected, captured, processed and results condensed (Creswell, 2003).

Quantitative data was collected by means of questionnaire which was coded and divided into different categories in order to assist with the final processing of both quantitative and qualitative data. Quantitative data was captured and analysed with the aid of a statistical analysis software EPI INFO version 7 on a computer. The data was coded by the same software and exported to excel 2013 for further analysis. The quantitative data was qualified by generating themes within the quantitative data and then compared with themes from the qualitative data, for the purpose of interpretation. These themes were then tabulated and inferences made in order to address the research questions (Creswell, 2003).

### 3.4 Research Ethics

Strydom (2005) stated that anyone who is involved in research needs to be aware of the general agreements about what is proper and improper in scientific research. It is essential that throughout the research process the researcher follows and abides by ethical guidelines (Strydom, 2005). Permission to conduct the Study in Cosmo city was obtained from the Ward Councillor. Ethical Clearance was granted by the University of South Africa, College of Agriculture and Environmental Sciences Ethics Committee. The researcher conducted the research in a manner that was respectful of the rights and integrity of all research subjects, as stipulated in the UNISA Research Ethics Policy.

According to Leedy & Ormrod (2005), the researcher should ensure that participants are not exposed to any undue physical or psychological harm. The survey process was clearly explained to the participants. Participants were given information sheets (Appendix 2) that outlined the process, confidentiality, withdrawal clause, potential benefits of the study, contact information of the researcher and Supervisor. All participants signed a consent form that confirmed that they have been afforded an opportunity to discuss relevant aspects of the project with the project leader, and hereby declare that they agree voluntarily to participate in the project.

### **3.5 Limitations**

The participants were home owners older than 21 years of age. Home owners younger than 21 years were excluded from the survey. In the low income area in Cosmo there are minors who are home owners. These home owners would not be able to answer certain questions and this could negatively affect the results. Only one participant per household was allowed to participate in the survey. Tenants were excluded from the study. Perceptions of tenants might not represent the perceptions of the community since they do not take part in community activities. Waste Collection Company and other local environmental activists were not interviewed.

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# CHAPTER 4: RESULTS AND DISCUSSION OF THE STUDY

## 4.1 Introduction

This chapter discusses the outcomes of the study and analyse the results of the three surveyed housing types. It also provides the results of the interviews with relevant government departments. It also gives the results of the field inspection on illegal dumping sites.

## 4.2 Demographics

### 4.2.1 Number of respondents per Age Group

Figure 4.1 shows the age of breadwinner for the low income, middle income and high income households in Cosmo City. Overall 392 participants responded. 167 respondents were from low income households, 157 from the middle income households and 68 from the high income households.

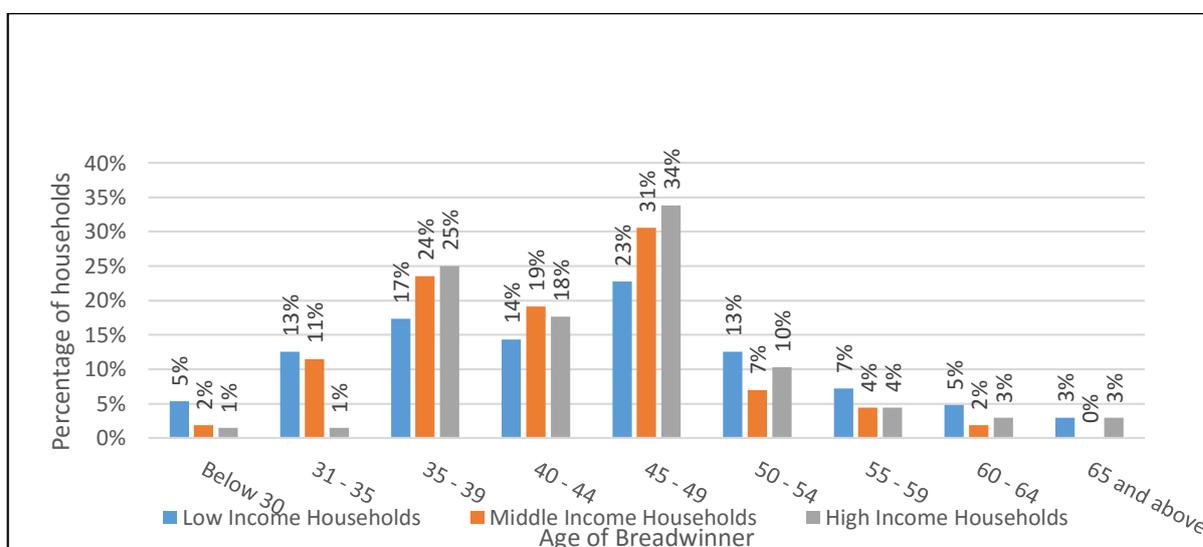


Figure 4.1: Age of breadwinner

The majority of households are between the ages of 45-49 across all income levels. This age group is made up of 23% of low income households, 31% of middle income households and 34% of high income households. The second major age group was 35-39 with 14% of low income households, 19% middle income households and 18% of high income households. Breadwinners of ages 35-49 comprise of 54% of Low income households, 74% of middle income households and 77% of high income households. 5% low income households, 2% of middle income households and 1% of high income household were aged below 30. 8% of low income household breadwinners, 2% of middle income breadwinners and 6% high income household breadwinner were of ages 60 and above.

#### 4.2.2 Gender of the breadwinner

Gender of the breadwinner was used in the study as one of the indicators that affects the level of income of the households and in turn the generation of waste. Overall 402 participants responded. Approximately 170 respondents were from low income households, 160 from the middle income households and 72 from the high income households. The summary of the gender of breadwinners are given in Figure 4.2.

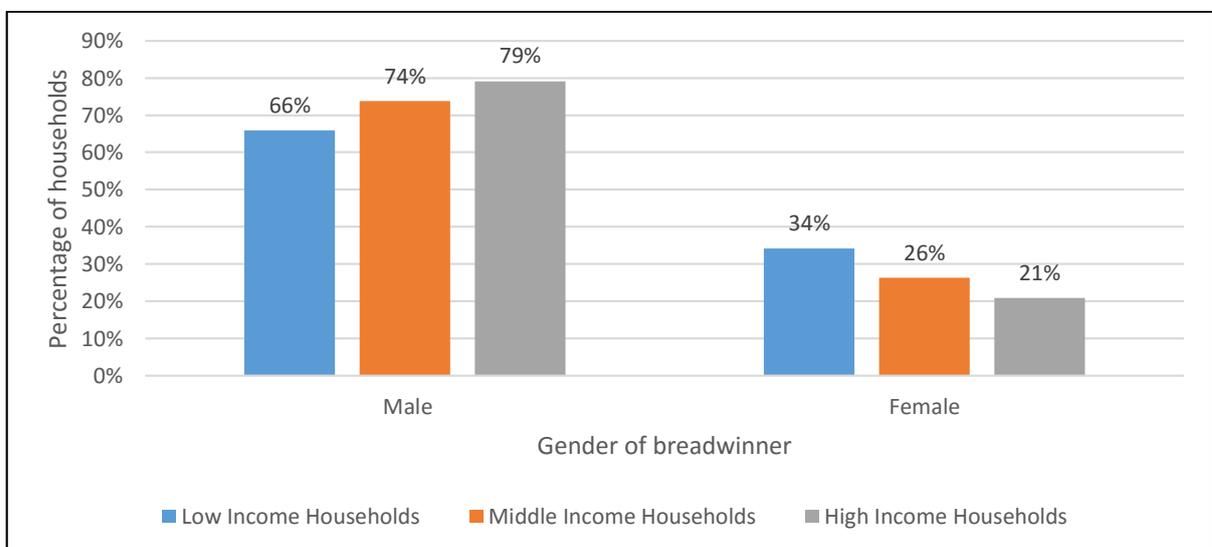


Figure 4.2: Gender of breadwinner

There is high percentage of male breadwinners across the three income groups. There are 66% of male breadwinners from low income households, 74% of male breadwinners from middle income households and 79% of male breadwinners from high income households. The % of male breadwinners increase from low income, middle income to high income households respectively. There is a low % of female breadwinners across the three income groups. There are 34% of female breadwinners from low income households, 26% of female breadwinners from middle income households and 21% of female breadwinners from high income households. The % of female breadwinners decrease from low income, middle income to high income households respectively. Women are most often the household managers and the ones who, within the household, are responsible for waste management from generation to disposal (Scheinberg *et al.*, 1999). Women decide mainly about the products used and their disposal. Gender of breadwinner influences the total income of the household and this in turn has an impact on the quality and nature of waste generated (Seholoholo, 1998). In Ghana a waste picker explained that there are more women waste cleaners because men are usually the bread winners of the family. Since the amount of money they receive is small, they cannot depend on that as their source of income. Women, usually play supportive roles in the family, and can afford to support their husbands with little income (Boamah, 2011).

#### 4.2.3 Household size

A total of 397 participants responded to this question. From this total number 171 respondents were low income households, 156 middle income households and 70 high income households. The impact of household size cannot be ignored when considering factors that influence waste generation. It is expected that bigger households generate more waste. The results of household size are summarised in Figure 4.3.

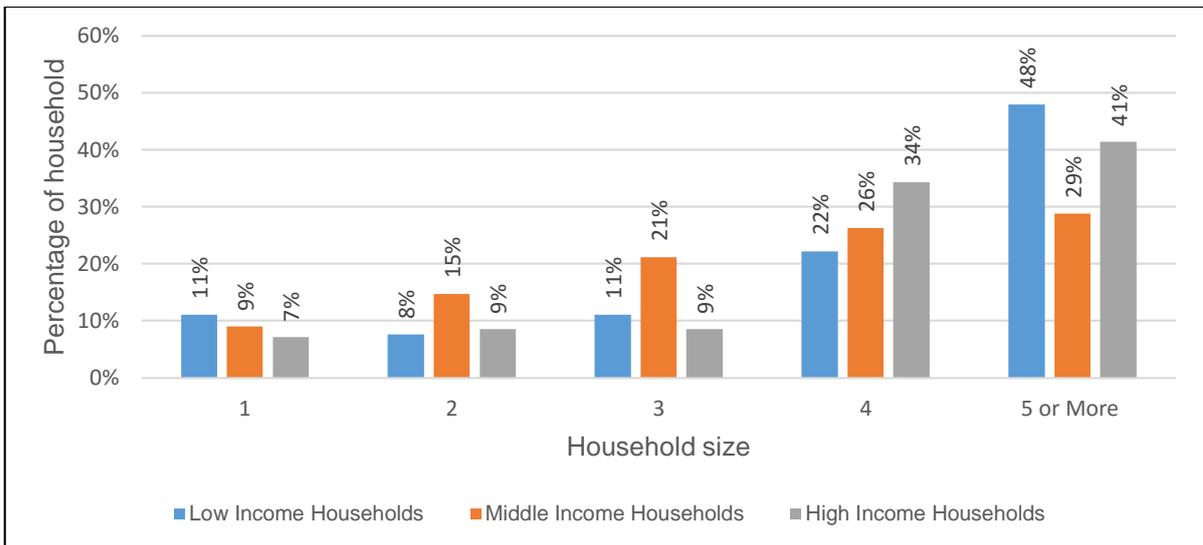


Figure 4.3: Number of household members

Low income households have a bigger percentage (48%) of households with 5 or more members. It was also revealed that 70% of low income households, 55% middle income households and 75% of high income households have more than four household members. The inverse is observed for household size of more than five, where middle income household's percentage is lower than both low income and high income households. Low income households were found to have the highest percentage at 48% for household size of more than 5, this is in line with the general concern of birth control among the low income households.

#### 4.2.4 Educational qualification

A total of 404 participants responded to this question. From this total number 172 respondents were low income households, 160 middle income households and 72 high income households. The summary of educational level of respondents are given in Figure 4.4.

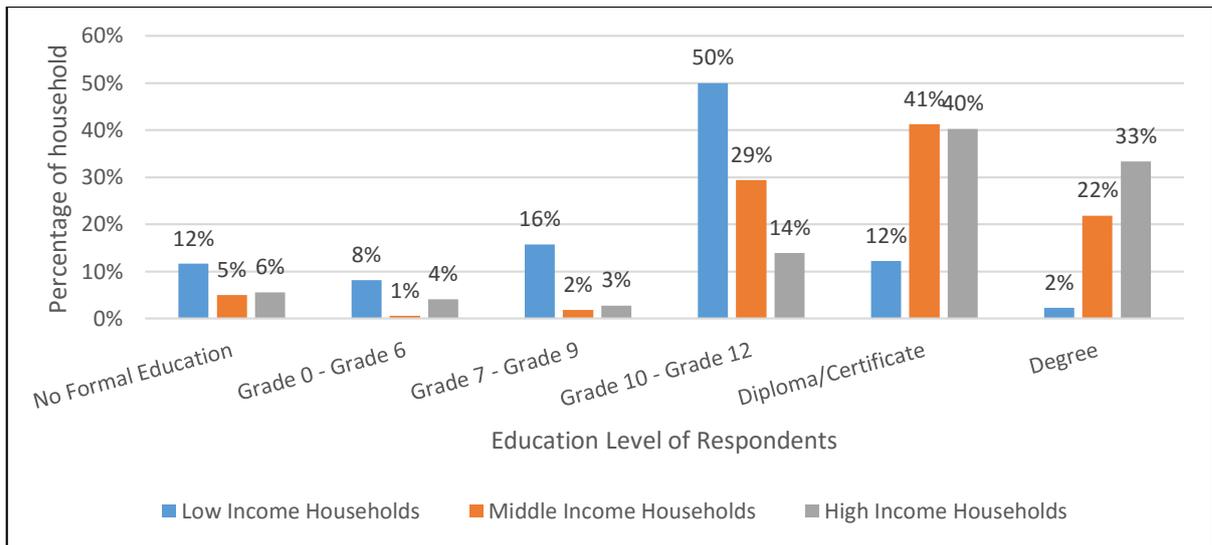


Figure 4.4: Education level of respondents

Most breadwinners (64%) from the low income household area have Grade 10 or higher qualifications. From the 64% of low income households heads only 14% have Certificate/Diploma/ Degree. Most of the Middle income breadwinners (92%) were found to have Grade 10 or higher qualifications with 41% breadwinners holding a diploma/ certificate and 22% holding a degree. An individual level of education improves ones chances of securing better paying Jobs. This phenomena easily explains the unemployment rate found in the low income household areas. Most of the High income breadwinners (87%) were found to have Grade 10 or higher qualifications, with 40% breadwinners holding a diploma/certificate and 33% of breadwinners holding degrees.

The relationship between education level and income level is directly proportional. This is clearly observed with 2% of low income breadwinners, 22% middle income households and 33% high income households holding degrees.

The study conducted in Kuala Lumpur revealed that urban poor communities with low-income and education have been proven to participate in waste separation from source and recycling. The study further showed that the relationship between percentage of respondents who separate waste from source and education level is

generally inverse (Murad, 2012). More educated and older household heads display higher concern for the environment (Tadesse, 2009). The trend observed in the study by Murad (2012) is further supported by Tadesse (2009) when further clarifying the behaviour of highly educated people, “More educated household heads use paid individuals to take the waste away from home and dispose of into containers”.

#### 4.2.5 Unemployment rate

A total of 402 participants responded to this question. From this total number 170 respondents were low income households, 160 middle income households and 72 high income households. Figure 4.5 shows the results of number of unemployed households.

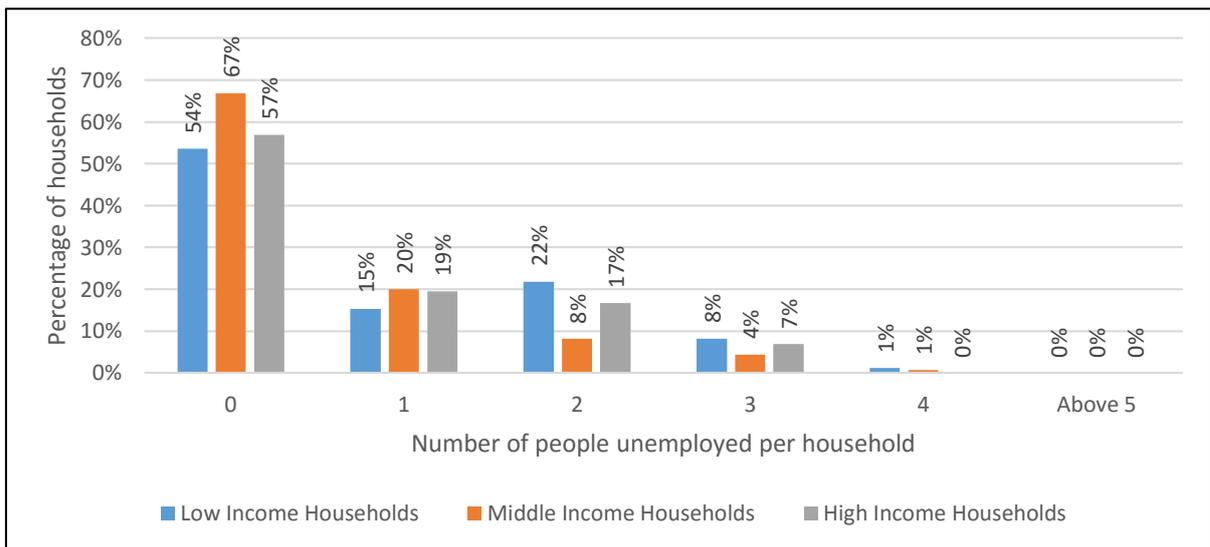


Figure 4.5: Number of unemployed people per household

The percentage of unemployed household members was found to be 46% for low income households, 33% for the middle income households and 43% for the high income households. Middle income household were found to have less unemployed household members, this is in line with the education level and household sizes.

The higher unemployment rate observed for low income and high income might be attributed to age of children and household size, level of education of household members older than 18 years and irrelevant qualifications in terms of skills required (mismatch between acquired education vs required skills).

Municipal waste collection rates are positively affected by increases in unemployment rate (Hage & Söderholm, 2008). Low income households are more likely to allocate time to separate waste and recycle waste than high income households. High income households prefer paying somebody to sort waste for them, usually the maid. (Hage & Söderholm, 2008). Unemployed people are more likely to engage in waste separation from source and recycling than employed people, the amount of money buy back centres pay for recyclables is not enough to encourage employed households to recycle waste. This indicator was included in the study since unemployment rate has a positive relationship with waste sorting from source and recycling (Medina, 2007a).

### **4.3 Waste Management**

#### **4.3.1 Waste generation**

A total of 403 participants responded to this question. From this total number 172 respondents were low income households, 159 middle income households and 72 high income households. Figure 4.6 shows the results of waste generation rate.

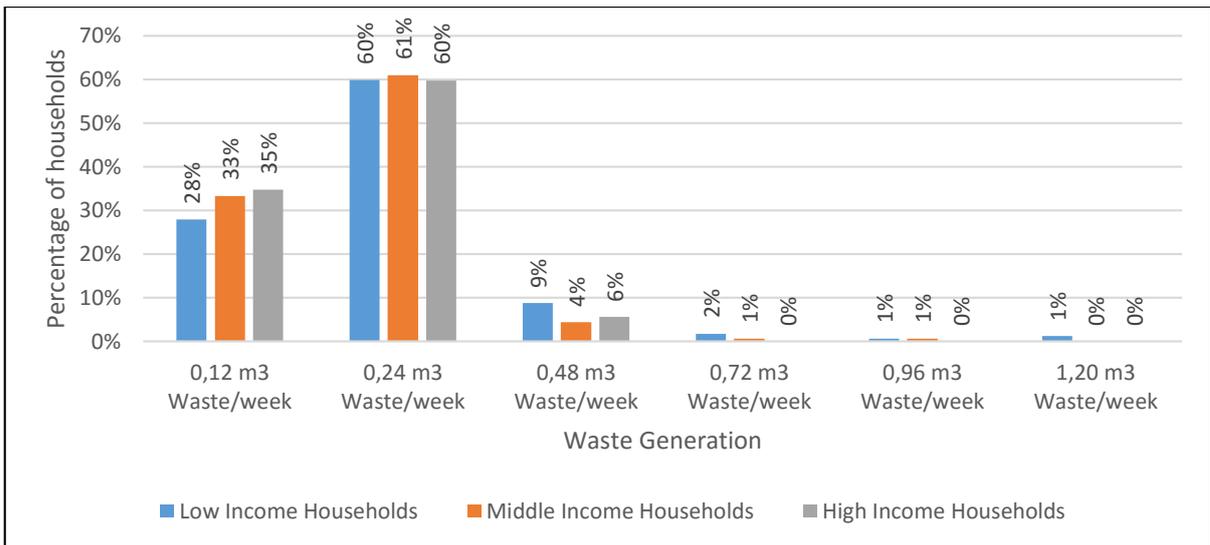


Figure 4.6: Waste generation

Volume of waste generated by each household varies depending on income and number of family members. Sixty percent of high income households generates 0.24 m<sup>3</sup> of waste every week. This Figure is relatively equal to the percentage for middle and low income households, where 61% and 60% of households generate the same amount of waste respectively. The highest amount of waste is generated by 1% of low income households, tenants in this households contribute to the total waste of 1.20 m<sup>3</sup> generated. The highest amount of waste generated by high income households was found to be 0.48 m<sup>3</sup> compared to 0.96 m<sup>3</sup> and 1.20 m<sup>3</sup> for middle income and low income households respectively. Thirteen percent of the low income household generate over 0.48 m<sup>3</sup> of waste while only 6% of the middle income households generate over 0.48m<sup>3</sup> and 6% of the high income households generate the same amount of waste.

#### 4.3.2 Recycling of waste by households

A total of 404 participants responded to this question. From this total number 172 respondents were low income households, 160 middle income households and 72

high income households. The results of recycling of waste per household are summarised in Figure 4.7.

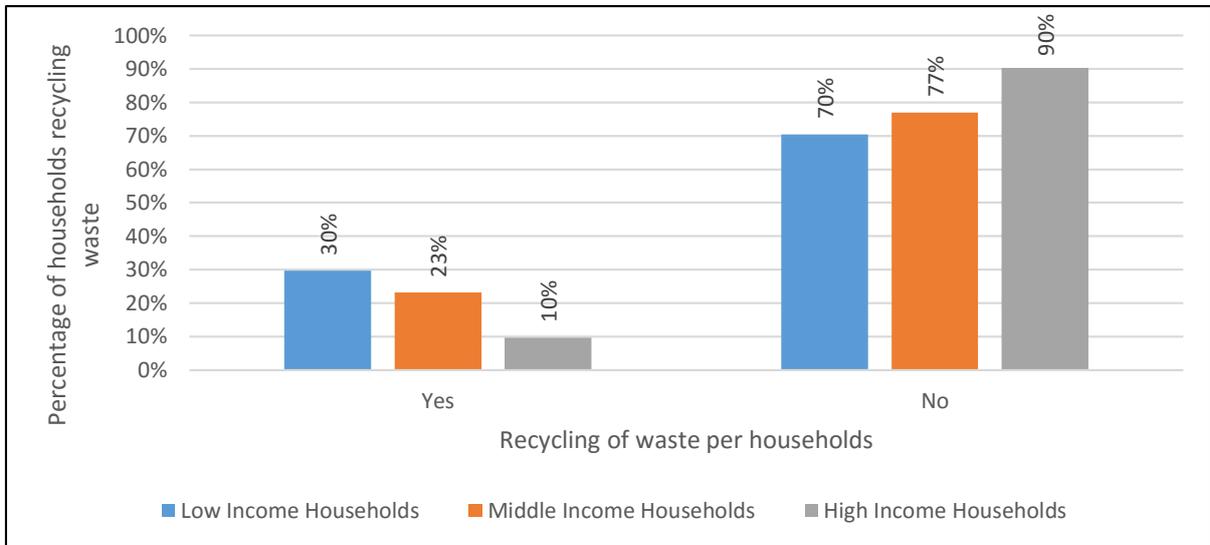


Figure 4.7: Recycling of waste per household

A few percentage of households recycle their waste. The low income households have 30% of households recycling their waste compared with middle income at 23% and high income households at 10%. Households who do recycle waste complained about the exchange rates at the buy-back centres, sorting time and storage space. Ninety one percent of high income households indicated that they do not recycle their waste. The resource value of waste, which allows people to make a living from discarded materials, was an important driver historically, and remains so in developing countries today (Wilson, 2007). The same driver is also expected in the low income communities, where the unemployment rate is high. Recycling of waste depends also on the accessibility of the local buy back centres. Recycling could be the solution to the high poverty and unemployment rate. Recycling if managed properly can produce sustainable cash injection to the community (Wilson, 2007).

### 4.3.3 Monthly expected income from recycling waste

Public awareness is a major important driver of waste recycling. Most households do not recycle their waste because there are not aware of how much money they can make if they start exchanging recyclable waste at the buyback centres. The findings in this section highlight the various wide range of expectation which reflects on the knowledge of the households in Cosmo City on recycling. A total of 365 participants responded to this question. From this total number 158 respondents were low income households, 146 middle income households and 61 high income households. The results of monthly expected income from recycling waste per month are summarised in Figure 4.8.

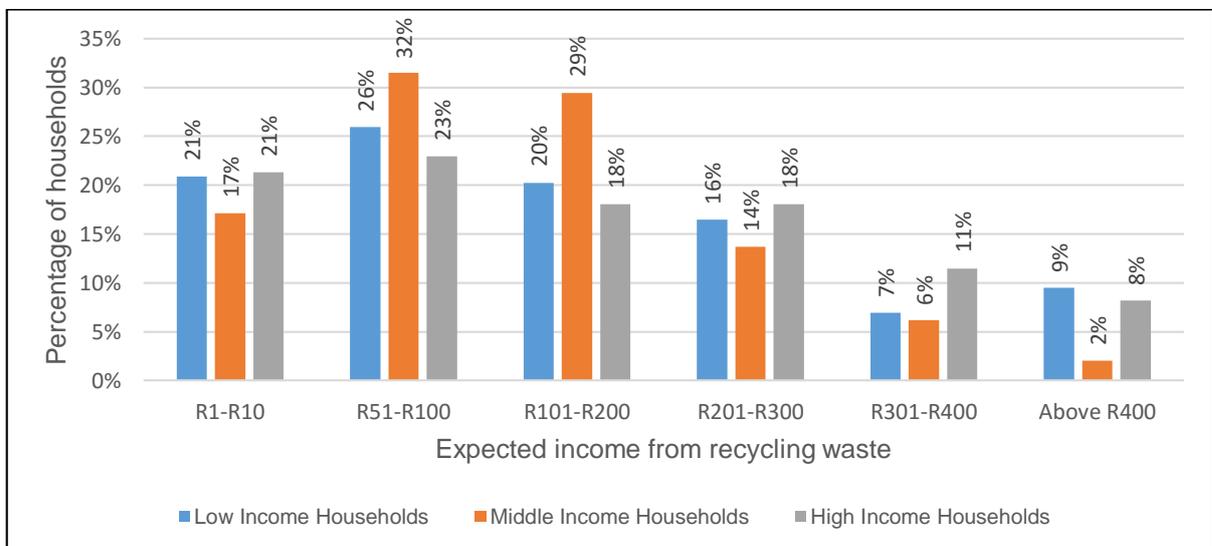


Figure 4.8: Expected income from recycling waste

Three income household groups showed closely similar trends in terms of expected income from recycling.. From low income households 46% of households showed an expectation of between R51-R200. Only 21% of low income indicated that they expect between R1-R10 incomes from recycling waste a month. This expectation shows a negative indication for the motivation of households to recycle waste, since R10 is no longer enough to even buy a loaf of bread. Middle income households

also showed a closely similar indication when 61% of households showed an income expectation of R51-R200, 41% of high income households indicated the same expectation (R51-R200). From the Middle income households group and high income households group 17% and 21% of households reported that they expected R1-R10 for recycling waste a month. This expectation has to be taken into consideration when implementing a household based source separation and recycling projects. Public policies that provide incentives to individuals to engage in recycling can have a positive economic and environmental impact (Medina, 2007b).

#### 4.3.4 Households willingness to sort waste

A total of 395 participants responded to this question. From this total number 166 respondents were low income households, 158 middle income households and 71 high income households. The results of household's willingness to sort waste are summarised in Figure 4.9.

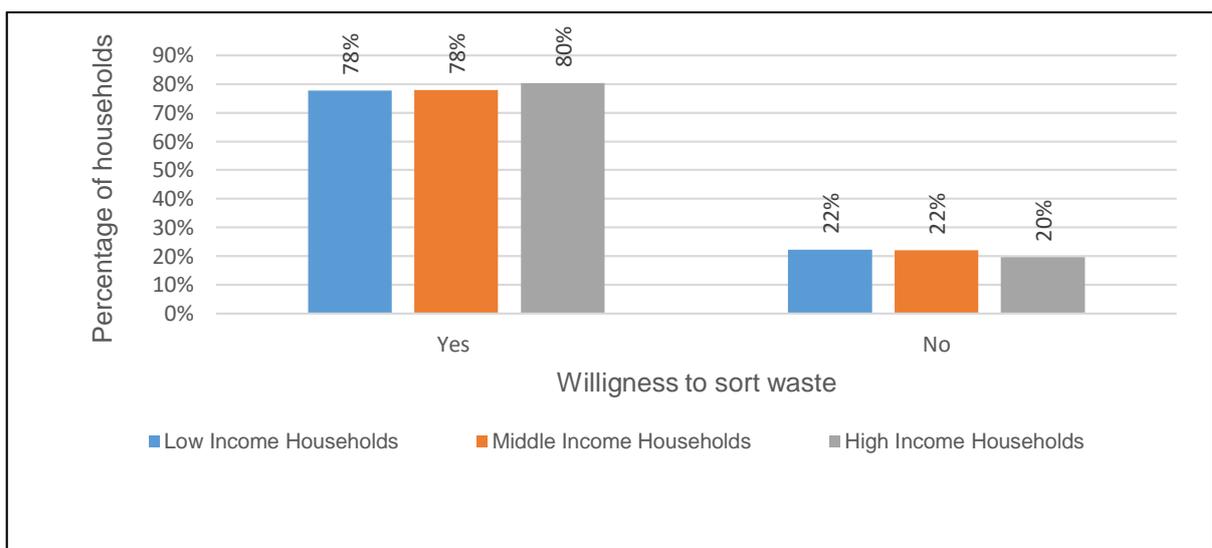


Figure 4.9: Households willingness to sort waste

The results of a survey on household's willingness to sort waste shows the same trend from low income households, middle income households and high income

households. The results showed 78% of low income households, 78% of middle income households and 80% of high income households are willing to sort waste from the source. Only 22% of low income households, 22% middle income household and 20% high income households were not willing to sort waste from source. Trend observed confirms Matsumoto (2011) findings that high income households actively engage in recycling activities. There are two major ways in which solid waste can be sorted and recycled – at the household level, when households are required to sort waste into a given number of categories, or in specialised sorting facilities. Traditionally, it has been thought that sorting at the household level is an inconvenience, as it uses space and requires time and effort (Czajkowski *et al.*, 2014). Households have a central role in waste management systems involving source-separation, as their work in separating waste forms the basis for all later steps in collection and recycling of waste (Owusu *et al.*, 2013). Studies have shown that high income household actively engage in recycling activities and well educated people actively engaged in recycling activities (Matsumoto, 2011).

#### 4.3.5 Willingness to sort waste without incentives

A total of 392 participants responded to this question. From this total number 164 respondents were low income households, 157 middle income households and 71 high income households. The results of household's willingness to sort waste without incentives are summarised in Figure 4.10.

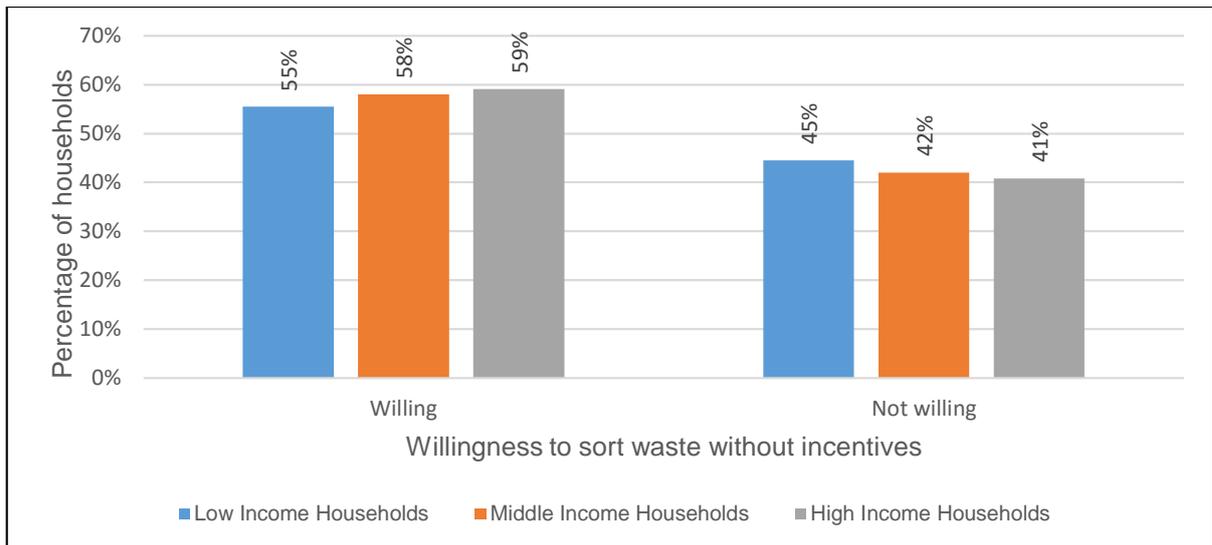


Figure 4.10: Willingness to sort waste without incentives

The results show that 55% of low income households, 58% middle income households and 59% high income households are willing to sort waste without incentives. There was definitely a drop of 23% for low income household, 20% for middle income household and 21% for high income household when the sorting waste without incentives was mentioned. This percentage drop indicates the impact that incentives have on household willingness to sort waste. Incentives can be used to stimulate household interest in sorting waste from source. This trend is also in line with the trend observed when households were asked about their willingness to sort waste from the source in Figure 4.10. Participation in source separation of recyclables without incentives can be challenging as source separation is considered as time consuming and possible being a dirty business. Incentives could be offered in the form of reduced monthly waste collection fees (CSIR, 2011). A study in Ghana showed that low income households were less interested to accept incentives than middle or high income households indicating that other factors than purely costs for waste management are important for households to sort waste (Owusu *et al.*, 2013).

#### 4.3.6 Expected incentives for sorting waste

A total of 373 participants responded to this question. From this total number 160 respondents were low income households, 143 middle income households and 70 high income households. The results of expected incentives for sorting waste are summarised in Figure 4.11.

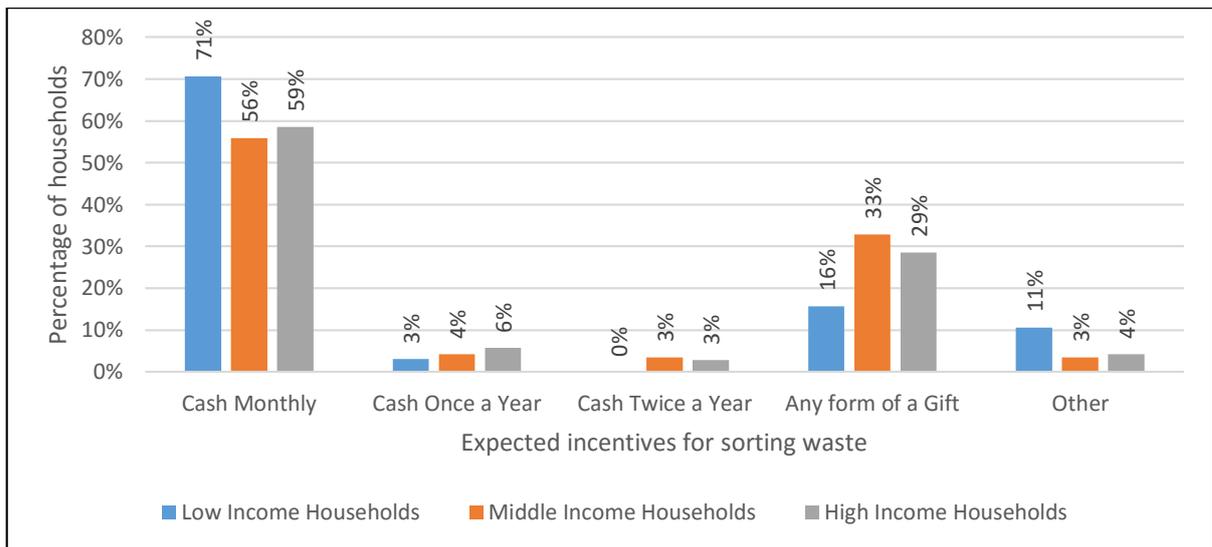


Figure 4.11: Expected incentives for sorting waste

About 71% of low income households, 56% of middle income household and 59% of high income household indicated cash monthly as an incentive for sorting waste from source.. The results also show that low income households were most willing to accept cash monthly than middle income and high income household. Low income households could be highly influenced by unemployment and availability of storage area for waste. The results also showed that 16% of low income households, 33% middle income households and 29% high income households were willing to accept any form of a gift. Middle income households were most willing to accept any form of a gift followed by high income households. Level of education and level of income might be the main contributing factors for willingness to accept any form of a gift. Low income households are less likely to accept cash

incentives than middle and high income households. This unexpected finding is evidence that other factors than purely costs for waste management are important for household's willingness to take part in source separation of waste. The perceptions on health and on sorting and the availability of open space in the households are important for the willingness to accept incentives for source separation (Owusu *et al.*, 2013). Type of incentive and frequency has an impact on household's willingness to sort waste from source.

#### 4.3.7 Waste collection service

A total of 371 participants responded to this question. From this total number 155 respondents were low income households, 149 middle income households and 67 high income households. The results of waste collection service rating are summarised in Figure 4.12.

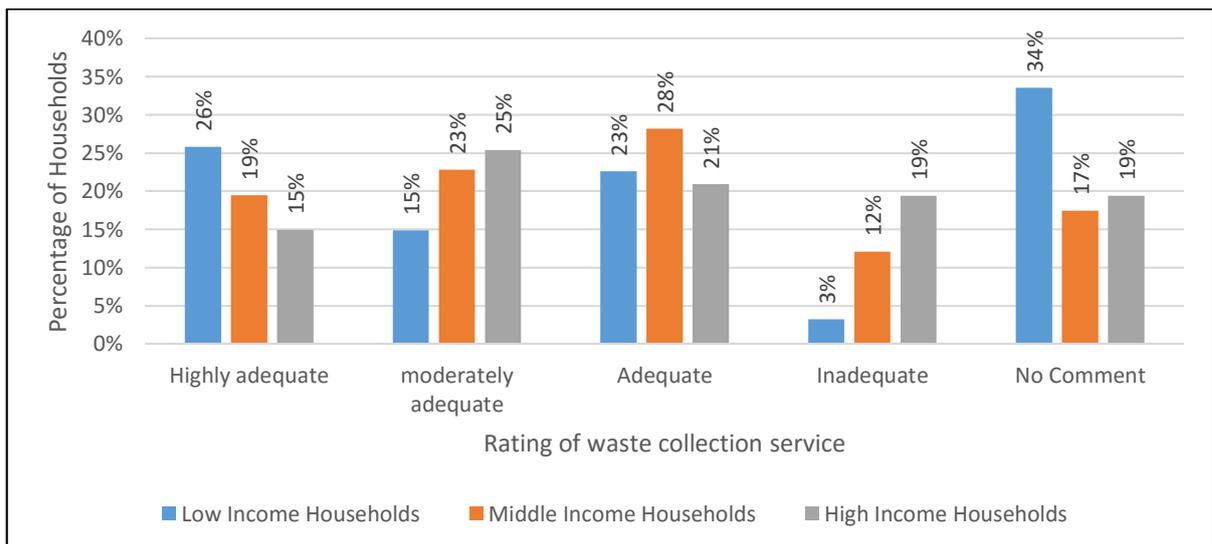


Figure 4.12: Rating of waste collection service

3% of low income household felt that waste collection in Cosmo City was inadequate whereas 34% did not comment. The high percentage of no comment feedback could mean there are some serious challenges that some residents are facing with

waste collection. The low income household area is associated with a number of illegal dumping spots. Low income household who felt that waste collection in Cosmo City was adequate kept on comparing it with their previous waste management in Severfontein and riverband (where they were residing before relocating to Cosmo City) where waste collection service was insufficient. 23% of low income residents felt that waste collection was adequate, 15% of the same group felt that waste collection was moderately adequate and 26% of the same group felt that waste collection was highly adequate. Overall 64% of low income felt waste collection in Cosmo city was adequate, moderately adequate or highly adequate. The middle income households had 70% of households who felt that overall waste collection was either adequate, moderately adequate or highly adequate. The high income households had 61% of households who felt that waste collection in Cosmo City was either adequate, moderately adequate or highly adequate. This results show in general that households feel that waste collection in Cosmo City is adequate with room for improvement. Many areas in Third World cities, mostly low income neighbourhoods, slums and squatter settlements, lack municipal waste collection (Medina, 2007a). Separate waste collection, recycling, and waste treatment prior to final disposal of the residues form the basis of a sensible waste management strategy for municipalities (Trois & Simelane, 2010). For waste management system to be sustainable it must be economically viable, technically appropriate, socially functional and environmentally acceptable (Owusu *et al.*, 2013). Most low and middle income countries solid waste collection and disposal services are not effective and sufficient for human use and that create negative impact on the environment and public health (Njoko, 2003).

#### 4.3.8 Potential adverse impacts of illegal dumping

A total of 402 participants responded to this question. From this total number 170 respondents were low income households, 160 middle income households and 72 high income households. The results of potential impacts of illegal dumping are summarised in Figure 4.13.

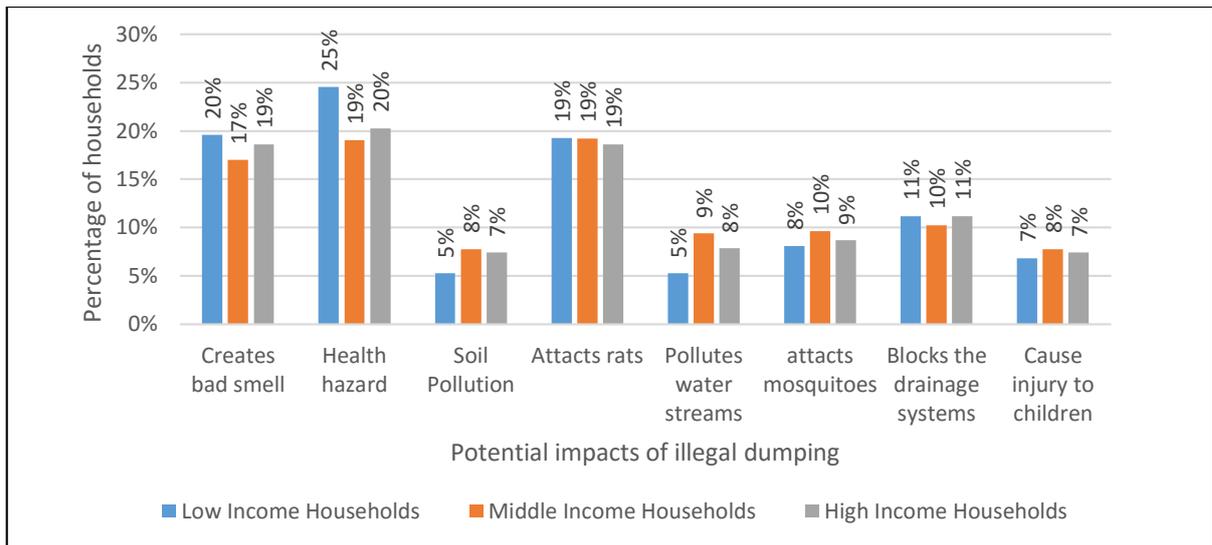


Figure 4.13: Potential impacts of illegal dumping

The results of the study showed that most households identified smell, health hazard and rats infestations as the major potential impacts of illegal dumping. The results showed that 64% of low income households identified smell, health hazard and rats as the major potential impacts of illegal dumping, 44% of middle income households identified smell, health hazards and rats as the major potential impacts of illegal dumping and 58% of high income households identified smell, health hazards and rats as the major potential impacts of illegal dumping.

Lack of neighbourhood pride creates a context where littering and the illegal dumping of waste takes place, which in turn results in a deteriorated public health (Winkler, 2012). Education and awareness is needed to make public aware of the impacts of illegal dumping e.g. waste pollution, decline in air quality, poor health, property depreciation. The City of Johannesburg reported that Illegal dumping is the second biggest waste stream contributing 16.5% following after waste collection from households contributing 54.7% (CoJ, 2011). At waste dumps waste pickers have reported to come into contact with blood, faecal matter, broken glass, needles, sharp metal objects, air particulates, chemical fumes, run-off, mice/rats, flies, mosquitoes, stray animals and animal carcasses (Nguyen & Chalin, 2003). General public suffer the indirect health risks associated with solid waste such as breeding

of disease vectors like mosquitos, rats etc, but the direct health risks are borne by the solid waste workers (Rani *et al.*,2010). More than 20 diseases have been proved to be associated with improper solid waste management. Most common health hazards identified are intestinal and respiratory infections, hepatitis, skin disorders (Rani *et al.*, 2010).

#### 4.3.9 Health concerns of sorting waste

A total of 402 participants responded to this question. From this total number 170 respondents were low income households, 160 middle income households and 72 high income households. The results of health concerns on sorting waste are summarised in figure 4.14.

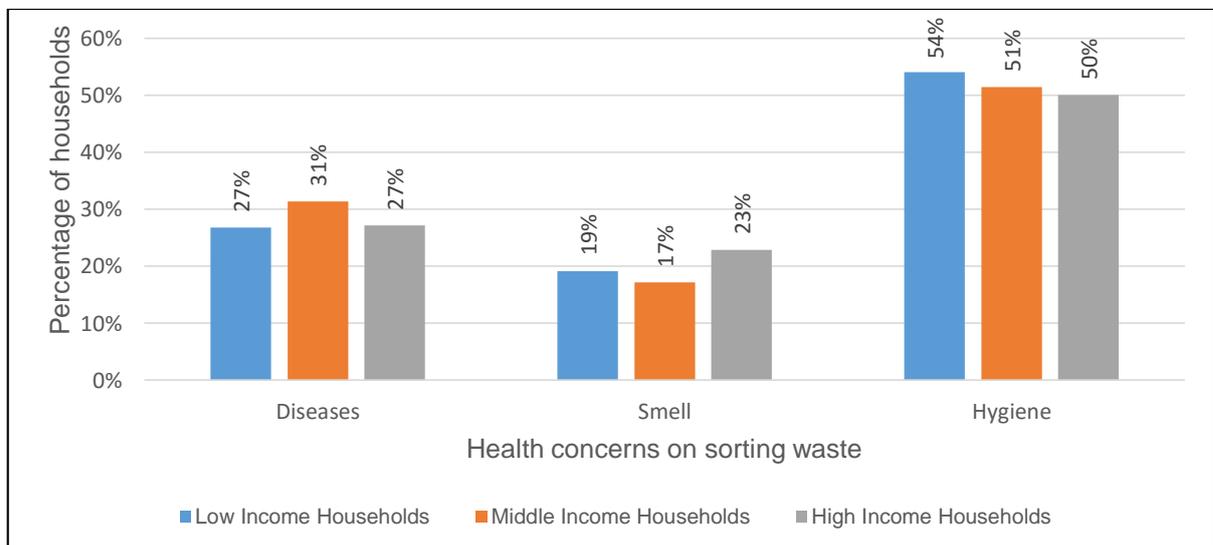


Figure 4.14: Health concerns on sorting waste

54% of low income households rated hygiene as the major health concern. The same trend is observed for the middle income at 51% and high income at 50%. Risk of contracting diseases was rated by 27% of low income households as a concern, 31% of the middle income households and 27% of high income households. Smell was rated by few households as a concern on sorting waste, with 19% of low income

households, 17% of middle income households and 23% of high income households. High income households showed a deviation from the trend with smell rated by most households as a concern than diseases. There is a relationship between solid waste handling and increased health risk (Nguyen & Chalin., 2003). Some of the common infections linked to poor solid waste management are hepatitis A, B and C, bacteraemia, haemorrhagic fevers, meningitis, respiratory infections, gastro enteric infections (Hossain *et al.*, 2011). The perception of one's capability is said to set a limit to what to do and ultimately what can be achieved (Longe *et al.*, 2009). The perceptions of household on the relationship of solid waste sorting and health risks involved can affect their willingness to sort waste.

#### **4. 4 Household's perceptions about waste pickers**

##### **4.4.1 Waste pickers increase security risk**

A total of 403 participants responded to this question. From this total number 172 respondents were low income households, 160 middle income households and 71 high income households. The results of waste pickers increase security risk of the area are summarised in Figure 4.15.

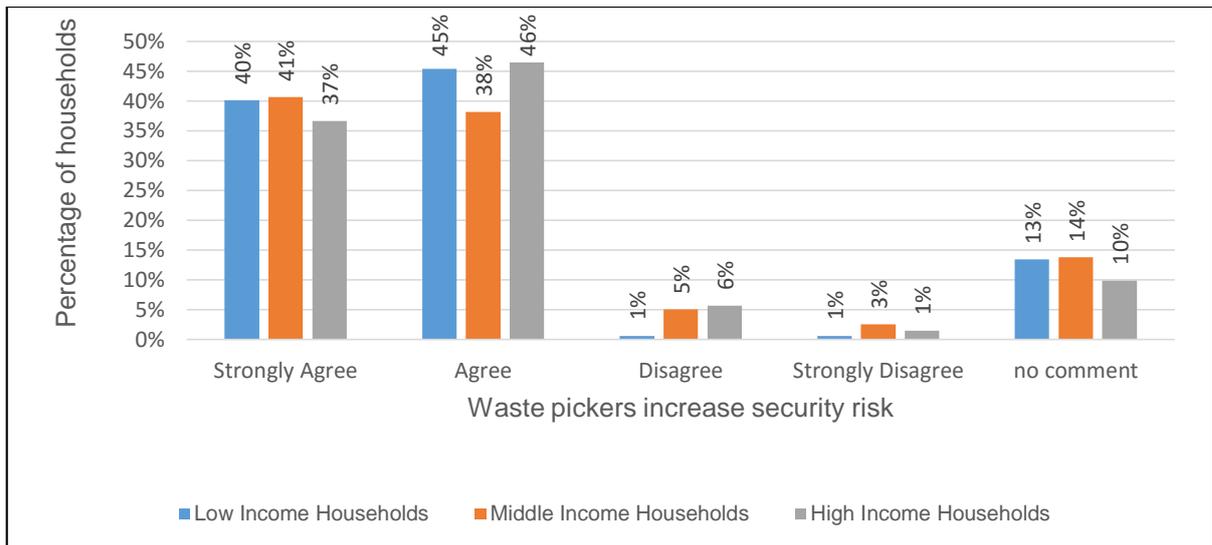


Figure 4.15: Waste pickers increase security risk of the area

The results showed that 85% of low income households agree or strongly agree that waste pickers presence increase the security risk of the area. Low income household's view was based on the high crime rate in their area and the presence of waste pickers could make it difficult to know whether they are genuine waste pickers or criminals disguising as waste pickers. Results of the middle income households showed that 79% of households agree or strongly agree that waste pickers increase the security risk of the area. High income households revealed that 83% of households agree or strongly agree that waste pickers increase security risk of the area. This results shows a rather unexpected outcome, generally it is expected that high income households will be more consent about security than low income households. The deviation could be explained by the integrated living areas that changed the perceptions of the community. The results could be different for the low income households and high income households who are not staying in an integrated environment. According to Gauley (1999) waste pickers have long been categorised as the poorest of the poor. This characterisation has resulted in waste pickers being perceived as vagrants, criminals and even garbage itself (Gauley, 1999). Historically, scavengers have been from low status groups, gypsies, immigrants, heretical religious sects, semi-criminal elements, untouchables and other low castes and outcastes (Sicular, 1991). Medina (2007a) reported that waste pickers are perceived as the poorest of the poor and marginal to mainstream

economy and society. They are subject to exploitation and discrimination by middlemen and by local and federal government policies. Efforts made previously to stop waste pickers failed. A better approach had to be developed to improve the working conditions of waste pickers in a more socially acceptable way. Waste pickers can provide an economic and environmental if efforts are made to organise and formalise them. Formalisation and organisation of waste pickers can help improve their working conditions and offer them an opportunity to earn higher income (Medina, 2007a).

#### 4.4.2 Households against waste pickers

A total of 404 participants responded to this question. From this total number 172 respondents were low income households, 160 middle income households and 72 high income households. The results of waste pickers should not be allowed to operate in our area are summarised in Figure 4.16.

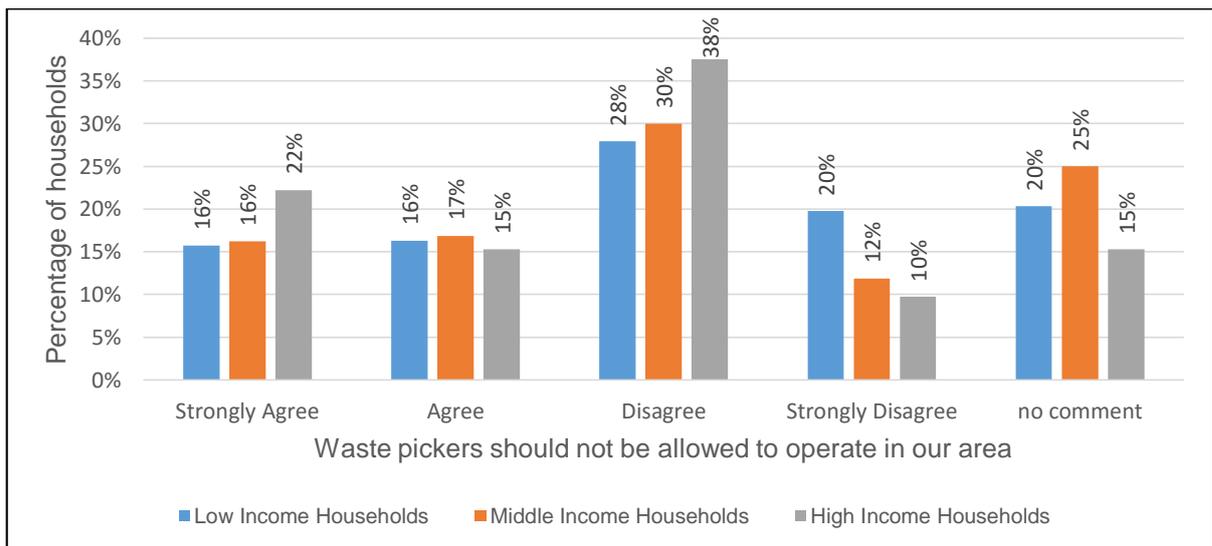


Figure 4.16: Waste pickers should not be allowed to operate in our area

The results showed that 32% of low income households agreed or strongly agreed that waste pickers should not be allowed to operate in Cosmo City, 48% disagreed

or strongly disagreed that waste pickers should not be allowed to operate in Cosmo City and 20% did not comment. Those who felt that waste pickers should not continue to operate in Cosmo City hinted crime as the major concern. The results from the middle income households showed that 33% agreed or strongly agreed that waste pickers should not be allowed to operate in our area, 42% of middle income households disagreed or strongly disagreed that waste pickers should not be allowed to operate in Cosmo City and 25% did not comment. Results of high income households showed that 37% of households agreed or strongly agreed that waste pickers should not be allowed to operate in Cosmo City, 48% of high income households disagreed or strongly disagreed with the statement that waste pickers should not be allowed to operate in Cosmo City and 15% did not comment. The results of the high income and the low income are in favour of waste pickers operating in Cosmo City is the same in this case indicating again the effect of integration of the community. Efforts to eliminate scavenging and to encourage waste pickers to engage in other occupations usually fail (Medina, 2007a). Many developing countries has declared waste picking as illegal and punished in many developing countries like Colombia, India, Philippine localities. Authorities often ignore waste picker's opinions. When waste pickers are formalised, their income level could improve to a level higher than some social service workers (Medina, 2007a). Godden-Bryson (2011) highlighted events in which waste picking was banned or criminalised by governments. Those on the side of waste pickers believe regulation is an excuse for states to criminalise waste picking. World bank and other organisations often recommended waste picking be banned at landfills and dumpsites (Godden-Bryson, 2011). In the United Arab Emirates, South and East Asian labourers are being targeted by an anti-waste picker taskforce in an effort to stop waste pickers collecting waste from household's waste bins. The taskforce has erected signs in six different languages to place on waste bins and high income households have been asked to report incidences of waste picking to the taskforce (Meehan, 2011).

#### 4.4.3 Household's support for waste pickers

A total of 401 participants responded to this question. From this total number 169 respondents were low income households, 160 middle income households and 72 high income households. The results of households who are willing to help waste pickers are summarised in Figure 4.17.

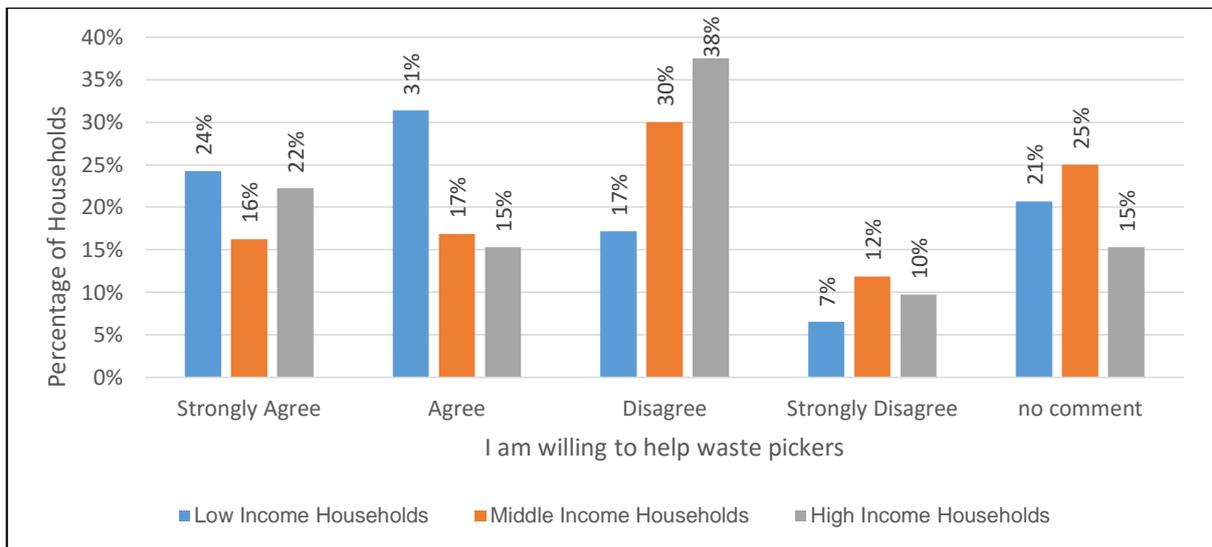


Figure 4.17: Households who are willing to help waste pickers

The results showed that 55% of households agree or strong agree to help waste pickers, 24% disagree or strongly disagree to help waste pickers and 21% did not want to comment. The positive results reflected are in support for helping waste pickers shows that the community believe in waste pickers. The community highlighted the importance of identification of waste pickers and regulation as the main important factors to offer their support. Households commented that if waste pickers can be easily identified by households then it will be easier for households to feel comfortable around them. Results for middle income households showed that 33% of households were willing to help waste pickers, 42% were not willing to help waste pickers and 25% did not want to comment. The results from high income

households revealed that 37% of households were willing to help waste pickers, 48% of high income households were not willing to help waste pickers.

In a study conducted in Pretoria, the public's perceptions on waste pickers were studied. It was established that there is no social relationship between waste pickers and the public. (Schenck & Blaauw, 2011). In India waste picker cooperatives, organisations and unions have formed an alliance of Indian waste pickers, which focuses on advocacy, peer support and sharing of information and experiences. Alliance efforts have affected positive changes to policies and government action plans affecting waste pickers (Godden-Bryson, 2011).

#### 4.4.4 Waste pickers visibility

A total of 404 participants responded to this question. From this total number 172 respondents were low income households, 160 middle income households and 72 high income households. The results of households who have not seen waste pickers in their area are summarised in Figure 4.18.

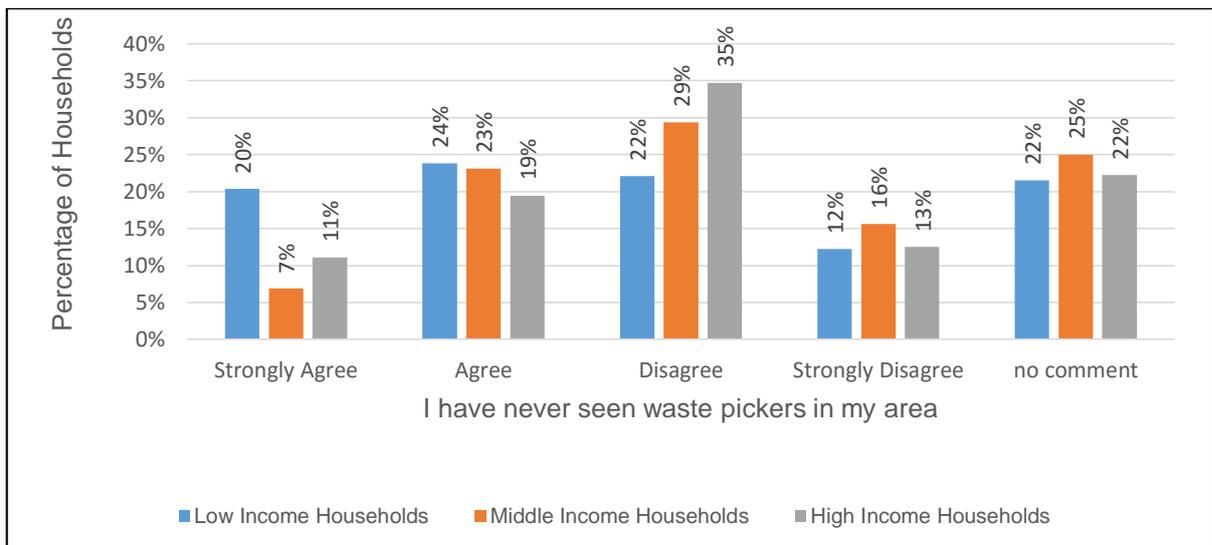


Figure 4.18: Households who have never seen waste pickers in their area

The results showed that 44% of low income households said they have never seen waste pickers in their area, 48% of low income households revealed that they have seen waste pickers in their area and 22% never commented. Results from Middle income households showed that 30% households have never seen waste pickers in their area, 45% of middle income households reported that they have seen waste pickers in their area and 25% never commented. Results from high income households showed that 30% of high income households have never seen waste pickers in their area, 48% of high income households reported they have seen waste pickers in their area. And 22% never commented. Most of the waste pickers are believed to come from the low income households and some operate in the same area and others that were interviewed operate in the middle income household area and high income area. There is still a smaller number of waste pickers operating in Cosmo City since waste pickers have long been characterised as the poorest of the poor. Takaki (2009) Waste pickers activity of picking through trash for recyclables has existed for a long time but has only gained considerable visibility recently. Due to the high number of urban poor relying on it for their survival and significant economic role they play in the production chain of recyclables (Takaki, 2009). Gauley (1999) revealed that waste pickers are visible component of a large recycling system, characterised by the sack they carry. This visibility combined with the competing perceptions of waste as pollution and waste as a resource raise social, economic, occupational health, and ecological concerns for activists, scholars and civil servants. Because of these concerns waste pickers tend to be the target of intervention schemes initiated by agents of change, or at the very least indirectly impacted by changes made to the recovery industry.

#### 4.4.5 Incorporation of waste pickers in the formal waste management system

A total of 404 participants responded to this question. From this total number 172 respondents were low income households, 160 middle income households and 72 high income households. The results of household's opinions on incorporation of waste pickers in the waste management system are summarised in Figure 4.19.

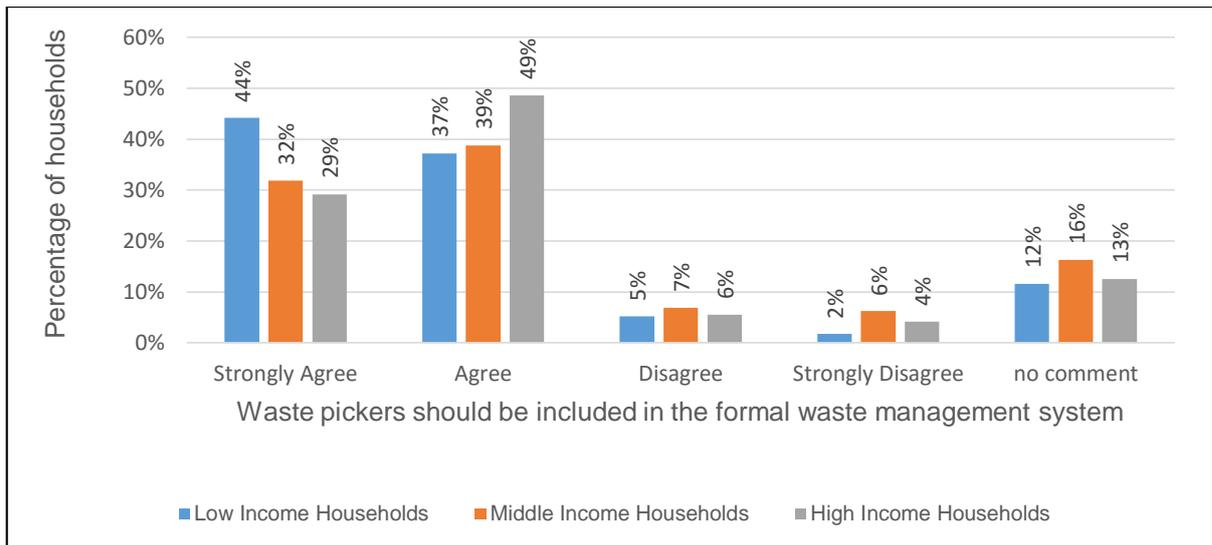


Figure 4.19: Incorporation of waste pickers in the waste management system

The results showed that 81% of low income households support the statement that waste pickers should be included in the formal waste management system, 7% of households do not support the incorporation of waste pickers in the formal waste management system and 12% did not want to comment. These results show a major change of perceptions of households only a small fraction is against the incorporation of waste pickers in the formal waste management system. The results of middle income households showed that 71% of households support the incorporation of waste pickers in formal waste management system, 13% of middle income households are against the incorporation of waste pickers in the formal waste management system and 16% did not comment. The results revealed that 78% of high income households support the incorporation of waste pickers in the formal waste management system, 10% of high income households were against the incorporation of waste pickers in the formal waste management system and only 13% did not comment. Policies towards waste pickers have changed due to failure of the American and European waste management technologies and environmental awareness (Medina, 2007a). Antonio (2010) provided a clear approach to incorporate waste pickers in the formal waste management system. The first step suggested was policy support to integrate informal recyclers in the solid waste management system. Secondly waste pickers must be formalised into organisations and cooperatives. Once formalised there must be provision of financial and

technical support (linking them to financial and training institutions, financial incentives/tax reduction, e.t.c.). Measures have to be in place for continuous protection of waste pickers from health hazards. Policy support for education and other skills capability development activities must be established (Antonio, 2010).

#### 4.4.6 Waste pickers and criminals

A total of 404 participants responded to this question. From this total number 172 respondents were low income households, 160 middle income households and 72 high income households. The results of waste pickers are not criminals are summarised in Figure 4.20.

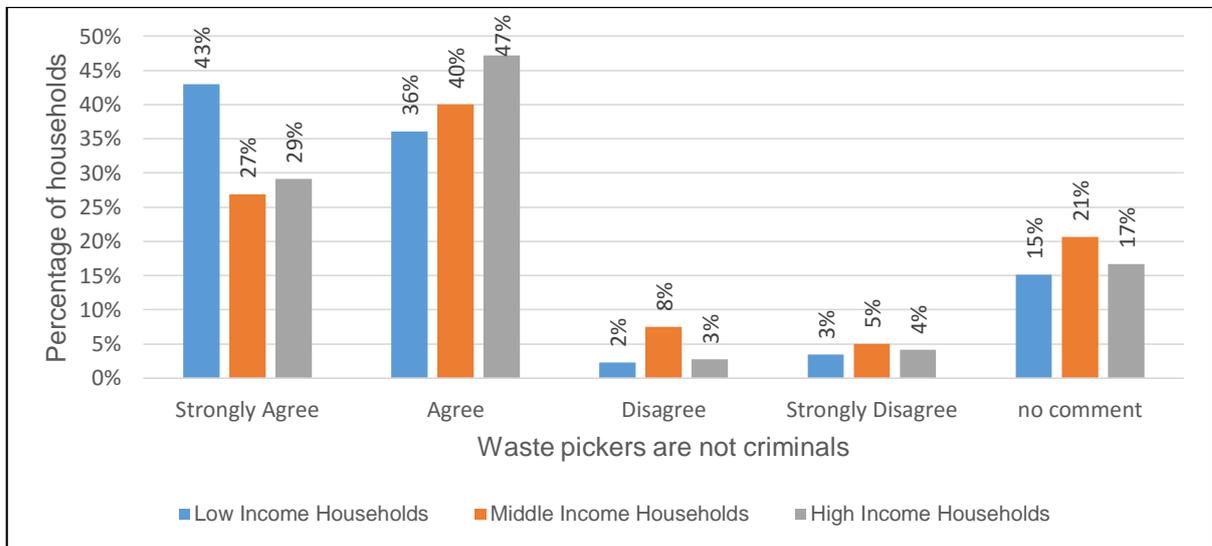


Figure 4.20: The view of households on waste pickers as criminals

The results showed that 79 % low income households believe that waste pickers are viewed as criminals, 5% of low income households believe that waste pickers are not viewed as criminals and 15% of the waste pickers did not comment. This results compared with the results in Figure 4.14 reveals that most households do think that waste pickers are criminals but that their presence if not regulated could invite criminals to take advantage of the initiative. The results also showed that 67%

of middle income households believe that waste pickers are viewed as criminals, 13% of middle income households believe that waste pickers are not viewed as criminals and 21% did not comment. The results for high income households revealed that 76% of households believe that waste pickers are viewed as criminals, 7% of high income households believe that waste pickers are not viewed criminals and 17% did not comment. Brechbühl (2011) revealed that waste pickers are often treated as nuisance, an embarrassment, or even as criminals by other city dwellers and public authorities. According to Medina (2007a), waste pickers are usually associated with dirt, disease, squalor, and perceived as nuisance, a symbol of backwardness, and even as criminals. Characterisation of waste pickers as the poorest of the poor has resulted in waste pickers being perceived as vagrants, criminals and even garbage itself (Gauley, 1999). Waste pickers collections of recyclable materials from bins within urbanised areas is frowned by my households who see it as a front for the increase in crime in their residential areas (Fiehn *et al.*, 2005).

#### 4.4.7 Recycling centre

A total of 403 participants responded to this question. From this total number 172 respondents were low income households, 160 middle income households and 71 high income households. The results of views of households community owned recycling centre are summarised in Figure 4.21.

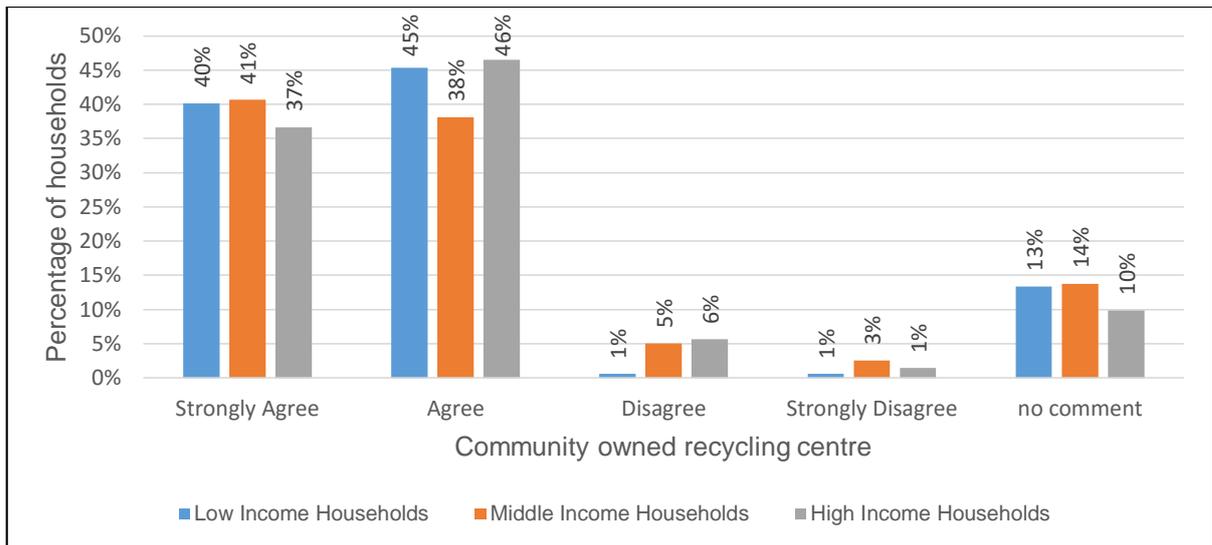


Figure 4.231: Views of Households on community owned recycling centre

The results showed that 85% of low income households support the idea of a community owned recycling centre, 2% of low income households do not support the idea of a community owned recycling centre and 13% of the low income households did not want to comment. Results from the middle income households showed that 79% households showed support for a community owned recycling centre, 8% of middle income households do not support the idea of community owned recycling centre and 14% of households did not want to comment. The results of high income households showed that 83% of households support the idea of community owned households, 7% of households did not support the idea and 10% did not comment. Lack of capacity and operational costs discourage Municipalities to implement the integrated waste management system (CSIR, 2011 ). Previously waste collection plans of Municipalities did not include minimisation and recycling since municipalities thought this duties were not part of their responsibilities (CSIR, 2011). The private sector is the main role player in the introduction and implementation of waste recycling initiatives, while community participation and government involvement has been limited (Fiehn *et al.*, 2005).

#### 4.4.8 Basic salary for waste pickers

A total of 404 participants responded to this question. From this total number 172 respondents were low income households, 160 middle income households and 72 high income households. The results of households view on basic salary for waste pickers are summarised in Figure 4.22.

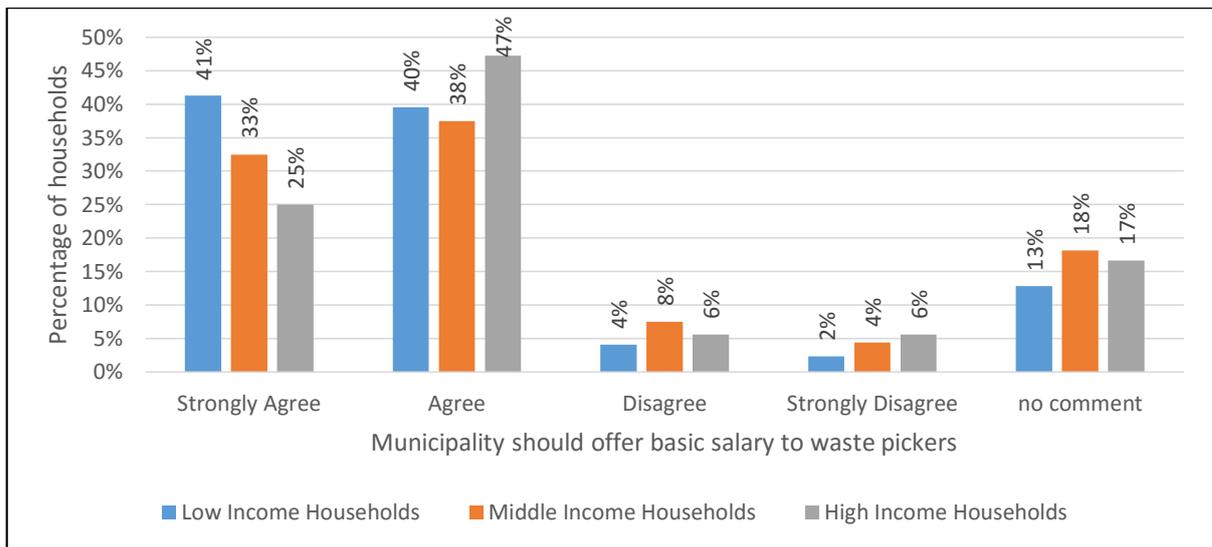


Figure 4.22: Households view on basic salary for waste pickers

The results showed that 81% of low income households felt that municipality should offer a basic salary to waste pickers, 6% of low income households felt that municipality should not offer a basic salary to waste pickers and 13% of households did not comment. Results from the middle income households showed that 71% of households felt that municipality should offer a basic salary to waste pickers, 12% of middle income households felt that municipality should not offer a basic salary to waste pickers and 18% did not comment. Results for high income households showed that 72% of households felt that municipality should offer a basic salary to waste pickers, 12% of high income households felt that municipality should not offer waste pickers a basic salary and 17% of high income households did not comment.

Based on the results from the current study, most of the households think that waste pickers should be offered a basic salary.

In a study conducted in Pretoria (South Africa) by (Schenck & Blaauw, 2011) it emerged that waste pickers mostly earn so little that they are unlikely to be able to contribute to the support of their families. The average weekly income earned by street waste pickers was found to be R156.35. On average, four people depend on each waste picker for survival (Schenck & Blaauw, 2011). McLean (2000) also found in a study conducted in Durban that an average of four people was supported by each waste picker. An average street waste picker will find it difficult to support four people on an average monthly income of R620. A relatively higher basic salary could help waste pickers to support their families.

#### 4.4.9 Regulation of waste pickers

A total of 403 participants responded to this question. From this total number 171 respondents were low income households, 160 middle income households and 72 high income households. The results of households view on regulation of waste pickers are summarised in Figure 4.23.

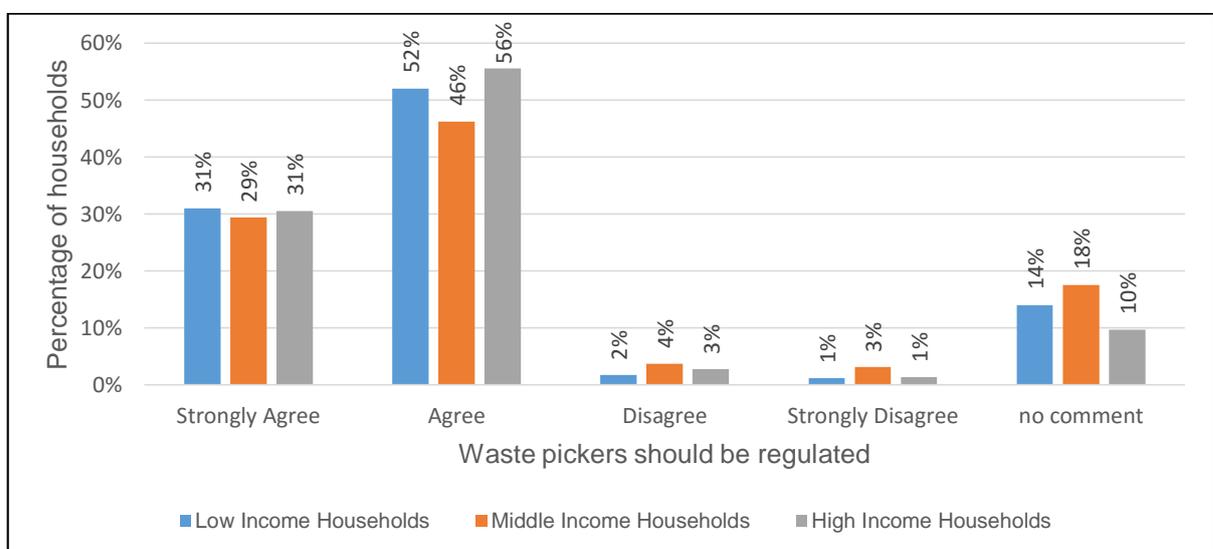


Figure 4.23: Households view on regulation of waste pickers

The results showed that 83% of low income households support the regulation of waste pickers, 3% of low income households did not support the regulation of waste pickers and 14% of low income households did not comment. Results of middle income households revealed that 75% support the regulation of waste pickers, 7% of middle income households did not support regulation of waste pickers and 18% did not comment. Lastly, 87% of high income households showed support for regulation of waste pickers, 4% of high income households did not support regulation of waste pickers and 10% did not comment. McLean (2000) suggested his final comments that local councils should recognise the potential social and environmental implications of facilitating informal collection. Waste pickers should be organised so as to allow them greater representation, including their needs in policies, recognising them as part of the waste management system of the cities and also acknowledging their contribution to the environment.

APO (2007) argued that waste picking should be considered a profession. In general, waste pickers are very helpful for solid waste management since they recover a large proportion of the waste for recycling and reusing. Waste pickers work needs to be organised and managed (APO, 2007). Sicular (1991) highlights the negative impacts of regulating waste pickers and explains that self-regulation of waste pickers encourages them to work more efficiently, longer, and encourages individualism and competition. According to Ezeah *et al.* (2013) the conference held in Bogota, Columbia on the 04<sup>th</sup> March 2008 emphasised the need to work for the social and economic inclusion of waste pickers in solid waste management systems through the implementation of improved laws and public policies which effectively strengthen their organisations.

#### 4.4.10 Contribution of waste pickers on illegal dumping of waste

A total of 404 participants responded to this question. From this total number 172 respondents were low income households, 160 middle income households and 72 high income households. The results of household's opinion on waste picker's contribution to illegal dumping are summarised in Figure 4.24.

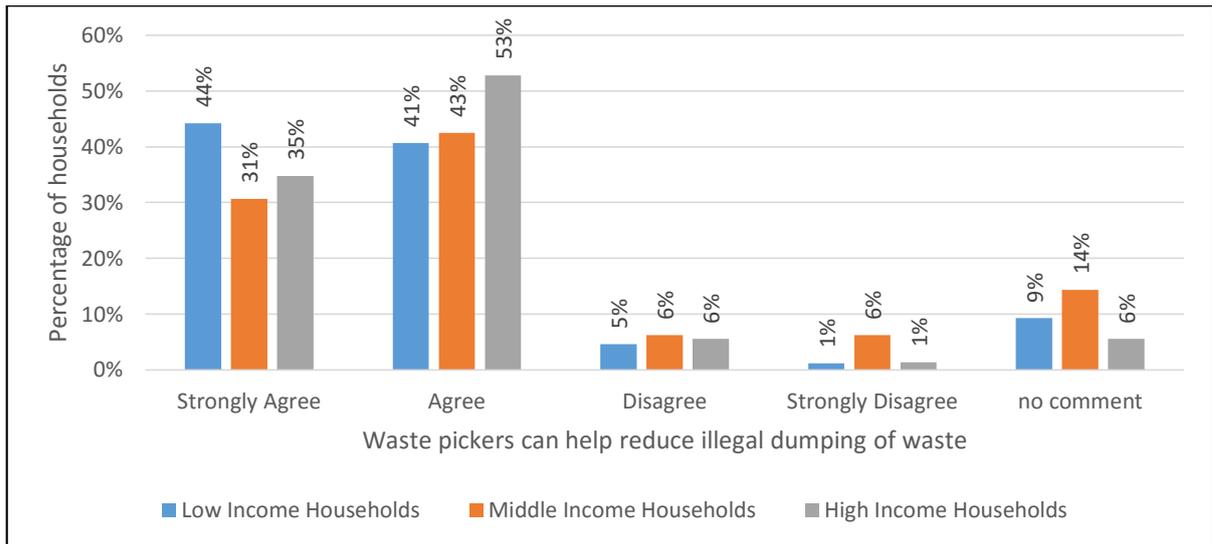


Figure 4.24: Households opinion on waste picker’s contribution to illegal dumping

The results showed that 85% of low income households felt that waste pickers can help reduce illegal dumping of waste, 6% of low income households felt that waste pickers cannot help reduce illegal dumping of waste. Results of middle income households showed that 74% of middle income households felt that waste pickers can help reduce illegal dumping of waste, 12% of middle income households felt that waste pickers cannot help reduce illegal dumping of waste and 14% did not comment. Results of High income households revealed that 88% of households felt that waste pickers can help reduce illegal dumping of waste, 7% of high income households felt that waste pickers cannot help reduce illegal dumping of waste and 7% of high income households did not comment.

According to APO (2007) waste pickers play a significant role in waste management, they collect recyclable materials from bins, households, and illegal dumpsites. It definitely clear that if waste pickers can reduce the amount of waste at source there will be less waste reaching illegal dumpsites and landfills. According to Medina (2007a), Indonesian waste pickers reduced the volume of waste to be collected municipalities by one-third.

#### 4.4.11 Employment creation

A total of 404 participants responded to this question. From this total number 172 respondents were low income households, 160 middle income households and 72 high income households. The results of employment creation in recycling are summarised in Figure 4.25.

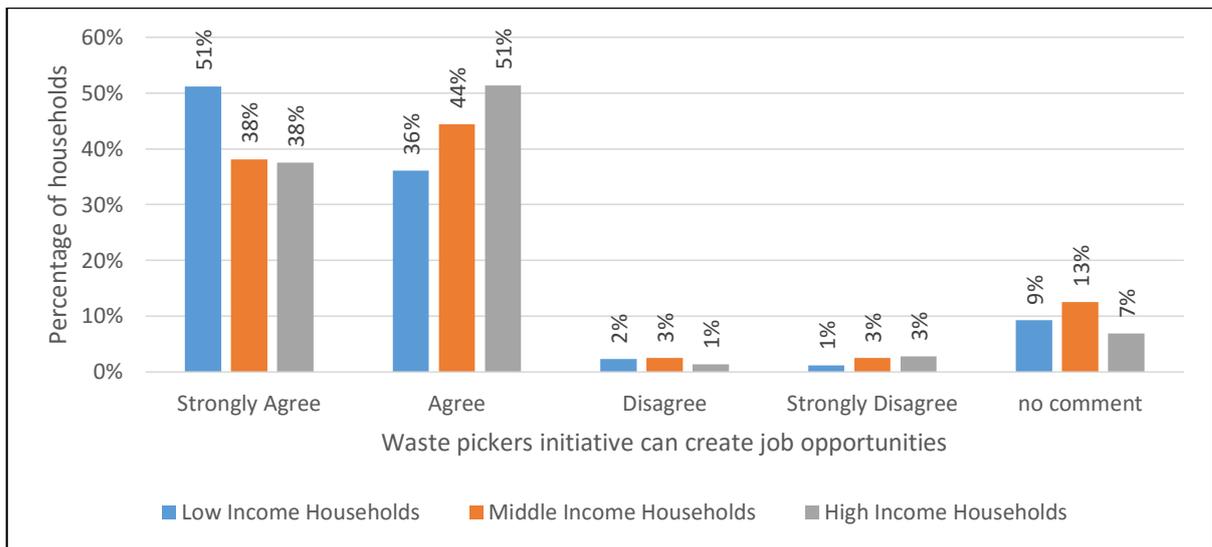


Figure 4.25: Employment creation in recycling

The results showed that 87% of low income households believe that waste picker's initiative can create job opportunities, 3% of low income households believe that waste picker's initiative cannot create employment and 9% did not comment. Results of middle income households showed that 82% of households believe that waste picker's initiative can create job opportunities, 6% of middle income households believed that waste picker's initiative cannot create job opportunities and 13% of middle income households did not comment. Results of high income households showed that 89% of households believe that waste picker's initiative can create job opportunities, 4% of high income households believe that waste picker's initiative cannot create job opportunities and 7% of high income households did not comment. According to Medina (2007a), countries that recognised the waste

picker initiatives and organised them into successful cooperatives include Columbia, Brazil, Argentina, Mexico, Philippines, India and Indonesia. The formation of waste picker cooperatives can bypass the middlemen, dismantle the monopolistic markets, and thus increase waste picker earnings. By supporting waste picker cooperatives, solid waste collection could be extended at a low cost, creating jobs and benefiting low-income communities. Waste picker cooperatives can promote grassroots development in an economically viable, socially desirable and environmentally sound manner (Medina, 2007a).

#### 4.5 Demographics relationship with waste management

##### 4.5.1 Education level of breadwinner versus willingness to sort waste

Table 4.1: Level of Education vs Willingness to separate waste

Educational level	Willingness to sort waste		
	No	Yes	TOTAL
No Formal Education	1%	3%	4%
Grade 0 - Grade 6	2%	6%	8%
Grade 7 - Grade 9	7%	28%	35%
Grade 10 - Grade 12	8%	22%	29%
Diploma/Certificate	2%	14%	16%
Degree	3%	5%	8%
<b>TOTAL</b>	<b>22%</b>	<b>78%</b>	<b>100%</b>

The results in Table 4.1 show that 3% of households who were willing to sort waste and 1% who were not willing to sort waste had no formal qualification. The results further revealed that 6% of households who were willing to sort waste and 2% who were not willing to sort waste had Grade 0- Grade 6. The majority of households 59 % who were willing to sort waste from source had Grade 12, lower qualification or no formal qualification. The results also show that 14% of households who were

willing to sort waste had a Diploma/Certificate. Lastly 5% of households who were willing to sort waste had degrees. In a study conducted in Poland (Czajkowski *et al.*, 2014), it was revealed that respondents with higher education are correlated with more sorting. Murad (2012) in a study conducted in Malaysia found that the relationship between percentage of respondents who source-separate wastes and education level is generally inverse and statistically significant ( $P < 0.05$ )

#### 4.5.2 Education level of breadwinner versus waste generation

Table 4.2: Education level of breadwinner vs Waste generation

Educational level	Amount of waste generated							TOTAL
	1,12 m <sup>3</sup> Waste/week	0,24 m <sup>3</sup> Waste/week	0,48 m <sup>3</sup> Waste/week	0,72 m <sup>3</sup> Waste/week	0,96m <sup>3</sup> Waste/week	1,20 m <sup>3</sup> Waste/week		
<b>No Formal Education</b>	2%	2%	0%	0%	0%	0%	<b>4%</b>	
<b>Grade 0 - Grade 6</b>	3%	4%	0%	0%	0%	0%	<b>8%</b>	
<b>Grade 7 - Grade 9</b>	11%	21%	3%	0%	0%	0%	<b>35%</b>	
<b>Grade 10 - Grade 12</b>	7%	20%	1%	0%	0%	0%	<b>29%</b>	
<b>Diploma/Certificate</b>	6%	8%	1%	0%	0%	0%	<b>16%</b>	
<b>Degree</b>	2%	4%	1%	0%	0%	0%	<b>8%</b>	
<b>TOTAL</b>	<b>31%</b>	<b>60%</b>	<b>6%</b>	<b>1%</b>	<b>0%</b>	<b>1%</b>	<b>100%</b>	

Table 4.2 shows the level of education against amount of waste generated and higher level of waste is generated by households with higher education. The higher amount of waste 0.48 m<sup>3</sup> waste/week is observed for households with degrees, Diploma/Certificate, Grade 10-Grade 12 and Grade 7 - Grade 9. Among the households who are generating 0.48 m<sup>3</sup> Waste/week the majority of households were from the low income households due to the backyard rooms in their yards, resulting in a high number of household members and hence the higher amount of waste observed. There was also a few households who reported that

they generate more than 0.48 m<sup>3</sup> waste/week and all of them had back yard rooms for rental with total number of tenants to an average of 10. A study conducted in Bangladesh by Sujauddin *et al.* (2008) revealed that education level of the family is positively correlated with the generation of solid waste. The amount of waste generated each day depends on the level of education, higher level of education corresponds with higher level of waste generation (Sujauddin *et al.*, 2008).

#### 4.5.3 Education level versus willingness to sort waste without incentives

Table 4.3: Level of Education vs Willingness to sort waste without incentives

Educational level	Willingness to separate waste without incentives		
	No	Yes	TOTAL
No Formal Education	2%	2%	4%
Grade 0 - Grade 6	3%	4%	8%
Grade 7 - Grade 9	15%	20%	35%
Grade 10 - Grade 12	14%	15%	29%
Diploma/Certificate	5%	11%	16%
Degree	3%	5%	8%
<b>TOTAL</b>	<b>43%</b>	<b>57%</b>	<b>100%</b>

The results in Table 4.3 shows that 41% of the respondents who are willing to separate waste without incentives had Grade 12, or lower qualification or no formal qualification. The results also show that 11% of households who were willing to separate waste without incentives had a diploma/certificate. Finally 5% of Households who were willing to separate waste without incentives had a degree. The results further show that 34% of respondents who were not willing to sort waste without incentives had Grade 12, lower qualification or no formal qualification. The results also showed that 5% of households who were not willing to sort waste without incentives had a diploma/certificate. Lastly 3% of households who were not willing to sort waste without any incentives had a Degree. What about those who were unwilling? Say something about them too. Ekere *et al.* (2009) in a study

conducted in Uganda found that higher education is correlated to higher income and waste separation from source is seen as time consuming. Not all research has shown the correlation between education level and willingness to participate in source separation to be positive (Owusu *et al.*, 2013).

#### 4.5.4 Education level versus incorporation of waste pickers in the formal waste management system

Table 4.4: Level of Education vs Incorporation of waste pickers in the formal waste management system

Educational level	Incorporation of waste pickers in waste management system						
	Strongly Agree	Agree	Disagree	Strongly Disagree	No Comment	TOTAL	
<b>No Formal Education</b>	1%	2%	0%	0%	0%	<b>4%</b>	
<b>Grade 0 - Grade 6</b>	2%	4%	1%	0%	1%	<b>8%</b>	
<b>Grade 7 - Grade 9</b>	13%	14%	2%	1%	6%	<b>35%</b>	
<b>Grade 10 - Grade 12</b>	10%	12%	1%	2%	3%	<b>29%</b>	
<b>Diploma/Certificate</b>	6%	6%	1%	0%	2%	<b>16%</b>	
<b>Degree</b>	4%	2%	1%	0%	1%	<b>8%</b>	
<b>TOTAL</b>	<b>37%</b>	<b>40%</b>	<b>6%</b>	<b>4%</b>	<b>14%</b>	<b>100%</b>	

The results in Table 4.4 show that 58% households who showed support for incorporation of waste pickers into the formal waste management system had grade 12 or below. Households with a Diploma/certificate contributed 12% of the total number of participants supported the incorporation of waste pickers in the formal waste management system. The results also revealed that 6% of the households who supported the incorporation of waste pickers in the formal waste management system had a degree. Integrating waste pickers into Municipal Solid Waste management in Pune, India is one example of a successful intervention to

incorporate waste pickers in the formal waste management system (Chikarmane, 2012). Waste pickers offer a service equivalent to US\$5 or for free to the municipality a month and their combined labour saved the municipality US\$316 455 in municipal waste transport.

#### 4.5.5 Education level versus health concern

Table 4.5: Level of Education vs Health concern

	Health Concern								
	Smell			Hygiene			Disease		
Educational level	No	Yes	TOTAL	No	Yes	TOTAL	No	Yes	TOTAL
No Formal Education	4%	1%	4%	3%	5%	8%	3%	1%	4%
Grade 0 - Grade 6	6%	2%	8%	7%	8%	16%	5%	3%	8%
Grade 7 - Grade 9	30%	5%	35%	4%	4%	8%	25%	11%	35%
Grade 10 - Grade 12	20%	9%	29%	7%	22%	29%	16%	12%	29%
Diploma /Certificate	12%	3%	16%	15%	20%	35%	11%	5%	16%
Degree	6%	2%	8%	1%	3%	4%	6%	2%	8%
<b>TOTAL</b>	<b>77%</b>	<b>23%</b>	<b>100%</b>	<b>38%</b>	<b>62%</b>	<b>100%</b>	<b>66%</b>	<b>34%</b>	<b>100%</b>

The results in Table 4.5 show that households heads who had grade 12 or below raised the following health concerns for separating waste from source; 17% of households choose smell as a health concern, 39% of households choose hygiene as a health concern and 27% of household choose diseases as a health concern.

Households with a diploma/certificate raised the following health concerns for separating waste from source; 3% choose smell as a health concern, 20% choose hygiene as a health concern and 5% choose diseases as a concern. Households with a degree choose the following concerns for separating waste from source; 2% of households choose smell as a health concern, 3% choose hygiene as a health concern and 2% choose diseases as a health concern. Murad (2012) revealed in a study conducted in Kuala Lumpur that the relationship between respondents being concerned over health implications of waste and education level is directly and statistically significant ( $P < 0.05$ ).

#### 4.5.6 Gender of breadwinner versus willingness to sort waste

Table 4.6: Gender of breadwinner vs Willingness to sort waste

Gender of breadwinner	Willingness to separate waste		
	Not willing	Willing	TOTAL
Male	16%	55%	71%
Female	5%	23%	29%
<b>TOTAL</b>	<b>22%</b>	<b>78%</b>	<b>100%</b>

The results in Table 4.6 shows that 55% of males are willing to separate waste and 23% of females are also willing to separate waste. From all the males that participated in the study  $\frac{55\%}{71\%} \times 100\% = 77\%$  are willing to separate waste from source and from all the females that participated in the study  $\frac{23\%}{29\%} \times 100\% = 79\%$  are willing to separate waste from source. The results further show that 16% of males are not willing to separate waste and 5% of females are also not willing to separate waste. From all the males that participated in the study  $\frac{16\%}{71\%} \times 100\% = 23\%$  are not willing to separate waste from source and from all the females that participated in the study  $\frac{5\%}{29\%} \times 100\% = 17\%$  are not willing to separate waste from source. Ekere *et al.*, (2009) in study conducted in Uganda found that gender is

negative and significant at 10% level implying that the likelihood of waste separation was higher among females. This is expected given the role women play in waste household management activities (Ekere *et al.*, 2009).

#### 4.5.7 Gender of breadwinner versus waste generation

Table 4.7: Gender of breadwinner vs Waste generation

Gender of breadwinner	Amount of Waste generated							TOTAL
	0,12 m <sup>3</sup> Waste/week	0,24 m <sup>3</sup> Waste/week	0,48 m <sup>3</sup> Waste/week	0,72 m <sup>3</sup> Waste/week	0,96 m <sup>3</sup> Waste/week	1,20 m <sup>3</sup> Waste/week		
Male	22%	43%	5%	1%	0%	0%	71%	
Female	9%	17%	2%	0%	0%	0%	28%	
<b>TOTAL</b>	<b>31%</b>	<b>60%</b>	<b>6%</b>	<b>1%</b>	<b>0%</b>	<b>1%</b>	<b>100%</b>	

The results in Table 4.7 shows that the male breadwinners generate the following amounts of waste per week; 22% of male breadwinners generated 0,12 m<sup>3</sup> Waste/week, 43% of male breadwinners generated 0,24 m<sup>3</sup> Waste/week, 5% of male breadwinners, 1% of male breadwinners generated 0,72 m<sup>3</sup> Waste/week. Female breadwinners generate the following amount of waste: 9% of female breadwinners generated 0,12 m<sup>3</sup> Waste/week, 17% of female breadwinners generated 0,24 m<sup>3</sup> Waste/week, 2% breadwinners generated 0,48 m<sup>3</sup> Waste/week. The major factors influencing waste generation were found to be the gender and educational level of the breadwinner, income level of the household and the household size (Seholoholo, 1998). Woman generate less waste than men (Cecere *et al.*, 2014; Ekere *et al.*, 2009).

#### 4.5.8 Gender of breadwinner versus willingness to sort waste without incentives

Table 4.8: Gender of breadwinner vs Willingness to sort waste without incentives

Gender of breadwinner	Willingness to separate waste without incentives		
	No	Yes	TOTAL
Male	30%	41%	<b>71%</b>
Female	12%	16%	<b>29%</b>
<b>TOTAL</b>	<b>43%</b>	<b>57%</b>	<b>100%</b>

The results in Table 4.8 show that 41% of breadwinners are willing to sort waste without incentives and 16% female breadwinners are willing to sort waste without incentives. According to Owusu *et al.*, (2013) in Ghana the willingness of males to separate waste from source when cash and non-cash incentives are provided was negative and statistically insignificant even at the 10% level. The Female's willingness to separate waste was found to be positive and statistically significant when cash and non-cash incentives were provided. The people given the responsibility of solid waste disposal at the household level are critical for households to participate in source separation (Owusu *et al.*, 2013).

4.5.9 Gender of breadwinner versus waste picker’s incorporation in the formal waste management system.

Table 4.9: Gender of breadwinner vs Waste picker's incorporation into the formal waste management system

	Incorporation of waste pickers in waste management system					
Gender of breadwinner	Strongly Agree	Agree	Disagree	Strongly Disagree	No Comment	TOTAL
Male	25%	29%	5%	3%	10%	71%
Female	11%	11%	1%	1%	3%	29%
<b>TOTAL</b>	<b>36%</b>	<b>40%</b>	<b>6%</b>	<b>4%</b>	<b>13%</b>	<b>100%</b>

The results in Table 4.9 show that 54% of male breadwinners support the incorporation of waste pickers in waste management systems and 22% of female breadwinners support the incorporation of waste pickers in waste management system. According to Scheinberg *et al.* (1999) gender-sensitive approach can increase the effectiveness and efficiency of most waste management systems.

#### 4.5.10 Gender of breadwinner versus health concern

Table 4.10: Gender of breadwinner vs Health Concern

	Health								
	Smell			Diseases			Hygiene		
Gender of breadwinner	No	Yes	TOTAL	No	Yes	TOTAL	No	Yes	TOTAL
<b>Male</b>	57%	15%	<b>71%</b>	47%	25%	<b>71%</b>	28%	44%	<b>71%</b>
<b>Female</b>	21%	8%	<b>29%</b>	19%	9%	<b>29%</b>	10%	18%	<b>29%</b>
<b>TOTAL</b>	<b>78%</b>	<b>22%</b>	<b>100%</b>	<b>66%</b>	<b>34%</b>	<b>100%</b>	<b>38%</b>	<b>62%</b>	<b>100%</b>

The results in Table 4.10 shows that male breadwinners have the following health concerns; 15% of male breadwinners choose smell as their health concern, 25% of male breadwinners choose diseases as their health concern and 44% of male breadwinners choose hygiene as their health concern. Female breadwinners had the following health concerns; 8% female breadwinners choose smell as a health concern, 9% of female breadwinners choose diseases as a health concern and 18% of female breadwinners choose hygiene as a health concern. The findings from Ghana in a study conducted by Owusu *et al.* (2013) confirmed that gender of the breadwinner and health concern positively influence the willingness to separate waste from source (Owusu *et al.*, 2013).

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## CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

Households play a key role in waste management as waste generators. Shortage of landfill space, life span of existing landfills, unemployment rate, role and working conditions of waste pickers, legislation on waste disposal and landfill management are all signals for a need to change the current waste management system in Cosmo City and other developing countries. Household's perceptions are key to the realisation of an integrated waste management system. A system where waste pickers can play a major role of recycling effectively and efficiently within the formal waste management system. An integrated waste management system could create employment and support entrepreneurial initiatives. Household's role in an integrated waste management system will not only be limited to waste generation but will extend to waste management.

The integration of communities of different levels of income is a major challenge worldwide. These communities remain segregated since they do not belong to the same economic class and also do not share the same interests. Communities of different levels of income have different perceptions about management of waste. This study focused on the following specific objectives

- Willingness of households to separate waste from source.
- Health concerns emanating when one interacts with waste at the sources.
- Effect of incentives on household's willingness to separate waste from source.
- Household's opinion on including the waste pickers in the formal waste management system.
- Effect of type of dwelling on household's willingness to separate waste from source.

In this chapter, the research findings are summarised, conclusions are drawn and the recommendations are made for further studies and guidance.

## 5.1 Research Findings

The findings from the study showed that most households are male headed, 79% for high income households, 74% of middle income households and 66% of low income households. The trend observed shows a reflection of the gender inequality in South Africa. Males occupy senior positions at work and there are more employment opportunities for males than females. Traditionally males are expected to provide for their families and hence have no alternative but to find employment to take care of the family. The trend in gender of the household head is a result of the legacy from the past which is expected to change in the near future.

Low income household were found to have the highest percentage of 48% for household sizes of 5 or more. There are various factors that contribute to the bigger household sizes in low income households some of them are, birth control awareness, level of education and unemployment rate et cetera. It was also revealed that most low income households have grade 12 as the highest qualification whereas middle income and high income households have a Diploma and Degree as the highest qualification respectively. Level of education determines the level of salary and employment opportunities of households. The high unemployment rate in the low income household's areas is related directly to the level of education and skills. Households with higher education levels have a higher probability of securing higher paying jobs. The results on unemployment rate showed that low income households had the highest unemployment rate. Middle income households were found to have the lowest unemployment rate. This observation could be attributed to the household's level of education in the area and the age of children as most of the households in this area are young graduates who recently started working.

The findings on waste generation revealed that 88% of low income households generates between 0.12 m<sup>3</sup> waste/week and 0.24 m<sup>3</sup> waste/week, 94% of middle income households generates between 0.12 m<sup>3</sup> waste/week and 0.24 m<sup>3</sup> waste/week and 95 % of high income households generates 0.12 m<sup>3</sup> waste/week and 0.24 m<sup>3</sup> waste/week. This findings show that waste generation depends on household income

level. High income households generate more waste since they have the buying power. The buying patterns of high income households involves a lot of disposable waste e.g. newspapers, cans and plastic containers.

The findings indicated that most households do not recycle their waste. The results indicated that 30% of low income households, 23% of middle income households and 10% of high income households recycle waste. Low income households were found to recycle waste more than middle income and high income households. Interest in recycling waste for low income households is encouraged by the high unemployment rate within this community and the need to provide for the family. Literature reviewed indicated that low income households are likely to recycle waste than middle and high income waste due to the loss of leisure time or economic benefit (Wilson, 2007). Most households indicated that if they were to engage in recycling they expected an income of between R51 to R200 income from the recyclable materials. Expected income of R51 to R200 was indicated by 46% of low income households, 61% of middle income households and 41% of high income households.

Most the households indicated that they are willing to sort waste from source given an opportunity and training. The study revealed that 78% of low income households, 78% of middle income households and 80% of high income households were willing to sort waste from source. Community awareness and training can encourage households to sort waste from source. Low, middle and high income households showed a closely similar response towards sorting waste without incentives. The results showed that 55% low income households, 58% middle income households and 59% high income households were willing to sort waste from source without incentives. Overall results showed about 20% drop when sorting waste without incentives was suggested. This clearly indicates that incentives for sorting waste can positively influence household's willingness to sort waste. Most of the households indicated that cash monthly as a form of incentive would encourage them to sort waste from source. The idea was supported by 71% of low income households, 56 % of middle income households and 59% of high income households. The other factors that influence willingness to sort waste is the household's health concerns. Most households rated hygiene as the

major health concern. The findings showed that 52% of low income households, 55% middle income households and 48% high income households rated hygiene as the major health concern on sorting waste from source.

Most households rated waste collection system as highly adequate, moderately adequate or adequate. The findings revealed that 64% of low income households, 70% of middle income households and 61% of high income households felt that waste collection system in Cosmo City is highly adequate, moderately adequate or just adequate. This results show in general that households feel that waste collection in Cosmo City is adequate with room for improvement. Education and awareness is needed to make the public aware of the impacts of illegal dumping e.g. waste pollution, air quality health and property depreciation. These findings showed that households identified smell, health hazards and rats as the major potential impacts of illegal dumping. From this households 64% of low income households, 44% of middle income households and 58% of high income households identified smell, health hazards and rats as the major potential impacts of illegal dumping.

Most of the households felt that waste pickers increase the security risk of the area. The findings revealed that 85% of low income households, 79% of middle income households and 83% of high income households felt that waste pickers increase security risk of Cosmo City. These results clearly show that the perceptions on an integrated community and how the integrated environment can change the perceptions of the community. The results could be different for the low income households and high income households who are not staying in an integrated environment. Some households wanted waste pickers to be banned from operating in Cosmo City, but most households responded in favour of allowing waste pickers to continue operating in Cosmo City. The findings showed that 48% of low income household, 32% of middle income households and 48% of high income households responded in favour of allowing waste pickers to continue operating in Cosmo City. The findings of the study revealed that most households do not think that waste pickers are criminals but their presence if not regulated could invite criminals to take advantage of the initiative. The results showed that 79% of low income households,

67% of middle income households and 76% of high income households believe that waste pickers are not criminals.

When asked about willingness to help waste pickers the response gave mixed results, most low income households were willing to help waste pickers and most middle and high income households were not willing to help waste pickers. Middle and high income households have a higher opportunity cost and in most cases it is the responsibility of the maid to take out trash. The findings revealed that 55% of low income households were willing to help waste pickers, 42% of middle income were not willing to help waste pickers and 48 % of high income households were not willing to help waste pickers. Waste pickers are mainly visible in the middle and high income household areas, this is due to the expectation that middle and high income households generates more waste than low income households. When households were asked about the visibility of waste pickers their response were; 34% of low income households, 45% of middle income households and 48% of high income households have seen waste pickers in their area.

Incorporation of waste pickers in the formal waste management system was supported by most households. The findings showed that 77% of low income household, 71% of middle income and 78% of high income households support the incorporation of waste pickers in the formal waste management system. Regulation of waste pickers will help to improve their working conditions, acceptance and support from households. The findings from the study revealed that 83% of low income households, 75% of middle income households and 87% of high income households support the regulation of waste pickers. Most of the households felt that waste pickers offer a service to the municipality and deserve a basic salary. The findings revealed that 81% of low income households, 73% of middle income households, 72% of high income households felt that waste pickers should be offered a basic salary. Waste pickers can reduce illegal dumping and help reduce the amount of waste that reaches the landfills. The findings on contribution of waste pickers to illegal dumping revealed that households believe that waste pickers can help reduce illegal dumping. The findings showed that 85% of low income households, 74% of middle income households and 88% of high income

households felt that waste pickers can help reduce illegal dumping. Waste pickers initiative can create employment and alleviate poverty. The findings of the study showed that households believe that waste pickers initiative can create employment. The results showed that 87% of low income households, 82% of middle income households and 89% high income households believe that waste picker's initiative can create employment.

Municipalities are responsible to implement policies and regulations that take into consideration the integrated solid waste management system. Recycling centres owned by the community or municipality will offer the municipality better control and implementation of the integrated solid waste management system. The findings from the study showed that households support the idea of a community owned recycling centre. The study revealed that 85% of low income households, 79% of middle income households and 83% of high income households support the idea of a community owned recycling centre. The community owned recycling centre will help resolve all the disadvantages associated with the private buy back centres.

#### 5.1.1 Waste management opportunities for Cosmo City

Cosmo City waste is currently managed by a contracted private company on behalf of the local Municipality. All residents pay rates and taxes from which portion is allocated to waste collection. Implementation of an integrated waste management system could save the municipality a huge amount of money. The new system could constitute, separation of waste from source, municipal/community owned recycling centre and the incorporation of waste pickers in the municipal waste management system. The municipality will save on transportation costs and landfill disposal/management costs. The integrated system will prolong the lifespan of the landfills and create employment opportunity within Cosmo City. There is support for such an intervention from the households, it's only left up to the municipality official and other stakeholders to draft the project implementation plan.

## **5.2 Challenges of waste management in Cosmo City**

- There is currently no waste management awareness campaigns
- Illegal dumping is increasing at an alarming rate in the low income households area
- Municipality does not recognise waste pickers and they work under hazardous conditions
- Residents are not involved in the waste management system and this limits the opportunity of improving the current system.
- Hazardous, medical and baby diapers are disposed of with general waste and pose a health hazard to the waste handlers.
- Waste collected is disposed of at landfills without any form of treatment before disposal.
- There is no application of latest technology to reuse waste, e.g. waste to energy and waste to fuel technology
- Municipality thus not have any recycling centre.

## **5.3 Waste management recommendations**

Integrated solid waste management system can offer a sustainable strategy for waste management in Cosmo City. There are certain areas in the low income household's area, where waste collection trucks cannot get access to houses due to narrow roads and sharp curves, the affected residents take their bins to a central location for collection by the contractor. High unemployment rate calls for job creation within waste management. Municipalities must follow the guidelines and objectives of the Polokwane declaration (DEAT, 2001). The Polokwane declaration vision is to implement a waste management system which contributes to sustainable development and a measurable improvement in the quality of life, by harnessing the energy and commitment of all South Africans for the effective reduction of waste.

The declaration required government, business and civil society to join in common efforts towards the accomplishment of the goal for reduction of waste generation and disposal by 50% and 25% respectively by 2012.

Cosmo City failed to accomplish the goal of reducing waste before the set deadline. Implementing an integrated waste management system will help Cosmo City towards aligning with the goals of Polokwane declaration.

## **5.4 Suggestions**

### **5.4.1 Reduce**

Municipality must organise community household solid waste awareness campaigns to educate the community about waste reduction. Waste reduction involves a change of behaviour of households in terms of purchasing and disposal. Households can choose to buy products that can be recycled or re-used. By implementing the separation of waste at source and recycling will ensure that less waste will reach landfills.

### **5.4.2 Re-use and recycle**

Municipality must ensure that the policies and regulations support recycling and re-use of materials. Resources for recycling should be made easily accessible to households. Households should be trained on recycling and separating solid waste for recycling and composting. Re-use of materials should be encouraged by encouraging retailers to sell products that can be re-used. Municipality should have relevant policies to deal with exchange rates at buy-back centres, sorting of waste and storage space.

### **5.4.3 Incentives for sorting waste**

Municipalities can encourage households to reduce waste generation, re-use materials, separate waste from source and recycle their waste by offering incentives. The incentive can be paid into the household's municipal account and this could help

reduce rates and taxes amount households are expected to pay monthly. Paying incentives to households in cash could have a bigger impact than reducing their municipal bills a month.

#### 5.4.4 Education

The Polokwane declaration suggests that government and local government should, in order to allow fair participation, offer training and development to the public (DEAT 2001). Households should be given training on separating waste and handling medical waste and hazardous waste. Informed households will be comfortable to separate waste and engage in recycling projects.

#### 5.4.5 Improve working conditions of waste pickers

Waste pickers should be recognised and acknowledged by government and local government. Waste pickers should be regulated by legislation. Training and educational intervention for waste pickers will help them to know their rights. Basic conditions of work for waste pickers need to be improved. Waste pickers provide a service to the municipality and should be paid a basic salary and offered employment benefits. Waste pickers should be organised into co-operatives. Countries that have successfully incorporated waste pickers into their solid waste management system achieved that by organising waste pickers into co-operatives. It's easier to work with an organised group of waste pickers than to deal with individuals.

#### 5.4.6 Involve Community

Communities must be involved in all the stages of waste management for the success of such a system. Regular meetings should be organised where all stakeholders will have an opportunity of sharing their opinions and concerns. To reach the goals of the Polokwane declaration community members need to fully participate in decision making and implementation.

#### 5.4.7 Waste disposal

Illegal dumping can be reduced by incorporating waste pickers in the formal waste management system. This initiative is in line with the Polokwane declaration on government expectation to implement and promote sustainable poverty relief projects (DEAT, 2001). Illegal dumping can also be eliminated by awareness campaigns and education on the adverse impacts of illegal dumping.

## **APPENDICES**

### **APPENDIX I: DRAFT MANUSCRIPT**

A draft manuscript is ready to be reviewed for publication purpose

**TITLE:** Perceptions of Waste Management in Different Income Households in Cosmo City, South Africa.

**AUTHORS:** Moja SJ and Mphaka DL

**TARGET JOURNAL:** International Journal of Integrated Waste Management, Science and Technology

**YEAR:** 2015

APPENDIX II Permission letter to conduct research from Cosmo City Municipality



CITY OF JOHANNESBURG  
METROPOLITAN MUNICIPALITY

OFFICE OF THE SPEAKER

**COUNCILLOR**

To whom it may concern

Re: Permission letter to conduct a waste management study

The purpose of this letter is to grant Dikobe Lucas Mphaka, a Student at the University of South Africa permission to conduct a study at Cosmo City (Ward 100). The title of the study is: Perceptions of the community on sorting solid waste in a mixed income suburb. The study entails conducting interviews with key stakeholders, field inspection and a questionnaire. Once the study is concluded the office would like to get a copy of the report. The report will help the office with the drafting and implementation of future environmental projects. I, Nonny Raphata (Councilor of Ward 100) hereby grant permission for Dikobe Lucas Mphaka to conduct the study in Cosmo City.

Sincerely,

Nonny Raphata

Signature



APPENDIX III Ethics Approval by UNISA to conduct research project



**CAES RESEARCH ETHICS REVIEW COMMITTEE**

Date: 03/09/2014

Ref #: **2014/CAES/130**  
Name of applicant: **DL Mphaka**  
Student #: **30987857**

Dear Mr Mphaka,

**Decision: Ethics Approval**

**Supervisor:** Prof SJ Moja

**Proposal:** Perceptions of waste management in different income households in Cosmo City, South Africa

**Qualification:** Postgraduate degree

Thank you for the application for research ethics clearance by the CAES Research Ethics Review Committee for the above mentioned research. Final approval is granted for the duration of the project.

*The application was reviewed in compliance with the Unisa Policy on Research Ethics by the CAES Research Ethics Review Committee on 03 September 2014.*

*The proposed research may now commence with the proviso that:*

- 1) The researcher/s will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.*
- 2) Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study, as well as changes in the methodology, should be communicated in writing to the CAES Ethics Review Committee. An amended application could be requested if there are substantial changes from the existing proposal, especially if those changes affect any of the study-related risks for the research participants.*
- 3) The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and*



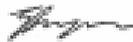
University of South Africa  
Pretter Street, Muckleneuk Ridge, City of Tshwane  
PO Box 392 UNISA 0003 South Africa  
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150  
[www.unisa.ac.za](http://www.unisa.ac.za)

scientific standards relevant to the specific field of study.

*Note:*

The reference number (top right corner of this communiqué) should be clearly indicated on all forms of communication (e.g. Webmail, E-mail messages, letters) with the intended research participants, as well as with the CAES RERC.

Kind regards,



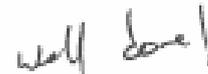
Signature

Prof EL Kampen



Signature

Prof MJ Linington



## APPENDIX IV Consent form to participate in the study

2014/CAE5/130



Dikobe Lucas Mphaka

Contact number: 0824731846

### CONSENT FORM

#### TITLE OF RESEARCH PROJECT

#### PERCEPTIONS OF WASTE MANAGEMENT IN DIFFERENT INCOME HOUSEHOLDS IN COSMO CITY, SOUTH AFRICA.

Dear Mr/Mrs/Miss/Ms \_\_\_\_\_ Date...../...../20...

#### NATURE AND PURPOSE OF THE STUDY

The purpose of this study is to compare the perceptions of waste management in different income households in Cosmo City, South Africa. The following lists objectives of this study:  
Find out if the community is willing to sort waste from source, Identify the health concerns of the community on sorting waste?, Do the community expect to get incentives per household for sorting waste from the source?, What is the opinion of the community on including the waste scavengers in the formal waste management system?, What is the opinion of the waste collection services company on including the waste scavengers in the formal waste management system?, Does community willingness to sort waste from the source depend on the type of dwelling?

#### RESEARCH PROCESS

1. Data collection (questionnaire/interview)
2. Data analysis
3. Report Writing
4. Feedback session

#### NOTIFICATION THAT PHOTOGRAPHIC MATERIAL, TAPE RECORDING\$, ETC WILL BE REQUIRED

You are encouraged to ask questions or raise concerns at any time about the nature of the study or the methods I am using. Please contact me at any time at the e-mail address or telephone number listed above. Our discussion will be audio taped to help me accurately capture your insights in your own words. The tapes will only be heard by me for the purpose of this study. If you feel uncomfortable with the recorder, you may ask that it be turned off at any time.

#### CONFIDENTIALITY

Any information supplied by you will be treated with strict confidentiality. There will be no form of identification on the questionnaire so the responses on the questionnaire cannot be traced back to you. The data will be stored on a password protected access file on a computer. The data will only be used for the intended study. Information on supplied will be seen by my supervisor, a second marker and the external examiner. The dissertation may be read by future students on the course. The study may be

published in a research journal. I will ensure that no clues about the participant's identity appear in the dissertation. Any extracts from what the participant said that are quoted in the dissertation will be entirely anonymous.

#### WITHDRAWAL CLAUSE

You also have the right not to participate or to participate or to withdraw from the study at any time. In the event you choose to withdraw from the study all information you provide (including tapes) will be destroyed and omitted from the final paper. Insights gathered by you and other participants will be used in writing a qualitative research report, which will be read by my professor. Though direct quotes from you may be used in the paper, your name and other identifying information will be kept anonymous.

#### POTENTIAL BENEFITS OF THE STUDY

Your participation could help members of the community by creating job opportunities, help investors who have interest in waste recycling projects (e.g. generation of bio fuels and energy generation), help waste collection companies by redirecting waste from landfills (this will increase landfill life span and reduce maintenance cost, help national, regional and municipal policy makers who design waste management policies.

#### INFORMATION (contact information of my supervisor)

Name	Title (Prof, Dr, etc)	Contact Number	e-mail address	Contact Address	Department/ School/ College
Shadung Moja	Prof	011 670 7000	Mojasj@unisa.ac.za	Room: 1-23; Block B, Environmental Science Dept., UNISA Florida Campus	Environmental Science Department

**CONSENT**

I, the undersigned, ..... (full name) have read the above information relating to the project and have also heard the verbal version, and declare that I understand it. I have been afforded the opportunity to discuss relevant aspects of the project with the project leader, and hereby declare that I agree voluntarily to participate in the project.

I indemnify the university and any employee or student of the university against any liability that I may incur during the course of the project.

I further undertake to make no claim against the university in respect of damages to my person or reputation that may be incurred as a result of the project/trial or through the fault of other participants, unless resulting from negligence on the part of the university, its employees or students.

I have received a signed copy of this consent form.

Signature of participant: .....

Signed at ..... on .....

**WITNESSES**

1 .....

2 .....

APPENDIX V Survey questionnaire for solid waste management in Cosmo City

2014/CAES/130



**Appendix B: Instrument**

**Biographical information**

1. Where do you stay in Cosmo City? (tick the correct option)

Ext 0 (credit link)	Ext 0 (bonded)	Ext 2	Ext 3	Ext 4	Ext 5
Ext 6 (credit link)	Ext 6 (RDP)	Ext 7	Ext 8	Ext 9	Ext 10
Hlanganani	Other (specify):				

2. How long have you been staying in Cosmo city (number of years)?

3. How many people are presently staying in the house? backyard rooms

Please specify the number \_\_\_\_\_

If you have backyard rooms how many people stay in the back-yard rooms (write zero if you don't have Backyard rooms)? Specify number

4. What is the gender of the household head? Male  or Female

5. What is the highest educational qualification of the household head

None	Grade 0-Grade 6	Grade 7-9	Grade 10-Grade 12	Diploma/Certificate	Degree
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6. How many people are unemployed and looking for a Job?

7. What is your minimum expected salary per month if you can get a Job?

None	R500-R2500	R2501-R6000	R6001-R10000	R10001-R20000	Above R20000
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**Waste Management**

8. How much waste do you generate a week?

$\frac{1}{2}$ Full waste Bin	1 Waste Bin	2 Waste Bins	3 Waste Bins	4 Waste Bins	5 Waste Bins
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9. Do you recycle any of your waste? Yes  or No

10. How much do you think you can make a month by recycling your waste?

R1-R10	R11-R50	R51-R100	R101-R200	R201-R300	R301-R400	Above 400
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11. Do you separate your waste from source? Yes  or No

12. If your answer was yes for the previous question, how do you separate your waste? Explain.

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13. If you are not yet separating waste from the source, the process involves separating your organic/food waste from the dry waste (plastics, paper, glass, tins) and then selling dry waste (recyclable materials) to the buy-back centres. Would you have interest in separating waste if given an opportunity and training? Yes  No
14. Would you be willing to separate waste without receiving any incentives? Yes  No
15. If it was possible to get incentives for sorting waste, what type of incentives will be acceptable to you?

Cash Monthly	Cash Once a year	Cash Twice a year	Any form of a gift	Other(specify):
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16. How will you rank waste collection service in Cosmo City

Highly adequate	Moderately adequate	Adequate	inadequate	No comment
-----------------	---------------------	----------	------------	------------

17. What are the potential adverse impacts of illegal dumping?

Creates bad smell	Health hazard	Pollutes the soil
Attracts rats	Pollutes water streams	Attracts mosquitoes
Blocks the drainage system	Cause injury to children	Other: .....

18. : What are the health concerns of the community on sorting waste?

Diseases	Smell	Hygiene	Other: (specify) _____
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19. There are currently few people, who go around picking up waste (scavengers) for recycling, what is your opinion about this people. Tick only one option in a row that describes your opinion the most for each of the following statements..

Opinion	Tick				
They increase the security risk of the area	Strongly agree	Agree	Disagree	Strongly disagree	No Comment

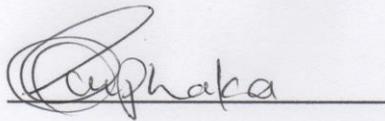
They should not be allowed to continue operating in the area.	Strongly agree	Agree	Disagree	Strongly disagree	No comment
I am willing to help them by allowing them to collect my recyclable materials without giving me any incentives.	Strongly agree	Agree	Disagree	Strongly disagree	No Comment
I have not seen them in my area and I would like to have them in my area.	Strongly agree	Agree	Disagree	Strongly disagree	No comment
They are doing a good Job and should be included in the waste management system of Cosmo city.	Strongly agree	Agree	Disagree	Strongly disagree	No Comment
They are not criminals and should be given all the support they need.	Strongly agree	Agree	Disagree	Strongly disagree	No comment
We need a recycling center owned by the community	Strongly agree	Agree	Disagree	Strongly disagree	No Comment
They are providing a waste collection service to the community they should be offered basic salary by the municipality.	Strongly agree	Agree	Disagree	Strongly disagree	No Comment
They need to be formally regulated	Strongly agree	Agree	Disagree	Strongly disagree	No Comment
They can help to reduce illegal dumping	Strongly agree	Agree	Disagree	Strongly disagree	No Comment
More unemployed people will have an opportunity of earning an income.	Strongly agree	Agree	Disagree	Strongly disagree	No Comment

APPENDIX VI Turnitin originality report

**DECLARATION**

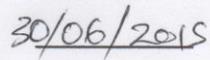
Student Number: 30987857

I declare that \* Perceptions of Waste Management in different income households in Cosmo City, South Africa is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.



SIGNATURE

(Mr D.L. MPHAKA)



DATE